Parkway Minerals NL
ACN 147 346 334
Level 1, 675 Murray Street
West Perth WA 6005

PO Box 1088
West Perth WA 6872
Australia

T +61 8 9479 5386
parkwayminerals.com.au

ASX
Announcement

05 November 2020

ASX: PWN
FSE: 4IP

COMPLETION OF KARINGA LAKES POTASH PROJECT PRE-FEASIBILITY STUDY (KLPP-PFS)

Highlights

PRE-FEASIBILITY STUDY

- The KLPP-PFS confirms the KLPP as a potentially attractive producer of high-quality, soluble grade, sulphate of potash (SOP) targeting key horticulture markets.
- Innovative aMES™ based flow sheet demonstrates potential (major improvement over scoping study), even for a relatively small-scale operation targeting annual SOP production of 40,000 tonnes, over an initial mine life of 20 years.
- aMES™ based development concept demonstrates highly efficient use of water.
- KEY FINANCIAL METRICS
  - Initial capital cost (CAPEX) of $80.0 million, inclusive of all non-process infrastructure and indirect costs (which includes a contingency of $6.7 million).
  - Production cost (OPEX) of $293/tonne of SOP, ex-mine gate.
  - Strong cash generation potential, with estimated EBITDA margin of 54.4%, resulting in annual EBITDA of $18.6 million.
  - Ungeared development of the KLPP would result in:
    - Project payback in approximately 5.5 years from first SOP production.
    - Post-Tax $NPV_{8\%}$ of $80.15 million with an IRR of 20.4%.
- Significant additional opportunities to improve the financial performance of the project were identified, particularly in relation to non-process infrastructure.
- KLPP-PFS prepared by owners' team, supported by leading industry consultants, with Worley as study manager, through existing Global Strategic Cooperation Agreement.

MINERAL RESOURCE ESTIMATE

- Reporting Indicated Mineral Resource of 1,000,000 tonnes of potassium, with 580,000 tonnes of potassium hosted within eight lakes that are incorporated into the mine plan.
- The mine plan includes production of 430,000 tonnes of potassium, which is sufficient to underpin an initial mine life of 20 years, based on a scheduled production rate of 40,000 tonnes per annum of SOP.

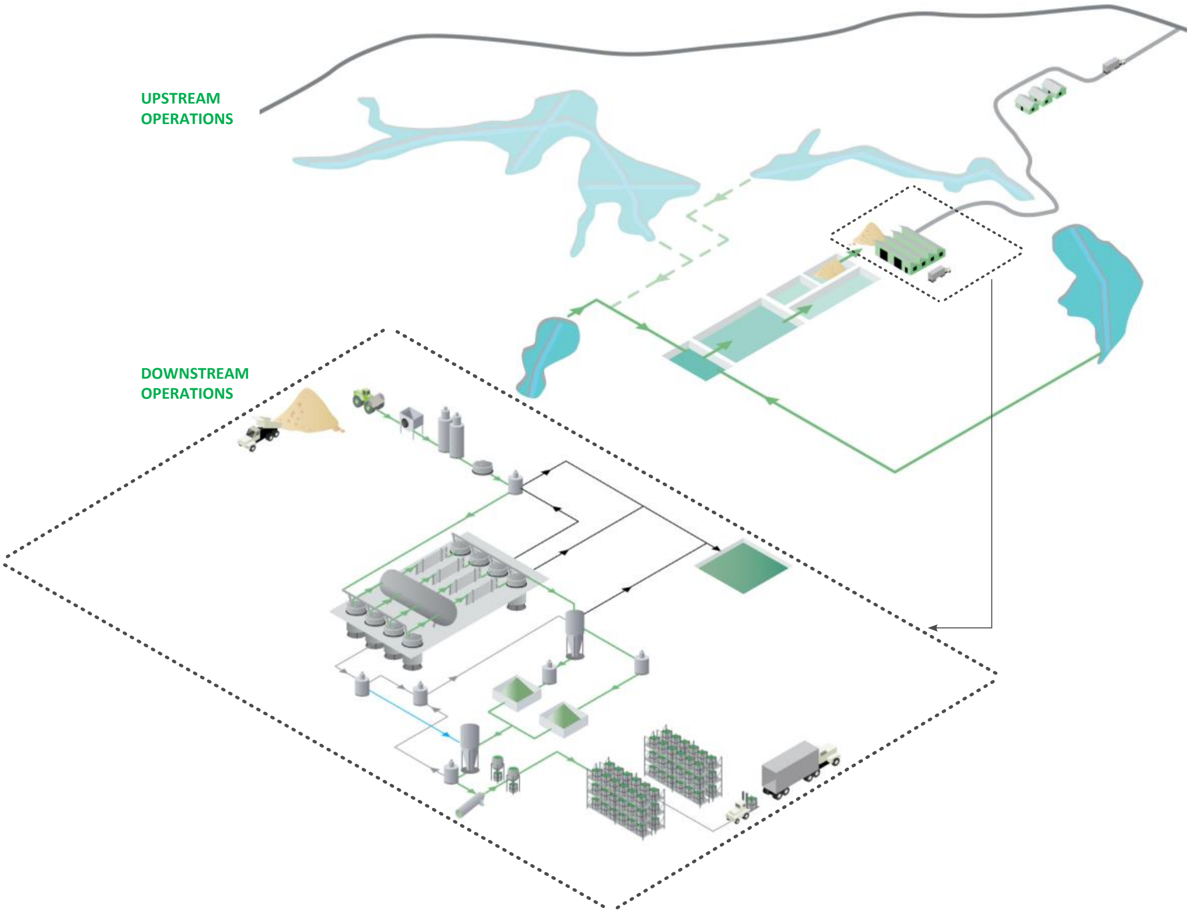
Parkway Minerals NL (ASX: **PWN**) (**"Parkway Minerals"** or the **"Company"**) is pleased to provide the following update, incorporating the release of two major reports:

1. The Karinga Lakes Potash Project – Pre-Feasibility Study (KLPP-PFS), Summary Report, which incorporates the below report, as *Appendix A*;
2. The Karinga Lakes Potash Project – Sulphate of Potash Resource and Production Plan (KLPP-SOPRPP).

1. Karinga Lakes Potash Project – Pre-Feasibility Study (KLPP-PFS) Summary Report

The generalised development concept for the KLPP is outlined in *Figure 1*.

Figure 1: Generalised Development Concept Outlined in the KLPP-PFS



The attached KLPP-PFS Summary Report should be read in conjunction with the rest of this announcement, with particular attention given to the Important Information.

2. Karinga Lakes Potash Project – Sulphate of Potash Resource and Production Plan (KLPP-SOPRPP)

The resource utilisation plan for the KLPP underpinning the KLPP-PFS is outlined in *Figure 2*.

Figure 2: KLPP Mineral Resource Estimate - Resource Utilisation in Mine Plan

Lake	Mineralisation Contained in Drainable Porosity	Indicated Mineral Resource contained in Total Porosity that meets reasonable prospects of economic extraction	Production
	Potassium Tonnage	Potassium Tonnage	Potassium Tonnage
	(kt)	(kt)	(kT)
Lakes included in the mine plan (x8)			
Sub Total	**300**	**580**	**430**
Remaining Lakes (x16)			
Sub total	**220**	**430**	
Totals	**520**	**1000**	**430**

The attached KLPP - Sulphate of Potash Resource and Production Plan should be read in conjunction with the rest of this announcement, with particular attention given to the Important Information.

The Mineral Resource estimate underpinning the production targets in this announcement were prepared by a competent person in accordance with the requirements of the JORC Code 2012.

Important Information

This announcement, including the, (1) *KLPP-PFS Summary Report* and the, (2) *KLPP-SOPRPP*, should be read in its entirety, with particularly consideration given to each of the following sections:

- Important Note
- Cautionary Statements, Risk Factors and Disclaimer
- Competent Persons Statement
- Forward Looking Statements

Commentary

Parkway Minerals – Managing Director, Bahay Ozcakmak commented:

“Completion of the KLPP-PFS represents a significant milestone for Parkway Minerals, as this study confirms our long-held belief, that our aMES™ technology, has the potential to transform the high-grade, but relatively small-scale potash resource at the KLPP, into a viable project. Notwithstanding the inherent challenges of developing a small-scale greenfield project in Central Australia, including the development of necessary non-process infrastructure (NPI) such as an access road and power station, the KLPP-PFS also highlights the many advantages of the aMES™ technology. The ability of the aMES™ based flow sheet to produce the intermediate product sylvite (MOP), in order to synthesise SOP, is an inherent advantage over SOP projects that need (or plan) to, purchase MOP as a process input. The KLPP-PFS also highlights the merits of our highly water efficient development concept, as a result of the aMES™ based process plant. Additionally, it also achieves very high potassium recoveries, representing a significant improvement over conventional technologies.”

“With these outstanding PFS results in hand, we will continue to engage with our JV partner, to determine the appropriate next steps for the KLPP. In addition to the KLPP, the KLPP-PFS provides Parkway Minerals with a strong foundation from which to progress commercial opportunities with other project developers/operators. In particular, those with existing operations which would benefit from the strategic application of the aMES™ technology. We have previously investigated the potential application of aMES™ technology for a range of projects, predominantly, in the energy and mining sectors. With the completion of the KLPP-PFS, we look forward to providing further details, as evaluations of these projects progress. On behalf of Parkway Minerals, I’d like to take this opportunity to thank the entire project team for delivering this breakthrough study, particularly our colleagues at Worley, for their continued support in assisting us unlock significant value from our innovative aMES™ technology.”

On behalf of Parkway Minerals NL.

Bahay Ozcakmak

Managing Director

This announcement and the attached reports have been authorised for release by Bahay Ozcakmak (MD) on behalf of the Board of Parkway Minerals NL.

Additional Information

For further information contact:

Bahay Ozcakmak
Managing Director
T: +61 414 596 007
E: bahay@parkwayminerals.com.au

Important Information

This announcement, including the, (1) *KLPP-PFS Summary Report* and the, (2) *KLPP-SOPRPP*, should be read in its entirety, with particularly consideration given to each of the following sections:

- Important Note
- Cautionary Statements, Risk Factors and Disclaimer
- Competent Persons Statement
- Forward Looking Statements

Important Note

Please refer to the assumptions, sensitivities, cautionary statements, risk factors and disclaimer in this announcement, as well as the relevant details in each of the KLPP-PFS Summary Report and KLPP-SOPRPP, as these may adversely impact upon the information, conclusions and forecasts outlined in this announcement.

Cautionary Statements, Risk Factors and Disclaimer

Certain statements in this study include estimates or future events that are forward-looking statements. They include indications of, and guidance on, future earnings, cash flow, costs and financial performance. Such forward-looking statements are provided as a general guide only and should not be relied on as a guarantee of future performance. When used in this report, words such as, but are not limited to, “could”, “planned”, “estimated”, “expect”, “intend”, “may”, “potential”, “should”, “projected”, “scheduled”, “anticipates”, “believes”, "predict", "foresee", "proposed", "aim", "target", "opportunity”, “nominal”, “conceptual” and similar expressions are forward-looking statements. Although the expectations reflected in these forward-looking statements are believed to be reasonable, such statements involve risks and uncertainties, and no assurance can be given that actual results will be consistent with these forward-looking statements. Forward-looking statements are provided as a general guide only and should not be relied on as a guarantee of future performance as they may be affected by a range of variables that could cause actual results to differ from estimated results and may cause actual performance and financial results in future periods to materially differ from any projections of future performance or results expressed or implied by such forward-looking statements. There can be no assurance that actual outcomes will not materially differ from these forward-looking statements.

The contents of this study are also subject to significant risks and uncertainties that include but are not limited those inherent in technology commercialisation, mine development and production, geological, mining, metallurgical and processing technical problems, the inability to obtain and maintain mine licenses, permits and other regulatory approvals required in connection with mining and processing operations, competition for among other things, capital, acquisitions of reserves, undeveloped lands and skilled personnel, incorrect assessments of the value of projects and acquisitions, changes in commodity prices and exchange rate, currency and interest rate fluctuations and other adverse economic conditions, the potential inability to market and sell products, various events which could disrupt operations and/or the transportation of mineral products, including labour stoppages and severe weather conditions, the demand for and availability of transportation services, environmental, native title, heritage, taxation and other legal problems, the potential inability to secure adequate financing and management's potential inability to anticipate and manage the foregoing factors and risks. There can be no assurance that forward-looking statements will prove to be correct. Where the KLPP-JV partners, directors, officers, employees and/or consultants express or imply an expectation or belief as to future events or results, such expectation or belief is expressed in good faith and on a reasonable basis. No representation or warranty, express or implied, is made that the matters stated in this study will in fact be achieved or prove to be correct.

Competent Persons Statement

The information in this announcement that relates to Exploration Results and Mineral Resources for the Karinga Lakes Potash Project is based on, and fairly represents, information compiled by Mr Ben Jeuken, who is a member of the Australian Institute of Mining and Metallurgy and a member of the International Association of Hydrogeologists. Mr Jeuken is employed by Groundwater Science Pty Ltd, an independent consulting company. Mr Jeuken has sufficient experience, which is relevant to the style of mineralisation and type of deposit under consideration and to the activity, which they are undertaking to qualify as a Competent Person as defined in the 2012 Edition of the ‘Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves’. Mr Jeuken consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

Forward Looking Statements

As outlined above in the *Cautionary Statements, Risk Factors and Disclaimer* section, and on page 8 of this ASX announcement.

aMES™ Technology

The *activated Mineral Extraction System*, or ***aMES™*** is an innovative process technology that enables the treatment of concentrated brine solutions to recover a range of valuable compounds, reagents and fresh water. The technology utilises a proprietary multi-staged process incorporating novel membrane technology and is based on proprietary IP, incorporating patents, expertise and know-how acquired over more than a decade of intense process development.

Advantages of the aMES™ technology include:

- improvements in mineral recovery and product quality,
- opportunity for substantial project capex & opex savings,
- efficient use of energy and produces pure water as a by-product, and
- improved project footprint and environmental sustainability.

Ongoing collaboration with a number of brine project developers and operators has confirmed there are many applications where the aMES™ technology has the potential to deliver substantial value by enhancing existing flowsheets, in order to improve overall project performance.

Additional Information

www.parkwayminerals.com.au/ames-technology

aMES™

Brine Processing Technology

Key Industries (Applications)

- Mining natural brine (salt lakes)
- Solution mining brine (potash)
- Refinery & industrial waste brine
- Wastewater treatment brine

Target Products (Produced)

- Potash (MOP/SOP/KMS)
- Lithium and magnesium salts
- Range of byproducts (B, Br, Ca, Co, Cu, I, Na, Ni, REE, Si, Sr)
- Reagents
- Water

iBC™ Technology

The *integrated Brine Causticization*, or ***iBC™*** is a patented process technology that simultaneously removes common impurities from waste brine streams and converts sodium carbonates and bicarbonates commonly found in coal seam gas (CSG) brines, into more soluble sodium hydroxide.

As a result of the causticization step, the iBC™ technology produces a purified brine suitable for downstream processing, including with the aMES™ technology, for the production of various salt products and industrial-grade sodium hydroxide.

Additional Information

https://www.parkwayminerals.com.au/ibc-technology

iBC™

Brine Pre-Treatment Technology

Key Industries (Applications)

- Oil & gas waste brine (CSG)
- Wastewater treatment brine

Target Products (Produced)

- Sodium hydroxide concentrate
- Sodium chloride
- Byproducts (Ca, Mg, Si)

About Parkway Minerals

In October 2019, Parkway Minerals (ASX: PWN) completed a transformational transaction by acquiring an Australian unlisted public company, Consolidated Potash Corporation (CPC). Through CPC, Parkway Minerals acquired a minority interest in the Karinga Lakes Potash Project (KLPP) in NT Australia. The CPC transaction, also resulted in Parkway Minerals acquiring the innovative aMES™ technology, which has been developed to process a range of challenging brine streams from the mining industry, in order to recover valuable minerals, reagents as well as produce fresh water.

Given the significant market opportunities, Parkway Minerals is focused on commercialising a world-class technology portfolio to provide long-term sustainable solutions for processing complex brines, in the energy, mining and wastewater industries. In order to achieve this objective, Parkway Minerals is partnering with leading industry participants to provide, BPaaS – Brine Processing as a Solution™.

Strategic Investment

Parkway Minerals holds a strategic investment in Davenport Resources (ASX: DAV), which has successfully delineated a globally significant in-situ potash resource (in excess of 550 million tonnes of contained potash), at its South Harz project in Central Germany. Recently completed scoping studies have delivered excellent technical and economic results and provide Davenport Resources with an attractive opportunity to create and unlock substantial value.

Parkway Minerals is commercialising a world-class technology portfolio to provide long-term sustainable solutions for processing complex brines, in the energy, mining and wastewater industries.

Our mission is to collaborate with leading strategic partners to deliver:

BPaaS – Brine Processing as a Solution™.

Forward-Looking Statements

This ASX Release may contain certain “forward-looking statements” which may be based on forward-looking information that are subject to a number of known and unknown risks, uncertainties, and other factors that may cause actual results to differ materially from those presented here. Where the Company expresses or implies an expectation or belief as to future events or results, such expectation or belief is expressed in good faith and believed to have a reasonable basis. Forward-looking information includes exchange rates; proposed or projected project or transaction timelines; uncertainties and risks associated with the advantages and/or performance of the Company’s projects and/or technologies; uncertainties and risks regarding the estimated capital and operating costs; uncertainties and risks regarding any envisaged timelines in relations to any results, milestones, partnerships, including but not limited to any milestones which may require obtaining approvals from third parties.

For a more detailed discussion of such risks and other factors, see the Company’s other ASX Releases. Readers should not place undue reliance on forward-looking information. The Company does not undertake any obligation to release publicly any revisions to any forward-looking statement to reflect events or circumstances after the date of this ASX Release, or to reflect the occurrence of unanticipated events, except as may be required under applicable securities laws.

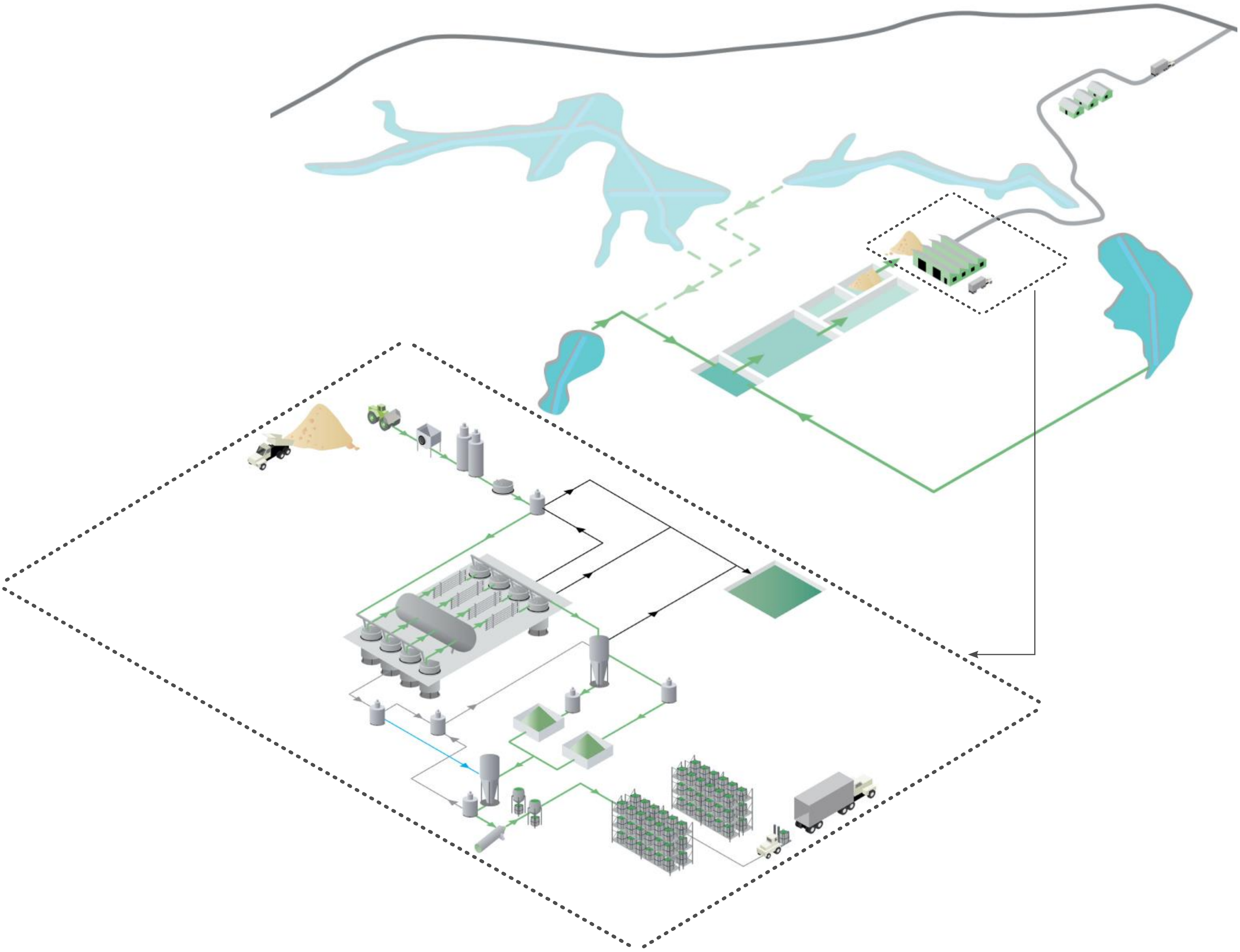
Report 1

Karinga Lakes Potash Project

Pre-Feasibility Study (KLPP-PFS) Summary Report

Karinga Lakes Potash Project
PRE-FEASIBILITY STUDY

KLPP-PFS



KLPP – JOINT VENTURE

VERDANT MINERALS

parkway MINERALS NL

SUMMARY REPORT

4 November 2020

Synopsis

The Karinga Lakes Potash Project (KLPP) located in Central Australia (N.T.), is owned through an unincorporated joint venture (KLPP-JV) between Verdant Minerals Ltd and Parkway Minerals NL (ASX: PWN). The KLPP has undergone extensive resource exploration and appraisal over a number of years, which has resulted in the delineation of a potassium resource potentially suitable for potash production. This pre-feasibility study (KLPP-PFS) outlines an innovative (aMES™ based) processing route which may be suitable for developing the KLPP. The KLPP development concept involves the processing of naturally occurring hypersaline brines from a series of salt lakes, in order to produce 40,000 tonnes per annum (tpa) of high-purity sulphate of potash (SOP), over an initial mine life of 20 years. The aMES™ technology is owned by Parkway Minerals NL, which also holds a 1% royalty (NSR) interest over the KLPP.

KLPP-PFS Basis of Preparation

On 8 May 2020, Parkway Minerals signed a Global Strategic Cooperation Agreement with Worley Services Pty Ltd (hereafter "Worley") to commercialise the aMES™ technology. On 11 May 2020, Parkway Minerals announced the commencement of the KLPP-PFS, through collaboration with Worley as study manager and supported by leading industry consultants and a range of key equipment vendors.

	ROLE IN KLPP-PFS
Worley energy | chemicals | resources	*Study Manager*
parkway MINERALS	*Preparation of Summary Report*
VERDANT MINERALS	*KLPP – Joint Venture Partner*
GROUNDWATER SCIENCE	*Mineral Resource Estimate and Production Plan*
WardKeller The Territory Law Firm	*Review of Land Tenure and Environmental Studies, Social Impact & Permitting*
***KLPP-PFS** – Summary Report*	*This report represents a summary of the KLPP-PFS*

Disclaimer

This report is provided on the basis that neither Parkway Minerals NL (the "Company) nor its respective directors, officers, employees, representatives, partners, consultants and advisers, and its related bodies corporate, make any representation or warranty (express or implied) as to the accuracy, reliability, relevance or completeness of the material contained in this report. Nothing contained in this report is, or may be relied upon, as a promise, representation or warranty, whether as to the past or the future. Except for statutory liability, the Company hereby excludes, to the full extent of the law, all liability whatsoever (including in negligence) for any loss or damage which may be suffered by any person as a consequence of any information in this announcement or any error or omission there from. ***This report should be read in conjunction with Chapter 15 (Risks - Cautionary Statements, Risk Factors and Disclaimer).***

Table of Contents

Appendices

Appendix A. Karinga Lakes Potash Project – Sulphate of Potash Resource and Production Plan

List of Tables

List of Figures

Definitions

AAPA	Aboriginal Areas Protection Authority
AHD	Australian Height Datum
AISC	All-In Sustaining Cost
aMES™	activated Mineral Extraction System
ARENA	Australian Renewable Energy Agency
ASX	Australian Securities Exchange
AWT	Activated Water Technologies
BOD	Basis of Design
BOM	Bureau of Meteorology
BWRO	Brackish Water Reverse Osmosis
CAPEX	Capital Expenditure
CHP	Combined Heat & Power
CICCC	Changsha Design & Research Institute of Ministry of Chemical Industry
CNG	Compressed Natural Gas
CPC	Consolidated Potash Corporation
CRU	Leading consulting group
DEM	Digital Elevation Model
DFS	Definitive Feasibility Study
DMIRS	Department of Mines, Industry Regulations and Safety
EBITDA	Earnings Before Interest, Tax, Depreciation & Amortisation
EIA	Environmental Impact Assessment
EL	Exploration Licence
ELA	Exploration Licence Application
ELR	Exploration Licence in Retention
EPC	Engineering, Procurement, Construction (contractor)
EPCM	Engineering, Procurement, Construction Management (service provider)
FAT	Factory Acceptance Testing
FID	Final Investment Decision
FTE	Full-Time Equivalent
ICP	Inductively Coupled Plasma mass spectrometry
ILUA	Indigenous Land Use Agreement
IRR	Internal Rate of Return
ISE	Ion Selective Electrode
KLPP	Karinga Lakes Potash Project
KLPP-JV	Karinga Lakes Potash Project – Joint Venture
KLPP-PFS	Karinga Lakes Potash Project – Pre-Feasibility Study
KMS	Kalium (potassium) Magnesium Sulphate
LBS	Lake-Bed Sediment
LiDAR	Light Detection And Ranging
LOM	Life of Mine

LPG	Liquefied Petroleum Gas
LPS	Low-Pressure Steam
MHW	engineering services provider
MCP	Module Control Panel
MIP	Module Interface Panel
ML	Mining Licence
MOP	Muriate of Potash
MOU	Memorandum of Understanding
NAIF	Northern Australia Infrastructure Facility
NPI	Non-Process Infrastructure
NPV	Net Present Value
NSR	Net Smelter Royalty
NTEPA	Northern Territory Environmental Protection Agency
NTMA	Native Title Mining Agreement
O&M	Operations & Maintenance
OEM	Original Equipment Manufacturer
OPEX	Operational Expenditure
PEMS	Potassium Enriched Mixed Salts
PFD	Process Flow Diagram
PFS	Pre-Feasibility Study
PWN	Parkway Minerals NL
QA	Quality Assurance
QC	Quality Control
SILO	Scientific Information for Land Owners
SOP	Sulphate of Potash
SOPM	Sulphate of Potash Magnesia
TDS	Total Dissolved Solids
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
WTP	Water Treatment Plant
WWTP	Waste-Water Treatment Plant
XRD	X-Ray Diffraction

Units

°C	degrees Celsius
cm	centimetre
ft	feet
GJ	gigajoule
GL	gigalitre

g	gram
ha	hectare
kg	kilogram
kL	kilolitre
km	kilometre
km^2	square kilometre
kt	kilo tonnes
kW	kilowatt
$kWh_{(e)}$	kilowatt hour – electrical
$kWh_{(th)}$	kilowatt hour – thermal
L	litre
m	metre
m^2	square metres
m^3	cubic metres
mbarg	millibar gauge
mm	millimetre
ML	megalitre
$MW_{(e)}$	megawatt - electrical
$MW_{(th)}$	megawatt - thermal
t	tonnes
tph	tonnes per hour
tpa	tonnes per annum
V	Volt
yr	year

Currency

AUD	Australian dollars
USD	United States dollars

NOTE: Unless stated otherwise, all amounts outlined in this report refer to AUD, Australian Dollars.

1. Executive Summary

1.1 Introduction

The Karinga Lakes Potash Project (KLPP), represents an attractive opportunity to potentially develop a specialised brine mining operation, to produce a high-quality, soluble grade, sulphate of potash (SOP) product, targeting key domestic markets, in Australia. As the most advanced Australian potash project outside of Western Australia, the KLPP is more proximal to key horticulture markets of Eastern Australia, compared to SOP project proponents in Western Australia.

The KLPP covers an area of approximately 1,100km^2, approximately 230km to the south west of Alice Springs in the Northern Territory, Australia. The production of various salt products from the brine resources in the vicinity of the KLPP was proposed as early as the late 1980's. More recently, the KLPP project operator (Verdant Minerals) published a scoping study in 2014, which was followed by a more recent scoping study in early 2019 (unpublished), based on a more innovative process route, incorporating the aMES™ technology. In contrast to prior studies, the aMES™ based process route, provided sufficient encouragement for the project operator and Parkway Minerals to commence a pre-feasibility study (KLPP-PFS) as first announced on 11 May 2020[1]. Parkway Minerals assembled an integrated project team, led by study manager Worley Services Pty Ltd, hereafter Worley, supported by leading industry consultants and a range of key equipment vendors.

1.2 Mineral Resource Estimate

This section should be read in conjunction with the *Karinga Lakes Potash Project (KLPP) Sulphate of Potash Resource and Production Plan*, which is provided in *Appendix A* of this report, with particular attention given to i) the basis of preparation, ii) the limitations of any conclusions and/or findings, and iii) *Section 5*, the *Competent Persons Statement*.

Based on extensive historical resource evaluation studies at the KLPP, as part of this study, an updated mineral resource estimate was prepared. Of the 24 lakes which constitute the KLPP, only 8 lakes proximal to the proposed SOP process plant location, were included in the mine plan (trench locations outlined in *Figure 1.1*). The updated Mineral Resource Estimate determined that these 8 lakes host an Indicated Mineral Resource of 580,000t of potassium; of this, the production schedule over the 20 year mine plan incorporates mining 430,000t of potassium (see *Table 1.1*).

The estimated production profile from each lake has been incorporated into a production schedule, as part of the proposed mine plan. The basis for the schedule is based on the net annual production of 40,000t of SOP, from a brine feed containing 42,000t of SOP (18,843t, equal to 44.87% of the SOP, is potassium). On this basis, the 430,000t of potassium production (as outlined in *Table 1.1*) is sufficient to underpin an initial mine life of 20 years. It may be possible to potentially increase the production profile and/or extend mine

---

[1] Parkway Minerals ASX Announcement, 11 May 2020.

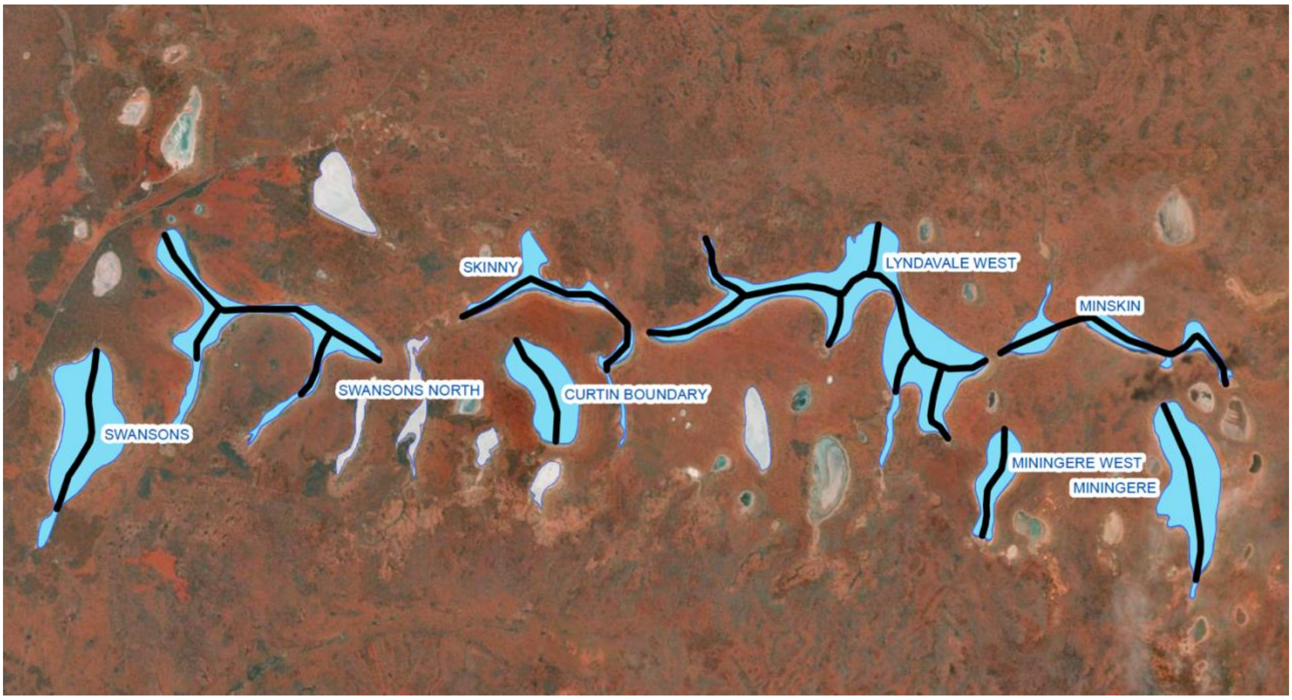
life, through the conversion of additional mineral resources into the mine plan, as well as delineating additional mineral resources, as described in *Chapters 4* & *5*.

Table 1.1. Karinga Lakes Potash Project - Mineral Resource Estimate

Lake	Mineral Resource Contained in Drainable Porosity	Indicated Mineral Resource contained in Total Porosity that meets reasonable prospects of economic extraction	Production
Lakes included in the mine plan	**K Tonnage (kt)**	**K Tonnage (kt)**	**K Tonnage (kt)**
Miningere	67	139	122
Miningere West	22	48	36
Minskin	14	29	29
Skinny	19	41	27
Lyndavale West	80	126	92
Curtin Boundary	24	54	35
Swansons	46	78	51
Swansons North	31	65	47
Sub Total	**300**	**580**	**430**

Note: The Indicated Mineral Resource is reported inclusive of the Production Tonnage. Totals are rounded to two significant figures.

Figure 1.1. Karinga Lakes Potash Project – Proposed Trench Layout



1.3 Development Concept

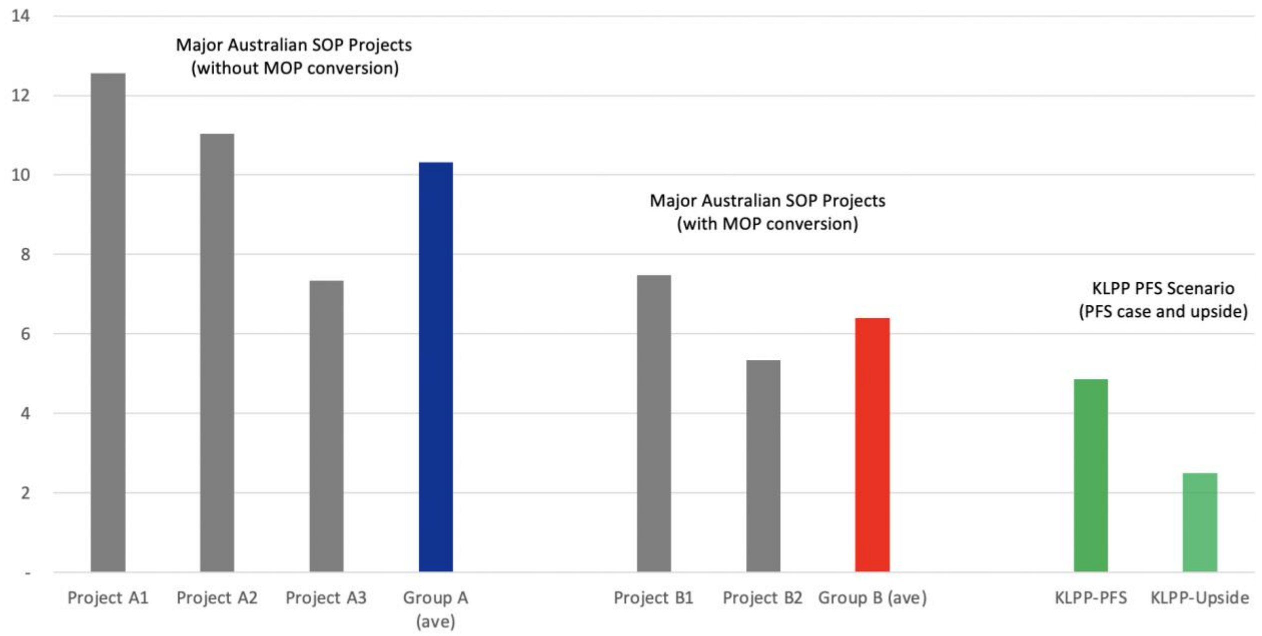
The KLPP development concept developed in this study, involves the processing of naturally occurring hypersaline brines from a series of salt lakes, in order to produce 40,000 tonnes per annum (tpa) of high-purity sulphate of potash (SOP), over an initial mine life of 20 years. The development concept is divided into two broad areas of operation, upstream and downstream operations (refer *Figure 2.1*):

- Upstream Operations – consist of excavated trenches in a series of salt lakes, to channel the natural brines into the evaporation and crystallisation pond network, where the end product, is a potassium enriched mixed salt (PEMS).
- Downstream Operations – involves the precise processing of the potassium enriched mixed salts from the upstream operations, in a processing plant, incorporating the innovative aMES™ based technology, in order to produce a high-purity SOP product.

A number of significant advantages of the proposed KLPP-PFS development concept have been established through this study, including:

- Strong Financial Performance - Despite the relatively small-scale of the project which would ordinarily be considered sub-economic, the development concept outlined in the KLPP-PFS appears to be financially attractive.
- High Potassium Recoveries & Grade - The unconventional processing route based on the aMES™ technology is capable of achieving high potassium recoveries.
- Efficient Water Use - As the aMES™ technology recovers freshwater during the processing of brines, the development concept outlined in this study, is highly efficient, in terms of water use. In comparison to other major SOP projects, the KLPP-PFS envisages a water use intensity of approximately half that of the peer group (refer *Figure 1.2*), with a realistic pathway to potentially reducing the intensity of water use, by approximately half again.

Figure 1.2. Water Intensity (m^3 of water per tonne of SOP production)



1.4 Key Financial Metrics

This report investigated the potential advantages of the proposed KLPP development concept, through a range of detailed studies, including the development of a project cost estimate. The project cost estimate was developed to a Class 4 level and was used as the basis for performing a range of financial evaluations, as outlined in *Chapter 11*.

Key Findings

- Upfront capital cost of $80.0 million for initial 40,000tpa SOP production capacity, inclusive of all infrastructure, indirects, owners' costs including $6.7 million in contingency:
    - Production cost (OPEX) of $293/tonne of SOP, ex-mine gate, or $391/tonne delivered to either Adelaide in South Australia, or other proximal regional markets.
    - Strong cash generation potential, with estimated EBITDA margin of 54.4%, resulting in annual EBITDA of $18.6 million.
    - Ungeared development of the KLPP would result in:
        - Project payback in approximately 5.5 years from first SOP production.
        - Post-Tax NPV$_{8\%}$ of $80.1 million with an IRR of 20.4%, after tax.
- These financial parameters do not include any form of financial gearing, which depending on available funding costs and corresponding conditions, may improve forecast financial returns, further.
- Significant opportunities to improve the financial performance of the project have been identified, particularly in relation optimising the design and procurement of non-process infrastructure, as well as, potentially being able to offset certain capital expenditures through support from a number of government agencies[2], including ARENA and or NAIF.
- The aMES™ based KLPP-PFS scenario compares favourably with conventional process routes, including historical studies performed on the KLPP.

Comparison to 2014 KLPP Scoping Study

In December 2014, KLPP-JV partner Verdant Minerals (formerly Rum Jungle Resources), delivered a scoping study for the KLPP[3]. The 2014 scoping study outlined a 125,000tpa SOP production scenario ("Scenario 1"), with estimated total CAPEX of $340 million (in 2014 dollars). The CAPEX and OPEX numbers for this scenario have been indexed to 2020 dollars, and benchmarked against the KLPP-PFS study, in order to demonstrate the relative cost estimates, as outlined in *Figure 1.3*.

It should be noted there are a number of significant differences between the 2014 scoping study scenario and the KLPP-PFS development concept. One of the major differences is that the 2014 scenario contemplated a much larger development, consisting of 125,000tpa of SOP production, compared to the aMES™ based KLPP-PFS scenario of a more modest 40,000tpa of SOP production. The smaller development

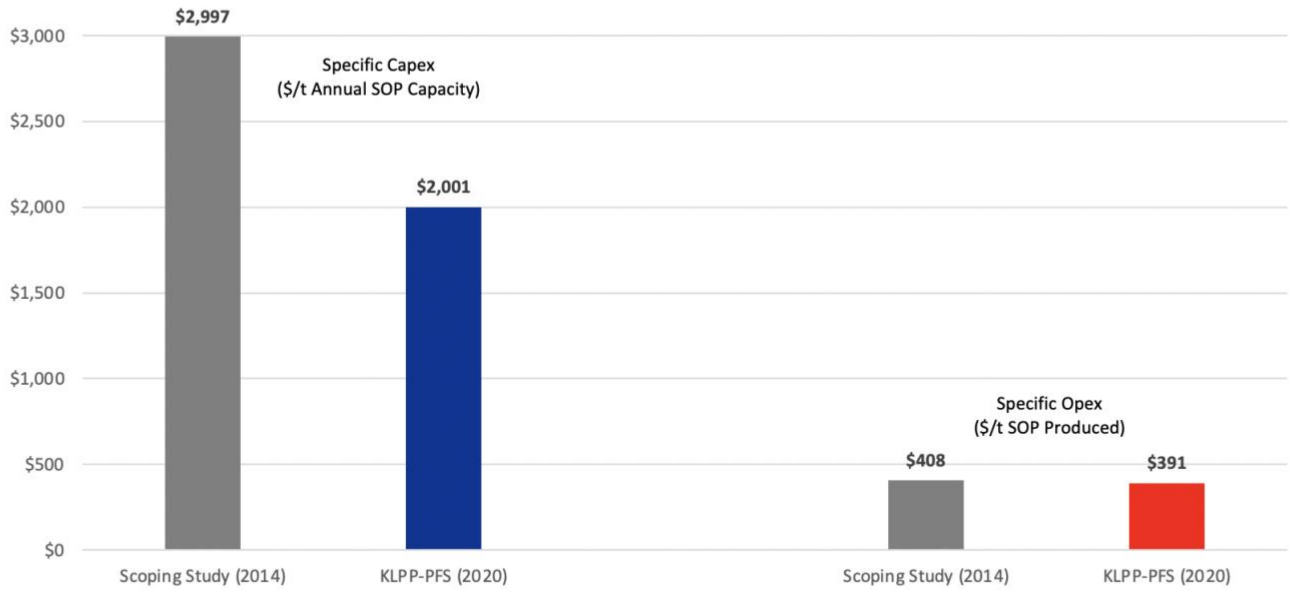
---

[2] No formal discussions have been conducted with either ARENA or NAIF in relation to the KLPP, as of the date of this report.

[3] Rum Jungle Resources, Karinga Lakes Potash Scoping Study, ASX Release 22 December 2014.

will require similar non-process infrastructure, such as roads which creates a proportionately higher burden for the smaller development envisaged in the KLPP-PFS, compared to the 2014 scoping study scenario. Notwithstanding the diseconomies of scale, the KLPP-PFS development concept compares favourably, with a lower OPEX profile, and a significantly lower CAPEX profile. A larger scale development of the KLPP-PFS development concept could reasonably be expected to achieve further improvements, however these are yet to be quantified and will be explored further during later stages of project evaluation.

Figure 1.3. KLPP Cost Estimate Comparison (CAPEX & OPEX, 2014 Scoping Study compared to 2020 PFS)



2. Introduction

2.1 History

The Karinga Lakes Potash Project (KLPP) covers an area of approximately 1,100km^2, in the Northern Territory. The KLPP has been the subject of extensive evaporite mineral exploration, including potash mineral exploration, since as early as the 1980's. The most recent project operator, Verdant Minerals has performed extensive resource exploration and appraisal related activities at the KLPP since 2010.

On the 10th of August 2017, Activated Water Technologies and Consolidated Potash Corporation (AWT and CPC, respectively) entered into an earn-in agreement with Verdant Minerals. Following the delivery of a successful scoping study for the KLPP based on AWT's aMES™ technology, on the 7th of February 2019, CPC acquired an initial 15% interest in the KLPP, and established an unincorporated joint venture with Verdant Minerals. Later in 2019, through a series of corporate transactions, on the 17th of September 2019, Parkway Minerals NL (ASX: PWN) completed the acquisition of both AWT and CPC, resulting in two key outcomes:

- Parkway Minerals became the owner of the aMES™ technology.
- Parkway Minerals (through its subsidiaries) became Verdant Minerals' JV partner for the KLPP.

Additional details about historical activity at the KLPP can be found in the following sections.

- Mineral resource exploration and appraisal activity, refer to *Chapter 4*.
- Metallurgical test work, refer to *Chapter 6*.

2.2 Project Description

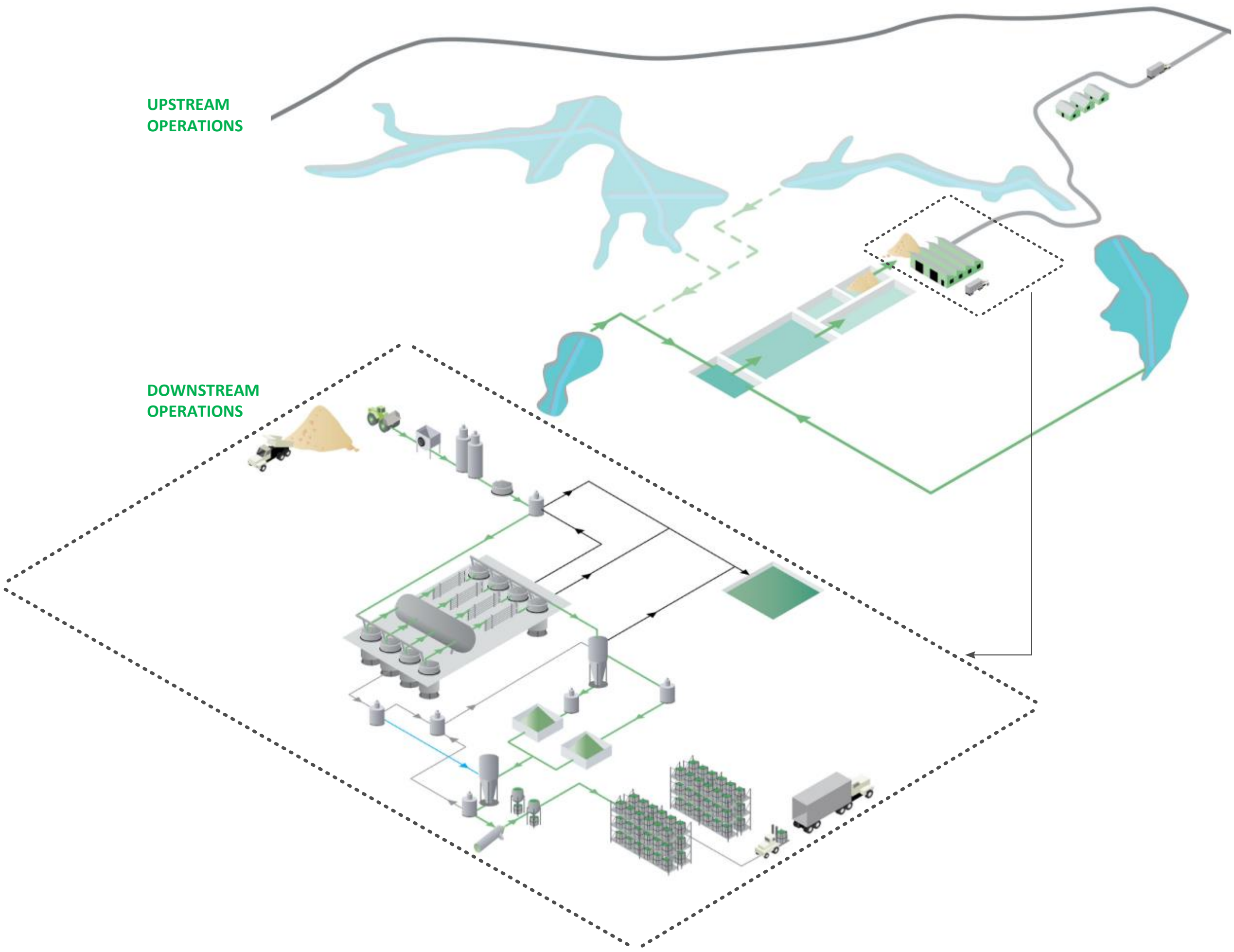
Introduction

The KLPP, represents an attractive opportunity to potentially develop a specialised mining operation, to produce a high-quality, soluble grade, sulphate of potash (SOP) fertiliser product, targeting key domestic markets in Australia. As the most advanced potash project outside of Western Australia, the KLPP is more proximal to key horticulture markets of Eastern Australia, compared to SOP project proponents in Western Australia.

Development Concept

The KLPP development concept involves the processing of naturally occurring hypersaline brines from a series of salt lakes, in order to produce 40,000 tonnes per annum (tpa) of high-purity sulphate of potash (SOP), over an initial mine life of 20 years. The development concept is divided into two broad areas of operation, upstream and downstream operations, as illustrated in *Figure 2.1*.

Figure 2.1. KLPP Development Concept



Upstream Operations – consist of excavated trenches in a series of salt lakes, to channel the natural brines into the evaporation and crystallisation pond network, where the end product, is a potassium enriched mixed salt. These salts are periodically harvested and stockpiled besides the process plant, ready for processing in the downstream operations.

Further details regarding upstream operations at the KLPP are provided throughout this report, including in the following sections:

- *Chapter 3 – Climate, Weather & Site Conditions.*
- *Chapter 4 – Mineral Resource Estimate.*
- *Chapter 5 – Production Plan.*
- *Chapter 7 – Pond Design.*

Downstream Operations – involve the precise processing of the potassium enriched mixed salts from the upstream operations, in a processing plant, incorporating the innovative aMES™ based technology. During processing, two intermediate salts are produced, which are subsequently reacted onsite, to produce a high-purity SOP product, ready for dispatch to key domestic markets.

Further details regarding downstream operations at the KLPP are provided throughout this report, including in the following sections:

- *Chapter 6 – Metallurgical Test Work Program.*
- *Chapter 8 – Process Plant Design.*

Other Operations – in addition to upstream and downstream operations at the KLPP, the other key area of operations relates to non-process infrastructure (NPI). Further details relating to NPI at the KLPP is presented in *Chapter 9*.

Project Ownership

The Karinga Lakes Potash Project is currently owned by an unincorporated joint venture, with the following ownership interests:

- 85% owned by Verdant Minerals Ltd (and related entity Territory Potash PL), as project operator.
- 15% owned by Parkway Minerals NL (through Consolidated Potash Corporation Limited), as project partner.

Through the KLPP joint venture agreement (KLPP-JVA), and subsequent agreements, Parkway Minerals may acquire an additional 25% equity interest in the KLPP-JV, by investing a further $2 million to advance the KLPP. The completion of the updated mineral resource estimate (*Chapters 4* & *5*) and the preparation of the KLPP-PFS amongst other costs, form eligible expenditure under the KLPP-JV. Whilst accounts for the KLPP have not been finalised as of the date of this report, it is anticipated that Parkway Minerals will have met its eligible expenditure obligations to acquire the additional 25% project interest (40% total interest), before the end of 2020 or in early 2021. As Parkway Minerals is a publicly listed company on the Australian Securities Exchange (ASX), Parkway Minerals will immediately make an ASX announcement once it has confirmed that it has moved to a 40% interest in the KLPP-JV.

Other

The KLPP historically consisted of 7 exploration licences (EL's) covering 1,081km^2. In order to reduce administrative costs associated with managing seven EL's and to simplify dealings with stakeholders, in September 2019, Verdant Minerals commenced a tenement consolidation process, with the objective of reducing the number of EL's from seven to three, to better match pastoral lease boundaries.

Further details about land tenure is outlined in *Chapter 12*, with further details provided in *Section 12.2 – Tenement Consolidation Process*.

2.3 Reliance on Other Experts

Preparation of the KLPP-PFS was delivered through an integrated team led by Worley, with cooperation from Parkway Minerals, Verdant Minerals and numerous consultants, specialists and equipment vendors.

3. Climate, Weather and Site Conditions

This chapter outlines the natural elements and their impact on the design, construction and performance of the KLPP. This chapter is an extract of a more detailed study performed by Worley, investigating the following key elements:

- Climate Data (i.e. evaporation, rainfall, wind speed and direction).
- Geotechnical Data (e.g. seepage expressed as permeability of soils, materials of construction, constructability, materials of construction, hydrogeology, geology, groundwater, seismic, etc.).

3.1 Climate Data

As the KLPP requires large-scale solar evaporation (as outlined in *Chapter 7*), key climatic variables relating to temperature, evaporation rates and rainfall, amongst others, are important considerations, in the effective design and operation of a successful brine-based potash project.

The climate in the KLPP area is arid with average annual rainfall of only 225 mm, which occurs mostly during the warm summer months, which usually give way to relatively mild winters.

3.1.1 Bureau of Meteorology (BOM) Data

As climate data for the specific KLPP project area is not available, data has been extrapolated from the nearby Bureau of Meteorology (BOM) Weather Stations at Curtin Springs and Erldunda, approximately 75km and 116km from the proposed KLPP site, respectively.

Temperature data from the Australian Bureau of Meteorology for Karinga (Latitude-25.3° S, Longitude 132.20° E, and elevation 490 m) is outlined in *Table 3.1* and has been used as the basis for design the KLPP plant facilities (*Table 3.2*).

Table 3.1. Temperature Data for KLPP

Parameter		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
T_{min}	°C	22	22	19	14	9.0	5.2	4.3	6.1	11	15	18	21	**14**
T_{max}	°C	38	37	34	29	24	20	21	24	28	32	35	36	**30**
T_{mean}	°C	30	29	26	22	16	13	12	15	19	23	27	29	**22**
T_{Lowest}	°C	18	19	15	10	3.6	1.4	**0.0**	2.4	6.9	11	15	19	**0.0**
$T_{Highest}$	°C	38	40	37	34	28	24	26	28	33	36	38	**41**	**41**

Table 3.2. Design Temperature Data

Item	Operating Parameters
Temperature design maximum	50°C (with solar radiation can go up to 70ºC for metal enclosures, black poly or tanks)
Temperature design minimum	0°C

3.2 Rainfall

In the vicinity of the KLPP, rains occur predominately in the summer with rainfall associated with tropical lows including cyclones and ex-tropical cyclones. Winter rains are typically the result of the northern extent of large southern fronts. The following rainfall data (*Table 3.3*) for the KLPP region since 1975 is sourced from the Scientific Information for Land Owners (SILO), a Queensland Government database, with the data for the Grid point (at the Project site), derived from the proximal Station locations (Curtin Spring & Erldunda).

Table 3.3. Summary of average monthly rainfall (mm/month) at the KLPP (Jan 1975 – Jun 2020)

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Avg	mm	28	27	31	11	16	11	10	6	10	18	24	33	225
Med	mm	21	8	6	2	2	2	1	1	2	5	20	18	199
Min	mm	0	0	0	0	0	0	0	0	0	0	0	0	32
Max	mm	202	230	288	92	103	123	63	59	80	122	105	170	650

3.3 Evaporation

As measured pan evaporation does not exist for the KLPP, again, the BOM and SILO data were averaged to estimate the evaporation rate for the purposes of performing the KLPP-PFS. The Net Morton Lake Evaporation Rate design inputs of 1,595mm/year or 4.37mm/day, as outlined in *Table 3.4*, were used for the basis of performing pond sizing for the KLPP.

Table 3.4. Summary of Monthly Morton Lake Evaporation Data (Jan 1975 – Jun 2020)

Month	Morton Lake Evaporation (mm/month)	Rainfall (mm/month)	Net Morton Lake Evaporation (mm/month)
January	226	28	198
February	187	27	160
March	177	31	146
April	127	11	116
May	90	16	74
June	69	11	58
July	81	10	71
August	111	6	105
September	146	10	136
October	187	18	169
November	201	24	177
December	218	33	185
Annual	**1820**	**225**	**1595**
Average	**152**	**19**	**133**

3.4 Geotechnical Assessment

3.4.1 Desktop Geotechnical Study

Worley's Advisian Geoscience Group was engaged to produce a geotechnical desktop report for the KLPP. The geotechnical report forms an appendix in the complete version of the KLPP-PFS and was used to provide the input data for design of the pond walls and general site construction aspects for civil and earthworks in the processing plant, amenities, facilities, accommodation camp and access roads.

Information and data provided for general site conditions for the KLPP has been limited, due to:

- Limited topographical data and information was available for the project area, with 5m AHD contours the best available information. As no other current topographical information is available, this will need to be sourced in future phases of this project, as outlined in *Chapter 16*.
- Absence of LiDAR information available for this area.
- A site visit to the KLPP has not been conducted, due to COVID-19 restrictions.

3.4.2 Site location

The KLPP site is located along a chain of dry salt lakes and is located within the Central Australian Groundwater Discharge Zone, the remnants of a paleo-drainage system that is recharged via a regional groundwater system. The site is accessed by unsealed tracks via the Lasseter Highway.

3.4.3 Site Description

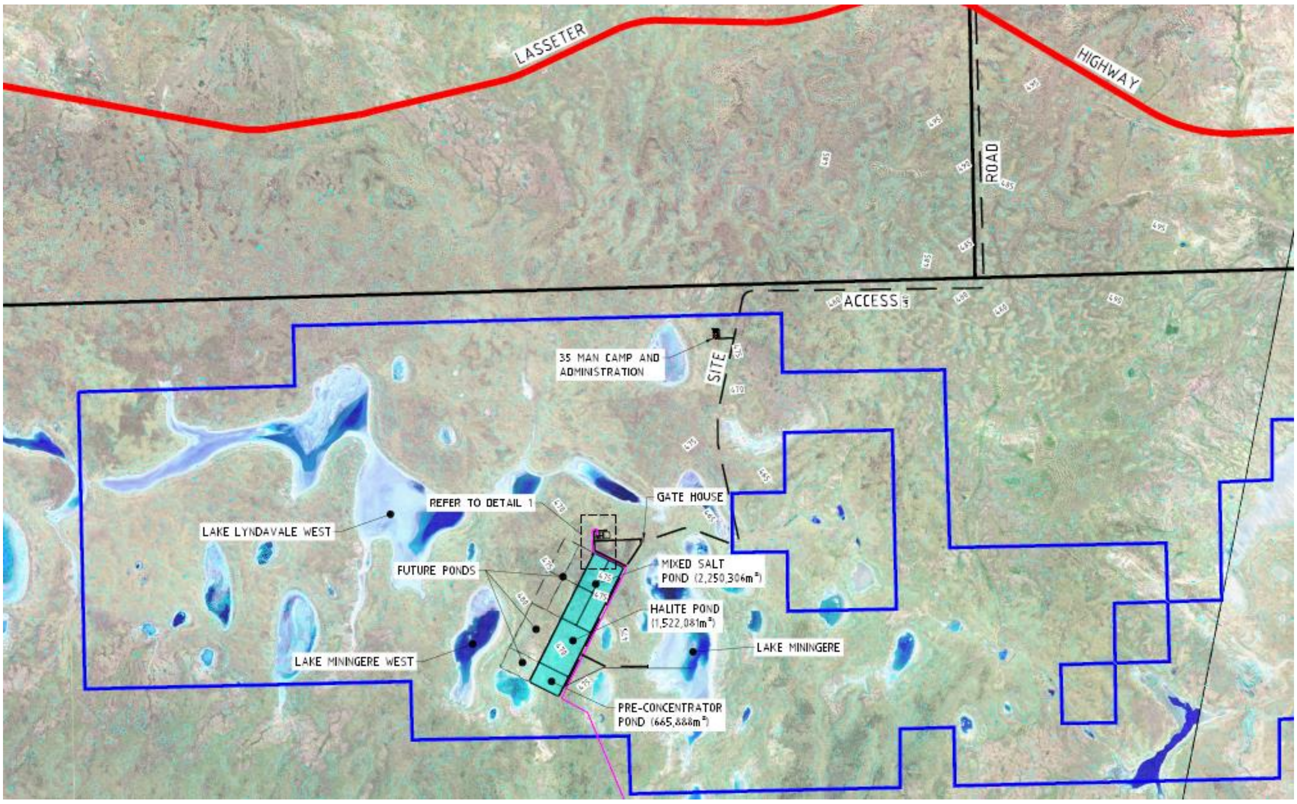
The KLPP site consists of two separate areas, namely the study area and the site access road. The study area comprises a rectangular-shaped area approximately 7.5km by 3.5km in size bounded to the east by Lake Miningere, that includes the proposed ponds, process plant, power station, fuel storage area, water utilities, laydown area and product storage area.

The proposed accommodation area is located approximately 6km to the north-northeast of the ponds and process plant, adjacent to the site access road. As outlined in *Figure 3.1*, the site access road is approximately 30km long and joins with the Lasseter highway to the north.

3.4.4 Topography

Although no detailed topographic survey is available for the KLPP, spot heights shown on published topographical mapping included within *Figure 3.1* indicate the topography within the immediate vicinity of the site is typically subdued, with ground levels ranging from 468m AHD and 481m AHD. The topographic map indicates the average height of sand dunes within the KLPP area are in the order of 12 metres.

Figure 3.1. KLPP Proposed Site Layout



4. Mineral Resource Estimate

This chapter is an extract from *Section 1.1* of the *Executive Summary* from the *Karinga Lakes Potash Project (KLPP) Sulphate of Potash Resource and Production Plan*. This chapter should be read in conjunction with the *Karinga Lakes Potash Project (KLPP) Sulphate of Potash Resource and Production Plan*, which is provided in *Appendix A* of this report, with particular attention given to i) the basis of preparation, ii) the limitations of any conclusions and/or findings, and iii) *Section 5*, the *Competent Persons Statement*.

4.1 Project Description

The Karinga Lakes Potash Project is being evaluated by Verdant Minerals and JV partner Parkway Minerals for potential production of Sulphate of Potash (SOP, K_2SO_4). The current proposal is to concentrate brine by solar evaporation to a potassium enriched mixed salt and subsequent processing to SOP.

A mineral Resource Estimate of the dissolved potassium contained in the deposit has been prepared.

The deposit is a brine hosted potash deposit. The potassium minerals are dissolved in brine contained in the pore spaces of sediment beneath a string of Playa Salt Lakes (Karinga Lakes) in the Northern territory. The Mineral Resource is estimated for 24 Lakes in the Lake chain which comprise an area of 125km^2.

The project tenure comprises 3 Exploration license application areas (ELA's) that are held in JV with Parkway Minerals and Verdant Minerals. Parkway Minerals hold a 15% interest in the JV, with the right to earn up to 40%.

The geological setting comprises basement rock of Devonian Horseshoe Bend Shale and Idracowra Sandstone of the Finke Group overlaid by a thin veneer of Quaternary Sediments. The recent cover forms lake bed sediments of silts, clays, sands and evaporite minerals. Material adjacent the lakes is gypsiferous dunes, and unconsolidated shifting dune sands capped or underlain with discontinuous calcrete.

The Hydrogeological system within the Karinga Creek chain of salt lakes is part of the Central Australian Groundwater Discharge Zone[4]. Groundwater within the greater Amadeus basin is understood to move toward the chain of Playa Lakes including the Karinga Creek chain and Lakes Amadeus, Hopkins, Mackay and Neale to discharge via evaporation from the shallow water table beneath the lake surfaces. The hydrogeological conceptual model of the lakes comprises a 2-layer system. The upper layer is the Lakebed Sediment (Described in the data tables as “Strat 1”) characterised as a high hydraulic conductivity aquifer with high specific yield and moderate total porosity. Underlying the LBS is the weathered Horseshoe bend Shale formation (Described in the data tables as “Strat 2”).

The salt lakes are terminal drainage features - there are no drainage lines that exit the lakes. Satellite data sets indicate that the Lakes are inundated up to approximately 20% of observations, indicating that they receive significant volumes of water by direct rainfall, and likely some limited run-off from the small catchments immediately adjacent each Lake.

---

[4] Jacobson, G. , Jankowski, J., “Groundwater-discharge processes at a central Australian playa”, Journal of Hydrology, Vol. 105, Issues 3–4, 28 February 1989, pp. 275-295.

The Climate is arid. Annual rainfall averages 231mm/year. Annual pan evaporation averages 3139 mm/year. Evaporation exceeds rainfall in all months. Temperatures range from 36.5 degrees average maxima in January to 4 degrees average minima in July.

4.2 Sampling Techniques and Data

Data has been obtained from several investigation campaigns conducted by Rum Jungle Resources from 2010 to 2013. The data is summarised in *Table 4.1*.

Liquid brine samples are obtained by sampling from open drillholes, hand dug pits trenches and boreholes. Depth specific brine samples were obtained by sampling yield during aircore drilling. Porosity, specific yield and total soluble potassium samples were obtained from sonic and vibracore drilling campaigns that yield intact samples of the deposit. Hydraulic properties of each stratigraphic unit were obtained by test pumping of 10 test bores and long-term pumping trials at three trenches and one bore. Geology was logged onsite by the supervising geologist.

No sub-sampling was undertaken. Brine samples are taken as composite samples for the full interval of each drillhole or trench from which the sample was taken. Brine is typically homogenous over short depth intervals and the mining method is not vertically selective. The exception was aircore drilling; brine samples were taken from the aircore rig cyclone at the end of each drill rod. This method produced depth specific samples, though downhole mixing cannot be excluded completely.

Brine assay was undertaken by inductively coupled plasma atomic emission spectroscopy (ICP-AES). Total porosity determination comprised gravimetric methods, weighing a sample before and after drying. Specific yield was determined gravimetrically by weighing a sample before and after dewatering by centrifuge. Specific yield was also determined in the field by pumping tests and trench pumping trials. The data from these trials was analysed by standard hydrogeological methods. QA/QC checks were undertaken to ensure a suitable data set.

In very general terms 498 data points inform a mineral resource estimate with a 124km extent providing a data density of 4 data points per square kilometre. This is a comparatively high data density for a brine resource. However, some data is clustered around trial trenches, and the data is generally located close to the lake edges due to access constraints to the centre of lakes.

Table 4.1. Source Data Sets

Data Sets	Number of Sample points	Stratigraphic Unit 1					Stratigraphic Unit 2		
		Brine Assay	Base Elevation	Flow Rate	Standing water level	Porosity	Brine Assay	Base elevation	Porosity
Hand dug pits 2010 and 2012	93	Y			Y				
Trenches 2010	4	Y			Y				
Vibracore Drilling 2011	8		Y			Total Porosity	Y		Total Porosity
Sonic and drilling 2011	55		Y				Y		
Sonic Piezos 2011	12	Y					Y		
Aircore Drilling 2012	98	Y	Y	Y			Y	Y	
Aircore Wells 2012	47	Y		Y			Y		
Aircore pumping tests 2012	10	Y		Y		Specific Yield	Y		
Sonic 2013	18		Y		Y	Total Porosity and Specific Yield	Y	Y	Total Porosity and Specific Yield
Aircore Drilling 2013	102	Y	Y	Y	Y		Y	Y	
Trenches 2013	3	Y		Y	Y	Specific Yield	Y		Specific Yield
Trench Piezometers 2013	48	Y		Y	Y				

4.3 Estimation and Reporting of Mineral Resources

The Mineral Resource is estimated as the product of the sediment volume, porosity and brine concentration of each Stratigraphic unit beneath each Salt Lake.

Volume

The area of each salt lake is defined by the extent mapped in Geoscience Australia's 1:250,000 Topographic data set[5] and checked against aerial imagery.

The Thickness of each stratigraphic unit was calculated by developing a series of gridded surfaces as follows:

- Collar elevation of all data points was assigned from geoscience Australia's 3 second DEM. All depth measurements were converted to elevation measurements by difference.
- The water table elevation was calculated data points as the difference between the collar and the reported depth to water. (rSWL.grd).
- The base of Strat Unit 1 elevation was interpolated from vibracore, sonic and aircore drilling data sets (Strat_2_B.grd).
- The base of Strat Unit 2 elevation was interpolated from aircore drilling data (Strat_2_B.grd).
- Thickness of Strat Unit 1 was calculated as the difference between the water table elevation and base of the stratigraphic Unit (Strat_1_Thickness.grd).
- Thickness of Strat Unit 2 was calculated as the difference between the base of the stratigraphic Unit 1 and the base of Strat Unit 2. (Strat_1_Thickness.grd).

Solute Concentration

Solute concentration was determined by assay of brine samples from the drilling and sampling campaigns described above.

The data was treated as follows:

- Profiles of brine concentration with depth from air-core drilling indicate that brine concentration is relatively constant with depth. Multiple brine assays from depth intervals sampled during aircore drilling were averaged to provide one average assay value per sample location. All other samples from sonic holes, bores, trenches and hand dug pits were assumed to be a single composite of the full depth of the borehole or excavation. Vertical composites are considered warranted since the mining method is not vertically selective. All brine will drain to the trenches.
- Spatial distribution of solute concentration was interpolated in 2 dimensions using Ordinary Kriging interpolation using 1500m search radius, minimum 1 data point per sector with one search expansion. Interpolation up to 3000m is consistent with the conceptual understanding of a relatively homogenous

---

[5] Geoscience Australia, 2006.

brine resource. The brine resource is generated in-situ by evaporation of a consistent groundwater source which is subject to sporadic mixing and dilution due to infiltration of rainwater, and subsequent re-concentration by evaporation.

Parameter interpolation was checked by querying the interpolated data sets to extract the interpolated value for each data point (drillhole) and analysing the variance.

Porosity

The mineral tonnage is calculated for specific yield and for a proportion of total porosity that is considered to be recoverable by abstraction within the mine plan timeframe (and therefore within the definition "reasonable prospects for eventual economic extraction).

In 2013 sediment samples were obtained by sonic drilling for total porosity determination. The data are presented in the Appendix. The median total porosity for Strat 1 and Strat 2 is 33 % and 36 % by volume respectively. These values are used in the mineral resource estimate. No spatial interpolation is undertaken on these parameters, they are applied as a constant value for each stratigraphic unit.

Specific yield porosity has been measured by a range of methods at the Karinga Lakes Project as follows:

- <u>Bore Pumping trials</u>: In 2013 constant rate pumping tests were undertaken at ten bores at Karinga Lakes. Test duration was 24 hours at each bore. Five bores exhibited an un-confined response and the data enabled determination of Specific Yield. Tests in Lakebed sediments return values of 0.14 and 0.16. Tests in siltstone returned values of 0.02, 0.05 and 0.011. Data analysis is reported in Groundwater Science, (2012).
- <u>Long term Trench Pumping Trials</u>. Long term (30 day) pumping trial were completed at 3 test trenches and one test bore in 2014. Specific yield determined from the trials ranged from 0.10 and 0.17 in lakebed sediments and 0.02 to 0.10 in siltstone. There is less certainty around the values for Strat 2 since this material was only slightly dewatered and the data analysis not overly sensitive to that parameter. Data analysis is reported in Groundwater Science, (2013).
- <u>Laboratory Determination</u>: In 2013 sediment samples were obtained by sonic drilling. Samples were subjected to Sy determination by weighing a saturated sample before and after removal of the drainable pore fluid by centrifuge. 71 samples were analysed.

Lakebed sediment (Strat 1) exhibits a median specific value of approximately 0.10 whilst weathered siltstone/sandstone (Strat 2) exhibits a median specific yield value of approximately 0.05. These values are used in the mineral resource estimate. No spatial interpolation is undertaken on these parameters they are applied as a constant value for each stratigraphic unit.

Mineral Resource Estimation

The mineral resource estimate for each grid cell was calculated as the product of the interpolated brine concentration, volume (stratigraphic unit thickness x cell area) and a constant value for porosity applied to each stratigraphic unit.

The mineral tonnage was calculated using drainable porosity. This represents the static free-draining portion of the mineral resource prior to extraction.

The mineral tonnage was also calculated using total porosity and application of a modifying factor. The modifying factor produces the portion of the total porosity hosted mineral tonnage considered to be extractable. On the basis of the production modelling reported in *Section 3* of *Appendix A*, a modifying factor of 0.34 is applied to the mineralisation hosted in total porosity. This proportion of mineralisation is considered to meet requirements of reasonable prospects of economic recovery and is reported as the Mineral Resource Estimate.

Results

The specific yield hosted mineral tonnage at the Karinga Lake Potash Project comprises 520kt of potassium as detailed in *Table 2.3 of Appendix A*. This drainable porosity mineral tonnage represents the static free-draining portion of the total porosity mineral tonnage prior to extraction. It does not take into account the impact of any groundwater recharge or solute transport which increases the amount of extractable brine above the static free-draining component over time.

The total porosity hosted Mineral Resource Estimate at the Karinga Lake Potash Project, after application of a modifying factor contains 1,000kt of potassium as detailed *Table 2.4 of Appendix A*. This is the portion of the total porosity hosted mineralisation considered to exhibit reasonable prospects for economic extraction based on the transient groundwater flow affecting the deposit during extraction. Rainfall and run-off recharge is particularly relevant to the upper zones of the Mineral Resource and has been assessed as a component of the dynamic hydrogeological modelling which was used to determine the KLPP-PFS mine plan.

The reported Mineral Resource Estimate is inclusive of the drainable porosity fraction of the mineral resource.

Discussion of the Relative Accuracy/Confidence

Brine resources are very different to solid mineral resources.

Brine production rate to a bore or trench is proportional to the hydraulic conductivity (permeability) of the host rock. This places a physical limitation on production rate that cannot be exceeded. The production rate will decline over time as the brine resource is depleted in proximity to a bore or trench. The production rate over longer time periods will be dependent on the rate of rainfall and run-of infiltration to the brine aquifer.

The brine concentration reported in the mineral resource is the starting point for production. This concentration will decline over time as the brine body is depleted and replaced by infiltrating recharge from rainfall and run-off and lateral inflow of lower concertation groundwater.

The capacity to mobilise a fraction of the potassium hosted in bound porosity is dependent on chemical equilibration of recharge from rainfall and run-off. The degree of equilibration is assumed from laboratory test work and has inherent uncertainty.

The cumulative effect of these characteristics is that the accuracy and confidence in a brine mineral resource declines with duration of mining. Over time:

- Flow rate will decline and is dependent on variable and uncertain recharge.
- Brine grade will decline and is dependent on variable and uncertain recharge.
- The final proportion of the resource that can be recovered is dependent on chemical equilibration of recharge and on the duration of mining.

The Resource Estimate is classified as an Indicated Resource on the basis that the estimate is adequate to inform mine planning and the application of modifying factors.

Table 4.2. Mineral Tonnage – Drainable Porosity

Lake			Strat 1					Strat 2					Total
Lake	Area (km²)	K Average (kg/m³)	Thickness (m)	Bulk Volume (Mm³)	Drainable Porosity	Brine Volume (Mm³)	K Tonnage (kT)	Thickness (m)	Bulk Volume (Mm³)	Drainable Porosity	Brine Volume (Mm³)	K Tonnage (kT)	K Tonnage (kT)
Corkwood	2.1	4.2	5.0	10.5	0.10	1.0	4.4	10.4	21.9	0.05	1.1	4.6	**9.0**
Curtin Boundary	5.2	4.3	2.2	11.2	0.10	1.1	4.9	17.5	90.1	0.05	4.5	19.5	**24**
Curtin North	14.3	3.4	2.8	40.3	0.10	4.0	13.9	17.5	249.8	0.05	12.5	43.1	**57**
Curtin West	1.0	5.7	5.2	5.4	0.10	0.5	3.1	12.6	13.0	0.05	0.7	3.7	**6.8**
Erldunda Boundary	10.2	3.3	1.0	10.0	0.10	1.0	3.3	10.5	107.3	0.05	5.4	17.9	**21**
Highway	3.0	3.1	0.8	2.5	0.10	0.3	0.8	14.7	44.2	0.05	2.2	6.8	**7.5**
Island 2	0.6	6.5	5.1	2.9	0.10	0.3	1.9	13.3	7.6	0.05	0.4	2.5	**4.4**
Island 4	1.4	5.2	4.3	6.2	0.10	0.6	3.2	13.9	19.9	0.05	1.0	5.2	**8.4**
Island 1	0.8	8.2	5.9	4.5	0.10	0.4	3.7	10.5	8.0	0.05	0.4	3.3	**6.9**
Island 5	0.7	5.3	5.2	3.6	0.10	0.4	1.9	14.1	9.7	0.05	0.5	2.6	**4.5**
Jetts	1.7	2.4	4.5	7.7	0.10	0.8	1.8	10.5	18.0	0.05	0.9	2.1	**4.0**
Lyndavale West	18.6	3.2	8.8	162.9	0.10	16.3	52.8	9.0	168.0	0.05	8.4	27.3	**80**
Main North Road	3.9	4.7	5.3	21.0	0.10	2.1	9.8	8.0	31.7	0.05	1.6	7.4	**17**
Mallee Well East	4.1	6.1	2.6	10.7	0.10	1.1	6.5	9.6	39.3	0.05	2.0	12.0	**18**
Miningere	7.8	7.7	3.0	23.9	0.10	2.4	18.4	16.1	126.2	0.05	6.3	48.7	**67**

Lake			Strat 1					Strat 2					Total
Lake	Area	K Average	Thickness	Bulk Volume	Drainable Porosity	Brine Volume	K Tonnage	Thickness	Bulk Volume	Drainable Porosity	Brine Volume	K Tonnage	K Tonnage
	(km²)	(kg/m³)	(m)	(Mm³)		(Mm³)	(kT)	(m)	(Mm³)		(Mm³)	(kT)	(kT)
Miningere West	3.0	5.6	2.3	6.9	0.10	0.7	3.9	21.6	64.4	0.05	3.2	18.0	**22**
Murphys	2.7	3.8	10.7	29.0	0.10	2.9	11.1	0.3	0.8	0.05	0.0	0.1	**11**
Mygoora South	1.2	4.8	1.2	1.5	0.10	0.1	0.7	10.6	12.7	0.05	0.6	3.0	**3.7**
Mygoora North	10.1	2.9	2.3	23.6	0.10	2.4	6.8	7.9	79.8	0.05	4.0	11.5	**18**
Pulcurra	5.8	3.9	4.7	27.3	0.10	2.7	10.8	10.9	63.1	0.05	3.2	12.4	**23**
Skinny	4.1	4.1	2.1	8.5	0.10	0.9	3.5	18.3	74.8	0.05	3.7	15.2	**19**
Swansons	8.8	4.3	7.1	62.8	0.10	6.3	27.1	10.1	89.0	0.05	4.5	19.2	**46**
Swansons North	9.0	3.3	2.2	19.6	0.10	2.0	6.5	16.1	145.0	0.05	7.3	24.0	**31**
Minskin	4.4	3.4	2.9	12.8	0.10	1.3	4.3	13.6	59.5	0.05	3.0	10.0	**14**
Total	125												**520**

Notes: 1) This drainable porosity hosted mineral tonnage represents the static free-draining portion of the total porosity hosted mineral tonnage prior to extraction. It does not take into account the impact of any groundwater recharge or solute transport which increases the amount of extractable brine above the static free-draining component over time.

Table 4.3. Mineral Resource Estimate – Total Porosity

Lake			Strat 1					Strat 2					Total		
Lake	Area	K Average	Thickness	Bulk Volume	Total Porosity	Brine Volume	K Tonnage	Thickness	Bulk Volume	Total Porosity	Brine Volume	K Tonnage	K Tonnage	Reasonable Prospects Modifier[2]	Mineral Resource Estimate[3]
	(km^2)	(kg/m^3)	(m)	(Mm^3)		(Mm^3)	(kT)	(m)	(Mm^3)		(Mm^3)	(kT)	(kT)		(kT)
Corkwood	2.1	4.2	5.0	10.5	0.33	3.4	15	10.4	22	0.36	7.9	33	48	0.34	16
Curtin Boundary	5.2	4.3	2.2	11.2	0.33	3.7	16	17.5	90	0.36	32.4	140	160	0.34	54
Curtin North	14.3	3.4	2.8	40.3	0.33	13.3	46	17.5	250	0.36	89.9	310	360	0.34	120
Curtin West	1.0	5.7	5.2	5.4	0.33	1.8	10	12.6	13	0.36	4.7	27	37	0.34	13
Erldunda Boundary	10.2	3.3	1.0	10.0	0.33	3.3	11	10.5	107	0.36	38.6	129	140	0.34	48
Highway	3.0	3.1	0.8	2.5	0.33	0.8	3	14.7	44	0.36	15.9	49	51	0.34	17
Island 2	0.6	6.5	5.1	2.9	0.33	1.0	6	13.3	8	0.36	2.7	18	24	0.34	8.2
Island 4	1.4	5.2	4.3	6.2	0.33	2.0	11	13.9	20	0.36	7.2	37	48	0.34	16
Island 1	0.8	8.2	5.9	4.5	0.33	1.5	12	10.5	8	0.36	2.9	23	36	0.34	12
Island 5	0.7	5.3	5.2	3.6	0.33	1.2	6	14.1	10	0.36	3.5	19	25	0.34	8.5
Jetts	1.7	2.4	4.5	7.7	0.33	2.6	6	10.5	18	0.36	6.5	15	21	0.34	7.1
Lyndavale West	18.6	3.2	8.8	162.9	0.33	53.7	174	9.0	168	0.36	60.5	196	370	0.34	130
Main North Road	3.9	4.7	5.3	21.0	0.33	6.9	32	8.0	32	0.36	11.4	53	85	0.34	29
Mallee Well East	4.1	6.1	2.6	10.7	0.33	3.5	22	9.6	39	0.36	14.1	86	110	0.34	37
Miningere	7.8	7.7	3.0	23.9	0.33	7.9	61	16.1	126	0.36	45.4	351	410	0.34	140

Lake			Strat 1					Strat 2					Total		
Lake	Area	K Average	Thickness	Bulk Volume	Total Porosity	Brine Volume	K Tonnage	Thickness	Bulk Volume	Total Porosity	Brine Volume	K Tonnage	K Tonnage	Reasonable Prospects Modifier[2]	Mineral Resource Estimate[3]
	(km²)	(kg/m³)	(m)	(Mm³)		(Mm³)	(kT)	(m)	(Mm³)		(Mm³)	(kT)	(kT)		(kT)
Miningere West	3.0	5.6	2.3	6.9	0.33	2.3	13	21.6	64	0.36	23.2	130	140	0.34	48
Murphys	2.7	3.8	10.7	29.0	0.33	9.6	37	0.3	1	0.36	0.3	1	38	0.34	13
Mygoora South	1.2	4.8	1.2	1.5	0.33	0.5	2	10.6	13	0.36	4.6	22	24	0.34	8.2
Mygoora North	10.1	2.9	2.3	23.6	0.33	7.8	22	7.9	80	0.36	28.7	82	100	0.34	34
Pulcurra	5.8	3.9	4.7	27.3	0.33	9.0	36	10.9	63	0.36	22.7	89	120	0.34	41
Skinny	4.1	4.1	2.1	8.5	0.33	2.8	11	18.3	75	0.36	26.9	110	120	0.34	41
Swansons	8.8	4.3	7.1	62.8	0.33	20.7	89	10.1	89	0.36	32.1	138	230	0.34	78
Swansons North	9.0	3.3	2.2	19.6	0.33	6.5	21	16.1	145	0.36	52.2	173	190	0.34	65
Minskin	4.4	3.4	2.9	12.8	0.33	4.2	14	13.6	60	0.36	21.4	72	86	0.34	29
Total	125														**1000**

Notes: 1) The total porosity tonnage is not presented as a mineral resource estimate. Only a proportion of the mineralisation might be recovered by mining. 2) The reasonable prospects modifier is that proportion of the total porosity resource for which there are reasonable prospects for economic recovery. This proportion is based on simulation of a 15-year production duration and incorporates recharge and dilution of brine by rainfall and run-off recharge. 3) The Mineral Resource Estimate is that proportion of the total mineralisation for which there are reasonable prospects for economic recovery. It is not reported as an Ore Reserve since a mine plan and schedule has not been developed to incorporate all Lakes. Totals are rounded to two significant figures.

5. Production Plan

This chapter is an extract from *Section 1.2* of the *Executive Summary* from the *Karinga Lakes Potash Project (KLPP) Sulphate of Potash Resource and Production Plan*. This chapter should be read in conjunction with the *Karinga Lakes Potash Project (KLPP) Sulphate of Potash Resource and Production Plan*, which is provided in *Appendix A* of this report, with particular attention given to i) the basis of preparation, ii) the limitations of any conclusions and/or findings, and iii) *Section 5*, the *Competent Persons Statement*.

5.1 Production Trench Design

Production planning and simulation has been undertaken to provide an estimated yield from production trenches to inform the production design. The production plan comprises the trench layout and production schedule.

Trenches are planned with a nominal water level at 6m depth. A single trench axial to each lake will meet the optimum spacing requirement such that the requirement volume of brine will flow to the trench.

Total trench depth will range from 6 to 8m. The designed brine level in the trench is 6m below surface, minimum brine depth at the base of the trench is 0.65m and the trenches will require up to 1.3m fall from one end of the lake to another (0.1 m per km).

5.2 Brine Production Simulation

Brine production from each playa lake was simulated by development of a groundwater flow and solute transport model. The model objective is to provide an estimate of the brine flow rate over time and the brine concentration over time for each lake.

A two-dimensional slice model of each lake was implemented. Model properties and boundary conditions are summarised in *Table 5.1*. Aquifer hydraulic conductivity is the geometric mean of the values from pumping tests in each stratigraphic unit. Specific Yield porosity and total porosity are the median values of field and laboratory tests. Recharge is a significant component of the production model and is based on monitoring of rainfall and recharge at 3 sites over a 16 month period to establish a recharge model, and subsequent analysis of 65 years rainfall data at Curtin Spring BOM station to develop a long-term average and an understanding of variability in recharge.

Table 5.1. ***Brine Production Model Properties***

Aquifer Unit	Hydraulic conductivity (m/day)	Specific Yield (v/v)	Total Porosity (v/v)	Recharge	Evaporation	Drain Boundary (trench simulation)
Strat 1	25 (Horizontal) 2.5 (Vertical)	0.10	0.33	0.0004m/day	0.004m/day 0.6m extinction depth.	6m depth. 25m/day conductance
Strat 2	3 (Horizontal) 3 (Vertical)	0.05	0.36			

Simulations were run for eight lakes summarised in *Table 5.2*. The average fetch was implemented as the width of the model. The thickness of the model was defined by the average thickness of Stat 1 and Strat 2 in the Resource Model. Simulations were run for 10 to 15 years as a single stress period with constant boundary conditions. Four lake simulations were extended to 15 years to allow for additional production.

Table 5.2. ***Production Simulation***

Lake	Area (km^2)	K Concentration (kg/m^3)	Trench Length (m)	Average Fetch / Model Width (m)	Base Stat 1 (m)	Model Base (m)	Simulated Production Duration (years)
Miningere	7.8	7.3	6,000	650	3.5	19.5	15
MinSkin	4.4	3.2	8,000	275	3.5	17.0	15
Lyndavale West	18.6	3.2	17,000	547	9.5	18.5	15
Skinny	4.1	4.1	8,000	256	6.0	24.5	10
Curtin Boundary	5.2	4.3	3,500	743	2.5	20.0	10
Miningere West	3.0	5.6	4,000	375	3.0	24.5	15
Swansons North	9.0	3.3	17,000	265	3.0	19.0	10
Swansons	8.8	4.3	6,600	667	7.5	17.5	10
Totals	**61**		**70,100**				

Solute (dissolved potassium) was simulated with an initial concentration of 100. Recharge was applied with a solute concentration of zero. Solute is removed from the model by the drain cell that simulates trench production. No additional solute is added to the model and the solute concertation decreases over time as the solute is diluted by recharge.

Total production is summarised in *Table 5.3*. On average 22% of the Potassium contained in total porosity is recovered from each lake in 10 years of production and 25-33 % when mining is extended to 15 years for the selected lakes.

Table 5.3. Production Summary

Lake	Area (km^2)	K Concentration (kg/m^3)	Tonnage K in Total Porosity[1]	10 Year Production (Tonnes K)	10 year Recovery	15 Year Production (Tonnes K)	15 year Recovery
Miningere	7.8	7.3	411,467	92,100	0.22	122,323	0.30
MinSkin	4.4	3.3	86,238	22,054	0.26	28,717	0.33
Lyndavale West	18.6	3.2	370,563	77,991	0.21	91,975	0.25
Skinny	4.1	4.1	121,182	26,985	0.22		
Curtin Boundary	5.2	4.3	156,458	34,941	0.22		
Miningere West	3.0	5.6	142,567	27,110	0.19	36,440	0.26
Swansons North	9.0	3.3	193,106	47,248	0.24		
Swansons	8.8	4.3	227,380	51,148	0.22		
Totals	**61**		**1,708,962**	**379,578**	**0.22**		

Notes: 1) The total porosity mineral tonnage is not presented as a mineral resource estimate. Not all the potassium can be recovered by mining. The data is presented here to calculate the percentage that is estimated to be recovered by mining.

Uncertainty analysis was undertaken by simulating seasonably variable recharge and different rates of recharge based on different wetting thresholds in the recharge model. The outcome was that predicted production can decline to approximately 60% of the base case, for different recharge scenarios.

The model is designed to allow planning and scheduling of brine production from the Playas comprising the Karinga Project to a Pre-Feasibility Standard. The model is un-calibrated. This is of necessity at this stage of project development since there is no medium-term pumping data available for calibration. The model is set up with carefully specified parameters based on extensive test work. However, any multiparameter groundwater flow model exhibits considerable uncertainty, and the uncertainty increases with simulation time.

The model also represents all Lakes as a homogenous aquifer with consistent aquifer properties for each stratigraphic unit, and consistent unit thicknesses for each lake. This is a necessary simplification of the real system. It is likely that specific lake performance will vary from that predicted by the model, but that the model provides a reasonable prediction of the average performance of all lakes over time.

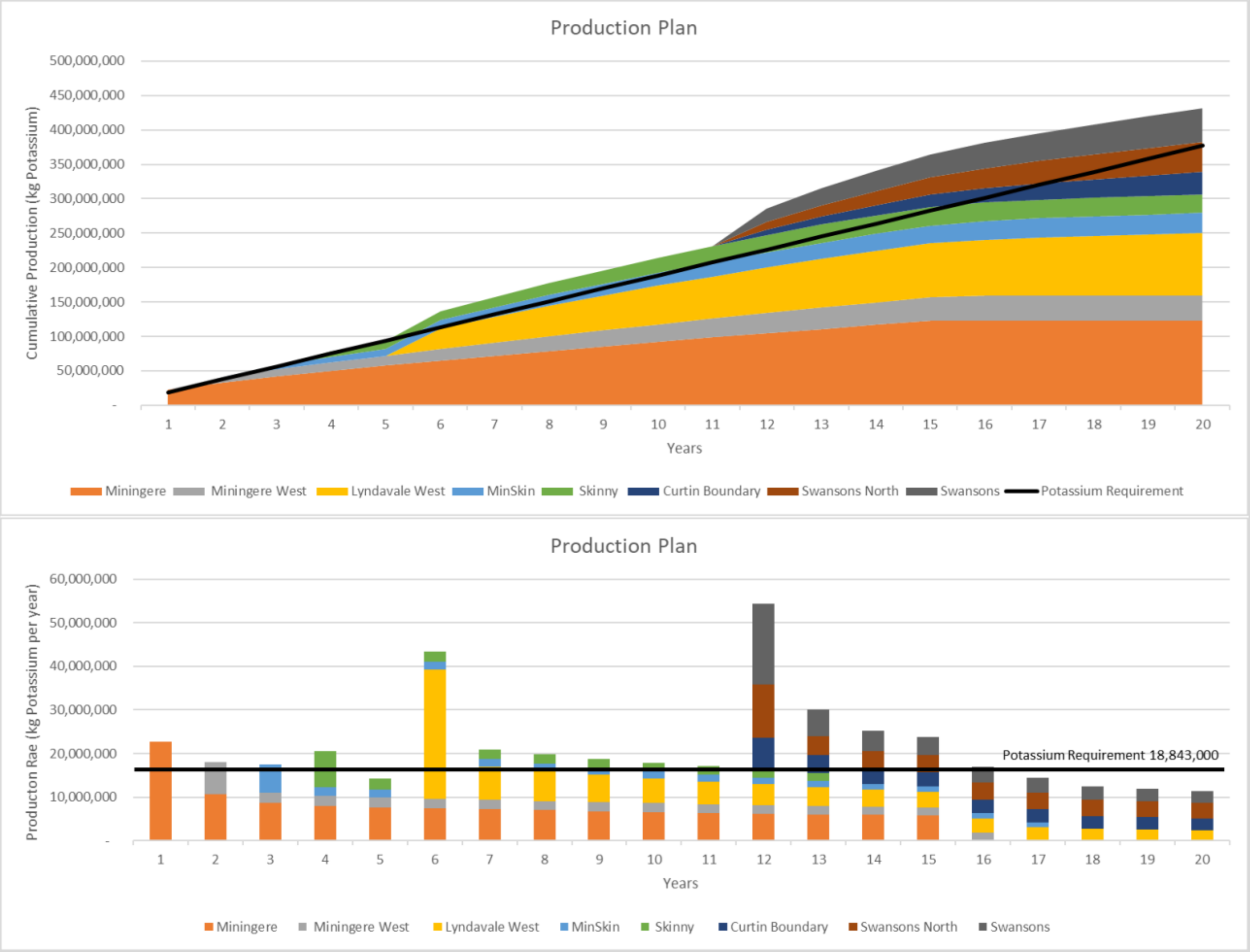
The model assumes that all bound solutes (solutes hosted in specific retention, or undrainable porosity) will equilibrate with infiltrating recharge and will mobilise to the trenches over time.

The model is intended to inform a Pre-feasibility Study. Work to progress to a Definitive Feasibility Study should include a trial mining exercise where a portion of a lake is trenched and the trench is pumped for a duration that encompasses significant primary drainage of the lake sediments, and takes in a recharge season so that the medium term brine yield is demonstrated, and so that the interaction between infiltrating recharge, and the in-situ brine can be demonstrated.

5.3 Production Plan and Schedule

The estimated production profiles from each lake have been incorporated in a production schedule. The basis for the schedule is the production of 40,000t Sulphate of potash per year from a brine feed of 42,000t SOP. The brine feed specified for this production is 18,843t Potassium.

Figure 5.1. Production Schedule – Potassium Production



The production plan is reported at the point of delivery to the first evaporation pond. There is no allowance in the production plan for subsequent recovery from the evaporation ponds or processing plant

In total the production plan comprises approximately 430kt potassium dissolved in approximately 130Mm^3 brine at an average life of mine grade of approximately 3.3kg/m^3. The total production is summarized in *Table 5.4*.

Table 5.4. Potassium Production Summary

Lake	Tonnage Potassium (kt)	Brine Volume (Mm^3)	Brine Grade (kg K/m^3)
Miningere	120	20	6.1
Miningere West	36	7.7	4.8
Lyndavale West	92	46	2.0
MinSkin	29	11	2.5
Skinny	27	7.6	3.5
Curtin Boundary	32	8.3	3.9
Swansons North	44	15	3.0
Swansons	49	16	3.1
Total	**430**	**130**	**3.3**

Brine resources are very different to solid mineral resources and the accuracy / confidence in a production plan is much lower:

- The production rate is naturally constrained and will vary over time with uncertainty increasing over time and is subject to uncertain rainfall recharge.
- The brine grade will decline over time at a rate that is subject to uncertainty. The uncertainty increases with mining duration and is subject to uncertain rainfall recharge which will vary due to climatic factors.
- The overall recovery of the Resource is dependent on the mining duration, and the mobilisation of brine by recharge which is subject to uncertainty.

Production in the first few years of production is quite predictable, however the production over longer periods becomes more uncertain due to all the factors above. The uncertainty increases with duration of mining.

Contingency options for this project to maintain brine production in later years are extremely important for managing the higher risk associated with a brine resource. Contingency options if required include:

- Additional lakes to maintain production. There are a further 16 Lakes in the Karinga Lakes chain with a total additional estimated Mineral Resource of approximately 431kt Potassium. Some of these can be developed if required.
- Deepening of trenches. Trenches can be deepened to extract the brine more efficiently at depth.

The project is currently at a Pre-Feasibility level of study. The study aims to evaluate development options for the project.

Feasibility Studies for the project should be designed to mitigate the production risks described above. The recommended approach is trial mining of a single lake (or portion of a single Lake). The trial mining duration should be long enough to:

- Achieve significant dewatering of the drainable porosity hosted fraction of the Mineral Resource.
- Maintain production through a recharge cycle (summer rainfall and recharge season).

The trial mining should be set up to measure, flow rate, brine grade and water level in the production trench, and an array of piezometers to measure the brine resource throughout the lake.

Trial mining also provides the opportunity to test evaporation pond performance, and to stockpile potassium within the ponds.

Resource utilization.

Resource Utilization is detailed in *Table 5.5*. For the eight lakes included in the mine plan, the Mineral Resource estimate is 580kt. Of this the production schedule over the 20-year mine plan incorporates mining 430kt. The Resource Estimate is reported inclusive of the Resources that are produced in the production plan.

Table 5.5. Resource Utilisation

Lake	Mineralisation Contained in Drainable Porosity Potassium Tonnage (kt)	Indicated Mineral Resource in Total Porosity that meets reasonable prospects of economic extraction Potassium Tonnage (kt)	Production Potassium Tonnage (kt)
Lakes in the mine plan			
Miningere	67	139	122
Miningere West	22	48	36
Minskin	14	29	29
Skinny	19	41	27
Lyndavale West	80	126	92
Curtin Boundary	24	54	35
Swansons	46	78	51
Swansons North	31	65	47
Sub Total	**300**	**580**	**430**
Remaining Lakes			
Corkwood	9.0	16	
Curtin North	57	122	
Curtin West	6.8	13	
Erldunda Boundary	21	48	
Highway	7.5	17	
Island 2	4.4	8.2	
Island 4	8.4	16	
Island 1	6.9	12	
Island 5	4.5	8.5	
Jetts	4.0	7.1	
Main North Road	17	29	
Mallee Well East	18	37	
Murphys	11	13	
Mygoora South	3.7	8.2	
Mygoora1	18	34	
Pulcurra	23	41	
Sub total	**220**	**430**	
Totals	**520**	**1000**	**430**

6. Metallurgical Test Work Program

6.1 Metallurgical Test Work Program

Historical Test Work

The production of various salt products from the brine resources in the vicinity of the KLPP (historically referred to as the NT Evaporites Project), was initially proposed as early as the late 1980's. An annual report[6] from the project operator in 1990, described laboratory tests indicating "… *the possibility of producing a wide variety of valuable industrial salts and liquids, from the playa brine*s". Several years later a historical pre-feasibility study prepared for Status Resources Australia, by BHP Engineering[7], outlined that the production of sulphate of potash (SOP) was a key target product from the project.

In late 2012, concurrently with ongoing resource evaluation activities, Verdant Minerals[8] engaged engineering services provider MWH, to perform a range of testwork focused on potash recovery from the KLPP. The MWH study[9] confirmed that *"for the (Schoenite rich) mixed salts (from the KLPP), a single-pass flotation process increases the K content by 112% and reduces the Cl content by 55% on average*". Following these encouraging results, during 2013, Verdant Minerals continued exploring processing options for recovering Schoenite (and other salts), from the potassium enriched mixed salts from the KLPP.

In July 2014, as part of a scoping study prepared for Verdant Minerals, the China based Changsha Design & Research Institute of Ministry of Chemical Industry (CICCC) developed a block flow diagram highlighting the options for converting potassium enriched mixed salts, from the KLPP, into Schoenite ($K_2SO4 \cdot MgSO_4 \cdot 6H_2O$) through a flotation process. The CICCC then proposed two pathways for either converting, or decomposing, the Schoenite into a SOP product as outlined in Reactions CICCC-1 and CICCC-2, respectively[10].

Schoenite Conversion Reaction (Reaction CICCC-1)

$$K_2SO_4 \cdot MgSO_4 \cdot 6H_2O + 2KCl \longrightarrow 2K_2SO_4 + MgCl_2 + 6H_2O$$

Schoenite plus MOP gives SOP, Magnesium Chloride and Water.

---

[6] Annual Report for Exploration Licences EL6509, Kulgera 1:250,000 Map Sheet, Northern Territory, Period covering August 1989 to August 1990, N.T. Evaporites Pty Ltd, October 1990.

[7] Pre-Feasibility Study NT Evaporites Project, Status Resources Australia, 30 July 1992.

[8] At the time of the study, Verdant Minerals had yet to change its name, and was registered as Rum Jungle Resources.

[9] Karinga Creek Potash Recovery Study – Evaporation, Cooling and Flotation Stages, MWH, March 2013.

[10] Karinga Lakes Potash Project Scoping Study Report, Table 6-15 Comprehensive comparison of SOP production technology, Changsha Design and Research Institute of Ministry of Chemical Industry (CICCC), 25 August 2014.

Schoenite Decomposition Reaction (Reaction CICCC-2)

$$K_2SO_4 \cdot MgSO_4 \cdot 6H_2O \longrightarrow K_2SO_4 + MgSO_4 + 6H_2O$$

Schoenite breaks up into SOP, Magnesium Sulphate and water.

The CICCC study concluded that given the Schoenite conversion reaction (CICCC-1) is widely used in major SOP operations in China and the Americas, this would be the preferred process route for converting the Schoenite to SOP. The advantages included "*continuous production, easy control, high yield, simple production process, and high product quality and energy conservation*". The study then went on to conclude however that, given the remote location of the KLPP and the purchase and transport of MOP required for the Schoenite conversion reaction would be prohibitive. The more appropriate process route for the KLPP therefore would be the Schoenite decomposition reaction (Reaction CICCC-2).

In order to demonstrate successful Schoenite flotation from the potassium enriched mixed salts from the KLPP and the subsequent conversion (Reaction CICCC-1), Bureau Veritas were engaged, in late 2014, to perform metallurgical testwork. Whilst one of the tests demonstrated encouraging potassium recoveries (91.9%) from the flotation testwork, larger samples yielded lower recoveries of 66.4 – 73.7%[11]. The Schoenite rich flotation concentrate was then reacted with a non-KLPP derived source of MOP, which yielded a potassium rich product, which was later identified as Leonite and disappointingly confirmed that no SOP was actually produced during the Schoenite conversion reaction. These experimental findings highlighted the sensitivities and challenges inherent in recovering potash salts and subsequently converting them to SOP, even with relatively conventional processes.

Overview of aMES™

The *activated Mineral Extraction System*, or aMES™ is an innovative process technology that enables the processing of concentrated brine solutions to recover a range of valuable compounds, reagents and fresh water. The technology utilises a proprietary multi-staged process incorporating novel membrane technology and is based on proprietary intellectual property, incorporating patents, expertise and know-how acquired over a decade of intense process development. The aMES™ technology is owned by Parkway Minerals.

Historical KLPP aMES™ Studies

In December 2014, Verdant Minerals announced the completion of the KLPP Scoping Study[12], outlining the proposed process route for the project, production, capital and operating cost assumptions, as well as, key opportunities and risks. As one of the first potash projects being evaluated in Australia, Activated Water

---

[11] Rum Jungle Resources Potash Flotation, Bureau Veritas, November 2014.

[12] Karinga Lakes Potash Project Scoping Study Completion, ASX Release, Rum Jungle Resources, 22 December 2014.

Technologies[13] (AWT) identified potential opportunities to improve the process route for the project and initiated exploratory discussions with Verdant Minerals in early 2015.

Following preliminary experimental test work, in October 2015, AWT delivered a proof-of-concept aMES™ Study[14], highlighting the potential of the aMES™ technology to unlock value from the KLPP. In addition to summarising the preliminary test work, the proof-of-concept aMES™ Study, it also provided some key results which confirmed all of the key objectives of the study had been satisfied and further test work, on feedstock from the KLPP, was warranted.

Following successful aMES™ based testwork, in August 2017, AWT's parent company (CPC), and Verdant Minerals entered into an earn-in agreement, to advance the KLPP through the aMES™ technology[15]. The first stage of the earn-in agreement culminated in the establishment of a joint venture[16] between Verdant Minerals and CPC, following the successful completion of the scoping study for the KLPP based on the aMES™ technology.

Recent KLPP aMES™ Test Work

As a process technology specifically developed for processing high-TDS (total dissolved solids) solutions, including natural brines, the aMES™ technology is well suited to direct-processing concentrated brines such as those produced from the KLPP. Although direct processing of concentrated brines from the KLPP is technically feasible, previous studies have highlighted that conventional solar evaporation is generally the most cost-effective option for concentrating potassium in raw brines, into potassium enriched mixed salts.

The process of concentrating potassium in a raw brine into potassium enriched mixed salts at the KLPP, is further outlined in the following sections:

- The brine sampling, flow-testing and other resource characterisation items are outlined in *Chapters 4* and *5*, *Geology & Mineralisation*, and the *Production Plan* sections, respectively.
- The subsequent abstraction of the brine, evaporation, and production of potassium enriched mixed salts, is outlined in *Chapter 7*, *Pond Design*.

The process of converting the potassium from the potassium enriched mixed salts, into a final SOP product, through the application of a proprietary aMES™ based processing route, can be divided into the following three stages:

- Potassium Extraction. The objective of this stage is to achieve effective dissolution of key ions from the potassium enriched mixed salts into a concentrated brine solution.
- Brine Processing. The objective of this stage is to process the concentrated brine solution produced during the Potassium Extraction phase, and separate impurities, from intermediate products.

---

[13] Activated Water Technologies (AWT), was subsequently acquired by Consolidated Potash Corporation (CPC), which itself was acquired by Parkway Minerals, in September 2019.

[14] Proof-of-Concept aMES™ Study, Activated Water Technologies, 30 Oct 2015.

[15] Karinga Lakes Sulphate of Potash Project – Earn-In Agreement, ASX Release, Verdant Minerals, 10 August 2017.

[16] Karinga Lakes Potash Project (KLPP) – Establishment of Joint Venture with Consolidated Potash Corporation, ASX Release, Verdant Minerals, 7 February 2019.

- SOP Synthesis. The objective of this stage is to convert the intermediate products harvested during the brine processing stage, into the final SOP product.

All of the sample analysis is based on a standardised testing procedures, to accurately determine chemical compositions based on measuring total dissolved solids (TDS), density, inductively coupled plasma (ICP) analysis to measure supernatant composition, ion-selective electrode (ISE) analysis to measure chlorides in solution and X-ray powder diffraction (XRD) analysis to determine the crystal phase of each of the solid products present in the feedstock, or produced during the various aMES™ based processing stages.

KLPP aMES™ Test Work - Potassium Extraction

As one of the earliest SOP focused resource projects in Australia, significant brine and salt composition data has been obtained from the KLPP. Since 2015, various brine and salt characterisation studies have been performed to investigate the suitability of a proprietary aMES™ based processing route. These studies have been based on raw brine harvested from individual salt lakes, as well as, composite brines harvested from a number of salt lakes at the KLPP site, which have subsequently been used as feedstock for producing potassium enriched mixed salts (*Figure 6.1a* & *b*). Importantly, the raw brine feedstock and the potassium enriched mixed salts have been harvested over several years, providing a detailed dataset of how the composition of both the brine and the potassium enriched mixed salts vary based on a range of conditions, including but not limited to the:

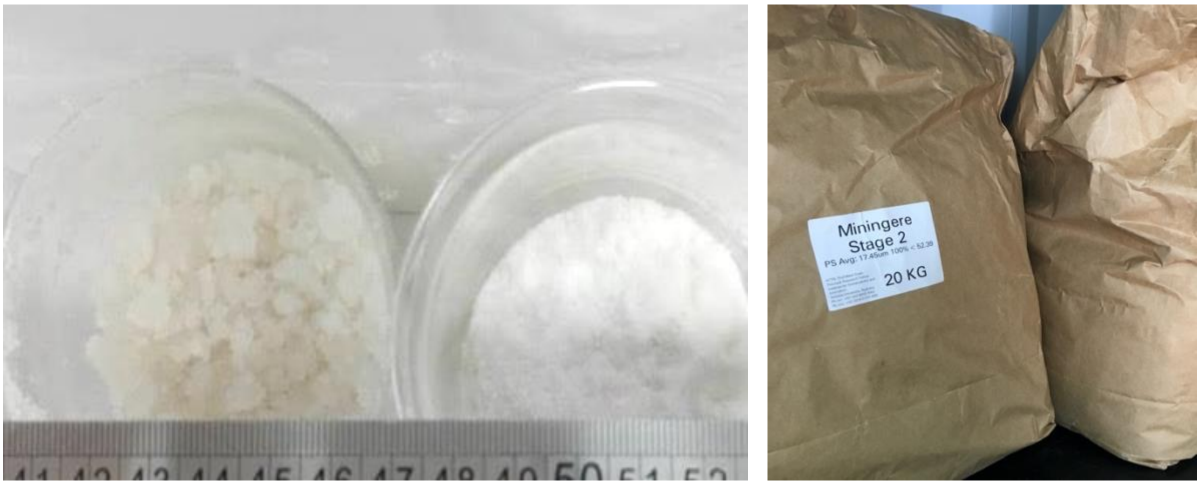
- Specific salt lake from which the raw brine was harvested.
- The evaporation conditions, including temperature, wind, humidity and rain events.
- The evaporation pond sequence, including transition between specific ponds.

Importantly, the evaporation pond system, is designed to produce potassium enriched mixed salts with the highest practical concentration of potassium, as well as, corresponding sulphate, whilst removing impurities, particularly, sodium and chloride.

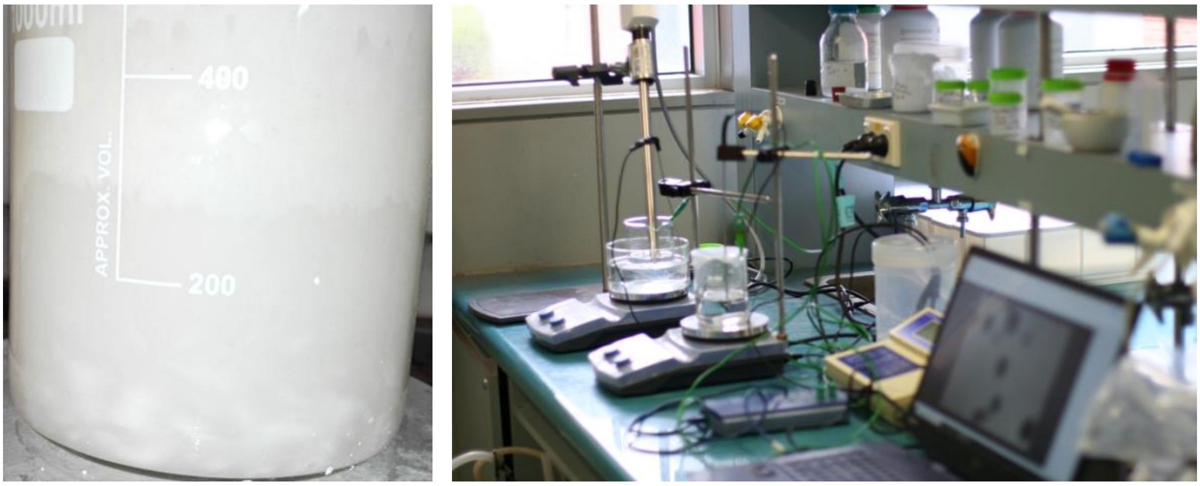
Once the potassium enriched mixed salts are harvested, these then undergo a milling process, to reduce particle size and ensure appropriate dissolution of the salts, specifically the potassium and sulphate, into solution. In order to optimise the efficiency of the extraction process, detailed test work has been performed on the potassium enriched mixed salts (*Figure 6.1c - f*). By varying key extraction parameters, including the salt milling size, mixing ratio and dissolution conditions (including temperature and duration), the optimal conditions for dissolving 99% of the potassium into solution, with sufficient sulphate, are able to be determined. This optimisation process has been performed experimentally, on a broad range of potassium enriched mixed salts from the KLPP, providing confidence of its achievability in a commercial operation.

Figure 6.1. ***Potassium Extraction Related Images***

a) 2017 Potassium enriched mixed salts (PEMS) harvest b) KLPP PEMS bagged for aMES™ processing



c) Coarse (L) and milled (R) potassium enriched mixed salts d) Milled salts from Lake Miningere



e) Coarse salt extraction f) Extraction optimisation studies

KLPP aMES™ Test Work - Brine Processing

The objective of this stage is to process the concentrated brine solution produced during the potassium extraction phase (described above) in order to produce two key intermediate products, necessary for the subsequent synthesis of SOP (described below). Based on the chemical composition of the potassium enriched mixed salts from the KLPP, processing of the extracted (saturated) brine with a proprietary aMES™ based processing route, these intermediate products are Sylvite and Leonite, respectively.

The proprietary aMES™ based processing route involves processing of the saturated brine stream (*Figure 6.2a* & *b*) to perform a range of important functions. First the impurities are removed (*Figure 6.2c*) followed by the concentration of intermediate products (*Figure 6.2d*) and finally the production of the target intermediate products (*Figure 6.2e* & *f*).

Figure 6.2. Brine Processing Related Images

a) Saturated brine processing b) Brine processing & dewatering c) Impurity (Halite) removal

d) Sylvite production phase e) Sylvite salt harvest f) Leonite salt harvest

Over several years, detailed test work has been performed, on a number of proprietary aMES™ based processing routes, involving a range of potassium enriched mixed salt derived brines from the KLPP. This extensive test work has provided high levels of confidence that the key objectives of this stage, particularly effective removal of impurities and the production of high-purity intermediate products (being Sylvite and Leonite), can be readily achieved.

KLPP aMES™ Test Work - SOP Synthesis

In this stage, the intermediate Sylvite and Leonite products are efficiently converted into a high-purity SOP product. The KLPP SOP Synthesis Reaction (outlined below) is similar to the sulphate transfer reaction (Reaction CICCC-1) as outlined above, but with two key differences:

- The KMS (kalium/potassium magnesium sulphate) utilised during the KLPP – SOP Synthesis Reaction, is a slightly more dehydrated form of Schoenite, in this case Leonite, which is produced during the Brine Processing Phase.
- Unlike a number of SOP brine projects which are required to purchase Sylvite (in order to react with the KMS, as outlined above, or with excess sulphates), the Sylvite used in the KLPP – SOP Synthesis Reaction is produced directly from the KLPP derived potassium enriched mixed salts, through the application of the proprietary aMES™ based processing route.

Leonite Conversion Reaction (KLPP - SOP Synthesis Reaction)

$$K_2SO_4 \cdot MgSO_4 \cdot 4H_2O(s) + 2KCl \xrightarrow{\quad} 2K_2SO_4(s) + MgCl_2 + 4H_2O$$

Leonite plus MOP gives SOP, Magnesium Chloride and water.

Various SOP Synthesis test work has been performed (*Figure 6.3a*) with KLPP derived Sylvite and Leonite. This includes real time in-situ visualisation to determine crystal morphology (*Figure 6.3b* & *c*), as well as, XRD mediated crystal phase analysis (*Figure 6.3e*) to confirm the composition and purity of the SOP product produced. SOP samples produced during test work (*Figure 6.3d*), readily yielded high purity SOP (>98% SOP). Chemical analysis of these samples was carried out by an independent laboratory[17] and confirmed the product purity of 98.8% SOP and 1.2% of impurities. The impurities primarily consisted of Sylvite (MOP), which is a high-grade potassium fertiliser.

In addition to producing high-purity SOP, a high yielding reaction (process design) is required to ensure maximum conversion of the intermediate products (Sylvite and Leonite) into SOP. In order to maximise process yields, the KLPP – SOP Synthesis Reaction is performed through an adaptation of a patented crystallisation process. Performance of the KLPP – SOP Synthesis Reaction was optimised in a simulation model (see below), to determine the optimised crystalliser design and operating parameters, resulting in an effective process yield of 69.4% for the KLPP – SOP Synthesis Reaction. Recent testwork performed in September 2020, based on the KLPP – SOP Synthesis Reaction, confirmed the effective production of SOP (verified by XRD analysis). It demonstrated that yields above 65% were readily achievable, with a maximum

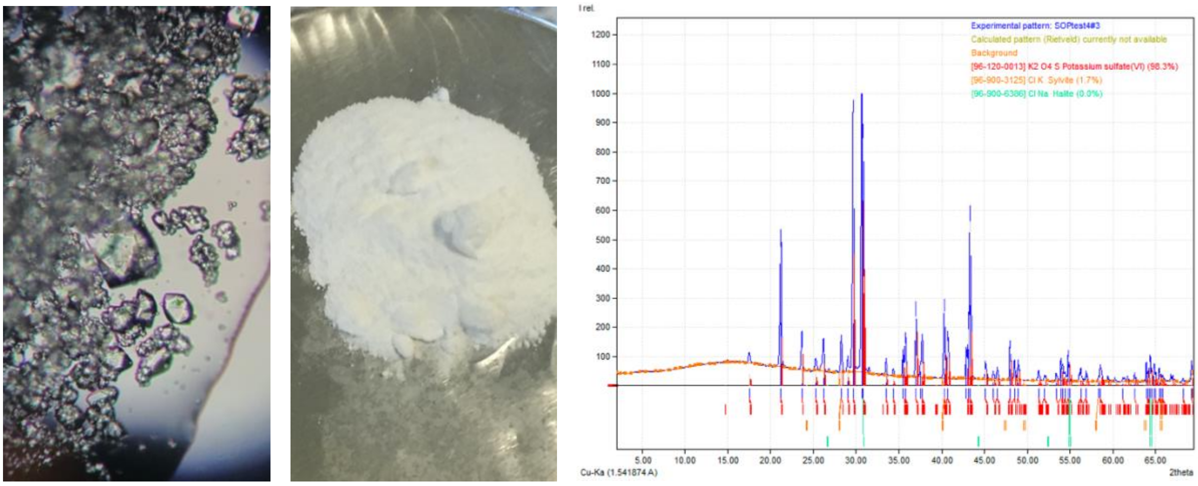
---

[17] ALS Certificate of Analysis, Batch No:19-02393, Report No: 731895.

SOP yield of 70% measured based on ICP analysis of the produced SOP. This indicated that a small proportion of the entrained brine contained further potassium from Sylvite.

Figure 6.3. SOP Synthesis Related Images

a) SOP synthesis sample monitoring
b) SOP crystal morphology characterisation



c) Crystal analysis
d) SOP salt harvest
e) XRD analysis of high-purity (98.8%) SOP

6.2 Validation of the aMES™ Model

An extensive and iterative validation process has been performed, since the KLPP-Scoping Study, to further validate the proposed aMES™ based processing route. This subsequent validation process consisted of three key phases:

- Piloting & Experimental Studies.
- Process Test Work.
- Process Simulation.

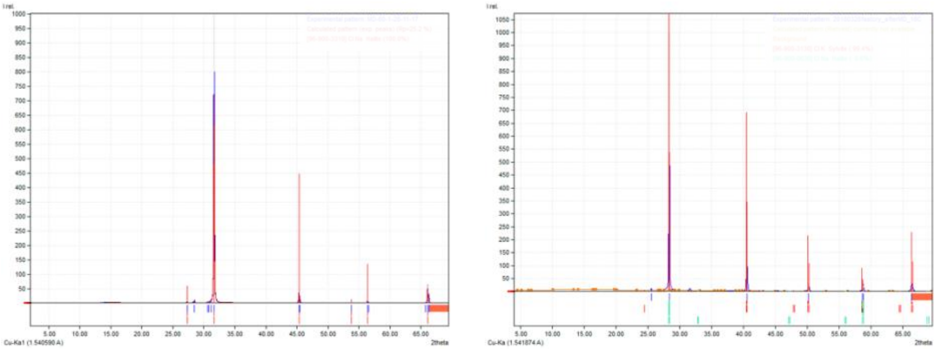
The piloting studies and process test work associated with the defined aMES™ based processing route have been described above. These extensive studies have successfully demonstrated and validated the performance of the three key stages in the aMES™ based processing route for the KLPP, as mentioned in the *Recent KLPP aMES™ Test Work* section above. These studies confirmed the performance of the aMES™ based processing route and as a result have produced both intermediate (Sylvite and Leonite) and SOP product samples (*Figure 6.4a* & *b*), respectively. The various salt samples produced through the aMES™ based processing route, have undergone extensive characterisation and evaluation with ICP, ISE & XRD techniques (*Figure 6.4c - f*) to determine both the composition and mineralogy of the respective samples.

Figure 6.4. KLPP Intermediate Products & Associated XRD Profiles

a) Range of salts produced from KLPP feedstock

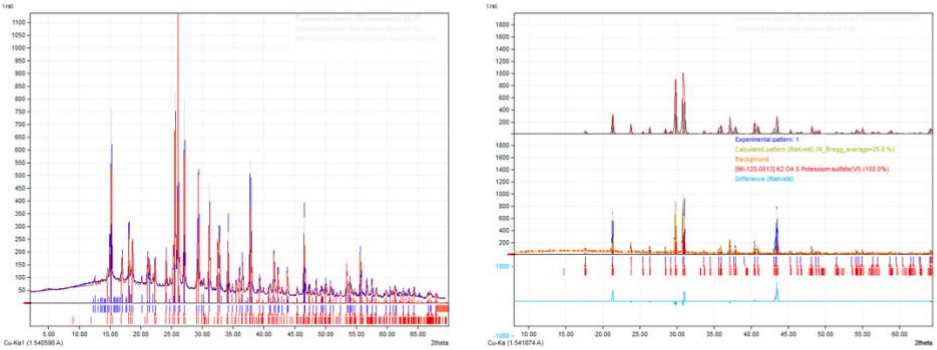
b) Produced samples of Sylvite, Leonite and SOP

XRD Analysis of – impurity removal (Halite), intermediary product (Sylvite & Leonite) and final product (SOP)



c) XRD Pattern: Halite (>99% purity)

d) XRD Pattern: Sylvite (>99% purity)



e) XRD Pattern: Leonite (>99% purity)

f) XRD Pattern: SOP (>99% purity)

The potassium enriched mixed salts have also undergone extensive testing and together with the final SOP product produced. The SOP purity has been confirmed through a Certificate of Analysis issued by an independent NATA accredited Australian laboratory, as outlined above in the *SOP Synthesis* section of this chapter.

Process Simulation & Optimisation

Based on the piloting studies and process test work, associated with the defined aMES™ based processing route described above, Parkway Minerals has developed a sophisticated process simulation model, to investigate, optimise and validate the aMES™ based processed route. The aMES™ simulation model has been built based on actual mass balance data that has been derived from the aMES™ based test work on potassium enriched mixed salts harvested from the KLPP. Furthermore, the model has been back tested, to further validate the model against experimental data derived over 5 years, confirming the suitability of the model in predicting key process parameters.

Development of the aMES™ process simulation model has enabled the optimisation of an effective aMES™ based processing route, with the incorporation of a number of recycle streams, which enables reprocessing of various process streams, thereby improving overall process recoveries. The aMES™ process simulation model has also assisted in incorporating additional enhancements to improve the performance of the overall process plant, as outlined in *Chapter 8, Process Plant Design*.

6.3 Validation of the Process Model

As outlined earlier in this chapter, the findings of the *Metallurgical Test Work Program* were used to verify the conclusions outlined in the *Validation of the aMES™ Model* section, above. In order understand how the aMES™ based process route integrates with the rest of the KLPP -, particularly the upstream operations (lakes, trenches, ponds and harvested potassium enriched mixed salts) and the rest of the process plant (downstream operations), a detailed process model was developed in a leading simulation software package.

Development of the process model enabled the energy and mass balance of the entire operation, from the salt lakes all the way through to the harvesting of potassium enriched mixed salts and the subsequent aMES™ based processing leading to the production of the final SOP, to be effectively modelled. In addition to important energy and mass balance related outputs, the process model enabled the process route for the entire operation to be optimised, ensuring the upstream and downstream operations integrated effectively. The process model also provided important design parameters necessary for developing mechanical equipment specifications, as well as, indicative site layout related outputs, which supported the development of capital and operating cost estimates.

The specific details relating to process plant design, including the i) basis of design, progress flow diagrams (PFD’s), mass balance, energy balance and water balance, are outlined in *Chapter 8, Process Plant Design*.

7. Pond Design

This chapter provides an assessment of the pond design related aspects of the Karinga Lakes Potash Project. As outlined in *Chapter 5* (*Production Plan*), the scenario evaluated in the PFS, involves the recovery of brine from 8 lakes at the KLPP through a series of production trenches, before subsequent processing via solar evaporation in the brine pre-concentrator ponds, Halite crystallisation ponds and potassium enriched mixed salts crystallisation ponds.

As per the mine plan outlined in *Chapter 5*, the intention is for Lake Miningere to be developed initially, with the development of the remaining 7 lakes in the mine plan (*Chapter 5*) scheduled, to match the production requirements of the SOP processing plant. Where appropriate, blending of the lake brines will occur to optimise production.

7.1 Design Standards

The engineering design standards applied to this scope are primarily based on:

- Industry standards for similar salt operations in Northern Territory and internationally.
- DMIRS Guidelines.
- AUSTROADS Design Guidelines, where applicable.

A comprehensive set of Preliminary Design Drawings were prepared as part of this study and form a component of the complete version of the KLPP-PFS report.

7.2 Pond Design Parameters

7.2.1 Brine Trenches

In order to abstract brine from each of the salt lakes, a brine trench is planned to be excavated along the length of each of the playa salt lakes (refer *Figure 1.1*). The trench base grade is approximately 1:5000 to allow for gravity flow towards a brine intake pump station. The brine intake pump station is a diesel driven pump set, trailer mounted for ease or mobilisation to other parts of the lake trench. An access track and berms are constructed from trench spoils to avoid surface water intrusion.

The brine is then pumped from the trench to the pre-concentrator pond for further concentration of the brine by solar evaporation. The brine then flows under gravity from the pre-concentrator pond to the Halite crystallisation pond and again to the potassium enriched mixed salts pond. The Halite and potassium enriched mixed salts ponds are solar crystallisation ponds. Their design is different to the pre-concentrator pond, as they are shallower, and discussed in further detail in subsequent sections.

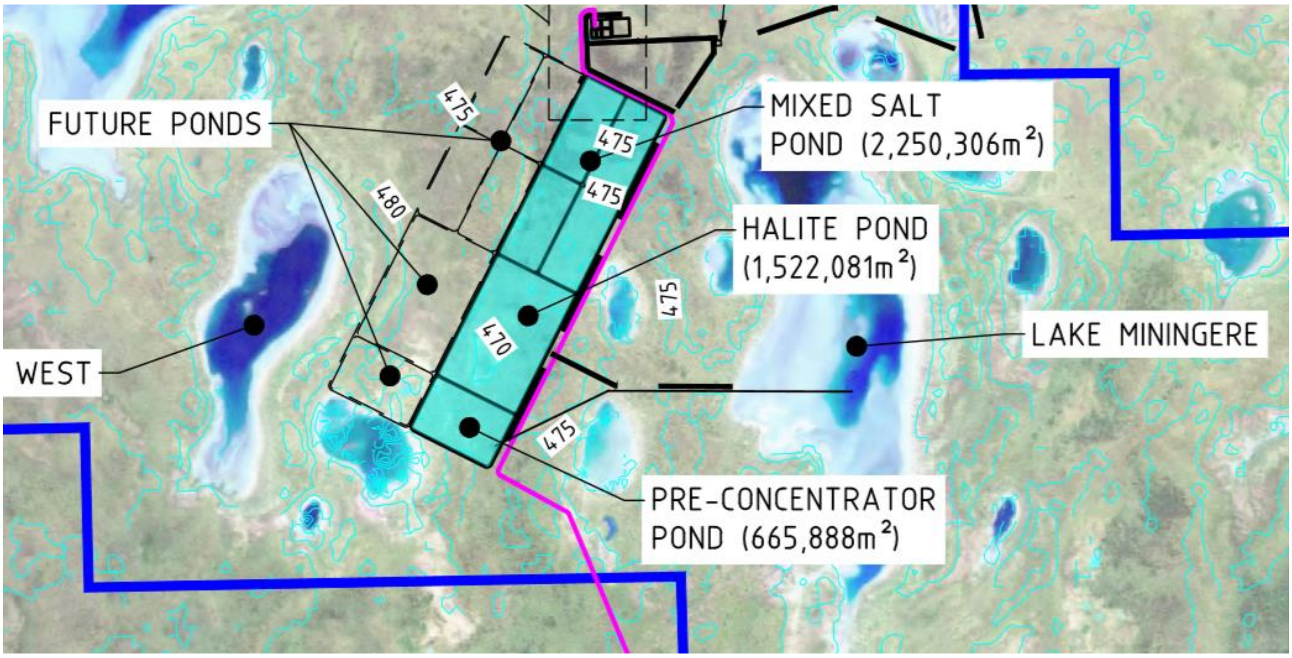
The brine trench layouts, lengths and indicative cross-section for each of the salt lakes are described in detail in *Karinga Lakes Potash Project (KLPP) Sulphate of Potash Resource and Production Plan*, which is provided in *Appendix A* of this report.

7.2.2 Ponds

Brine from the trenches is transferred from one pond to the next, primarily by gravity flow. The water levels in the ponds are controlled by weirs and adjustable boards. In total there are 3 ponds:

- Pre-Concentrator Pond. The pre-concentrator pond is the first pond after the brine channel. The brine enters into this pond through a weir from the brine channel. The walls around this pond are non-trafficable. This pond is deeper (< 150cm) as it acts as an evaporation pond. The concentration of the salts occurs as evaporation takes place in this pond. The area of the pond is 665,888m^2.
- Halite Pond. Brine enters the Halite pond via the weir through the separation wall from the pre-concentrator pond discharge. This pond is shallow (< 40 cm) as it facilitates the crystallization of salt. The area of the pond is 1,522,081m^2.
- Mixed Salt Pond. The mixed salt pond is designed as a potassium enriched mixed salt crystallization pond, and is divided into four cells, as shown in *Figures 7.1* & *7.2*. Brine enters into the cells of this pond through weirs. This pond is shallow (<30cm) as it facilitates the crystallization of potassium enriched mixed salts. The area of the pond is 2,250,306m^2. The potassium enriched mixed salts are harvested from these crystalliser-pond cells in turn and stockpiled for processing in the SOP processing plant.

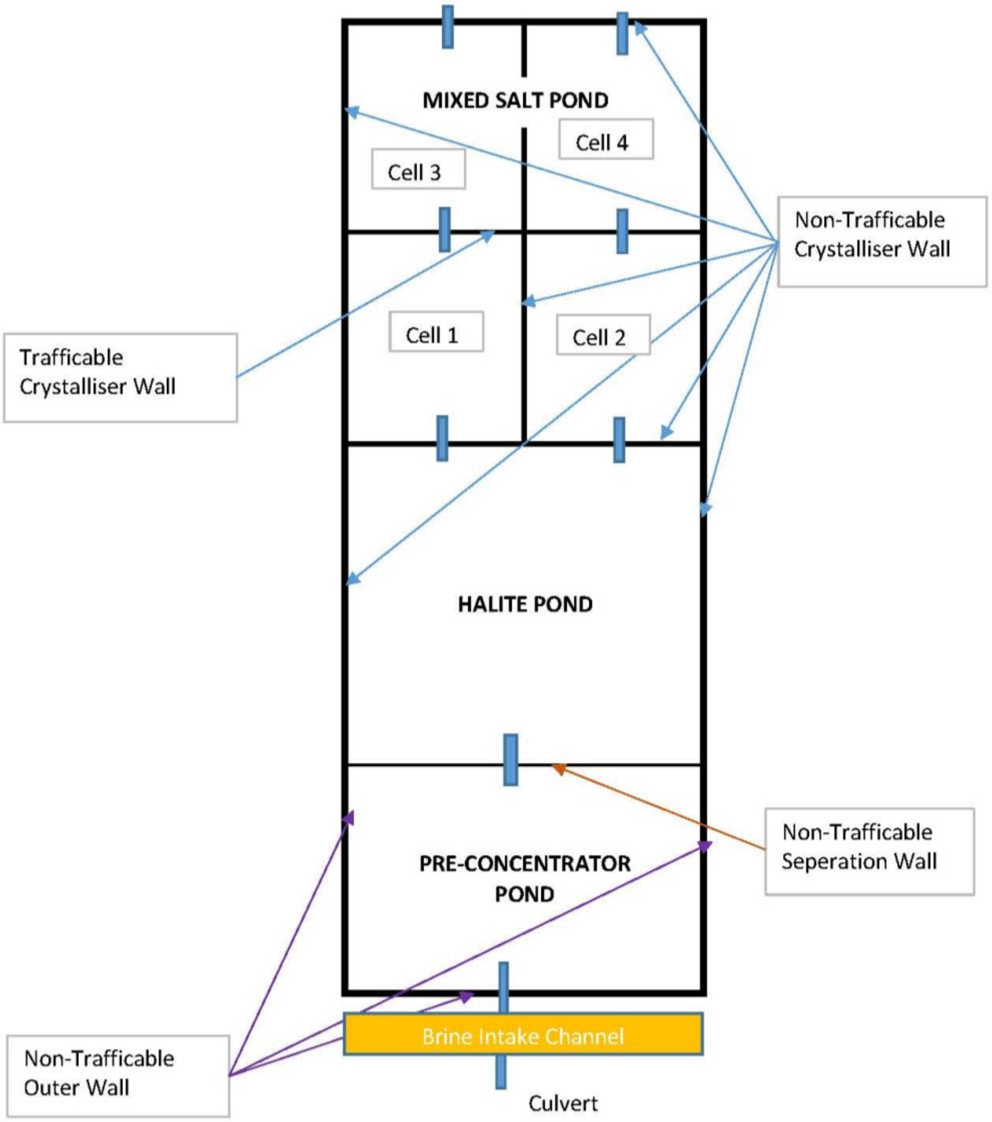
Figure 7.1. Evaporation & Crystallisation Pond Site Layout



7.3 Pond Walls Design

The schematic layout of the pond network and associated walls are shown in *Figure 7.2*, with the details about the different pond wall designs, described in subsequent sections.

Figure 7.2. Pond Layout Schematic



7.3.1 Pond Weirs (gravity overflow)

Pond weirs are proposed to transfer the flow from one pond to another pond under the gravity head. Eight weirs are proposed in the ponds. The design parameters of the weirs and culverts are tabulated in *Table 7.1*, with a typical weir platform installation shown in *Figure 7.3*.

Figure 7.2 shows the arrangement of a weir structure proposed for the pre-concentrator pond. As the pre-concentrator pond is deeper, a ladder and platform with safety rails is likely to be required.

Table 7.1. Pond Weirs & Culvert Dimensions

Weir	Brine Transfer		Culvert Diameter	No of Barrels
	From	To		
Weir # 1	Brine Intake Channel	Pre-Concentrator Pond	300mm	1
Weir # 2	Pre-Concentrator Pond	Halite Pond	300mm	1
Weir # 3	Halite Pond	Mix-Salt Pond Cell-01	300mm	1
Weir # 4	Halite Pond	Mix-Salt Pond Cell-02	300mm	1
Weir # 5	Mix-Salt Pond Cell-01	Mix-Salt Pond Cell-03	300mm	1
Weir # 6	Mix-Salt Pond Cell-02	Mix-Salt Pond Cell-04	300mm	1
Weir # 7	Mix-Salt Pond Cell-03	Bitterns Channel (optional)	300mm	1
Weir # 8	Mix-Salt Pond Cell-04	Bitterns Channel (optional)	300mm	1

Figure 7.3. Typical Weir Platform Installation for Ponds

7.4 Construction Materials

The required materials for pond walls are riprap, clay, sand, and granular fill. The materials of construction have been identified in a preliminary geotechnical report and require a site visit and testing to confirm sufficient quantities are available of each material. All material will be borrowed from adjacent and nearby deposits to the project area:

- Rip-Rap: The available material of Qc (Calcarite, vadose and chalcedonic, phreatic) could be used as a riprap material after geotechnical testing.
- Clay Material: The available material of Qp (Playa Deposits – mud, clay, evaporite crust, and deposits) could be used as a stiff clay material after geotechnical testing.
- Common Fill Material: The available material of Qr (Colluvium and sheet flood plains) could be used as a common fill material after geotechnical testing.
- Sandy fill material: The available material of Qs (Sand sheets and dune fields) could be used as a sand fill material after geotechnical testing.
- Pavement Material: The available material of Qr (Colluvium and sheet flood plains) could be used as a pavement material after geotechnical testing.

8. Process Plant Design

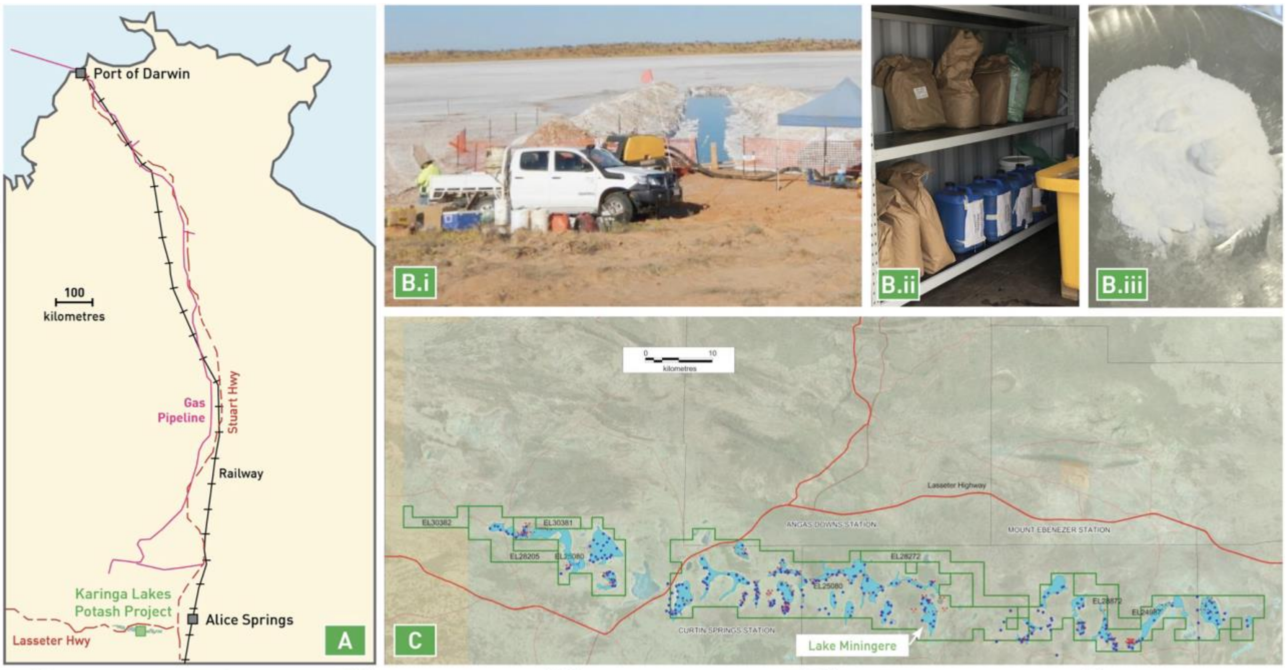
8.1 Overview & Basis of Design (BOD)

As outlined in *Chapter 2*, the KLPP development concept is based on the production of potassium enriched mixed salts, on-site processing with an integrated aMES™ based processing plant to produce SOP, and the subsequent dispatch to key markets (further details on key market are outlined in *Chapter 10*).

Process Plant Location

The KLPP is located approximately 230km to the southwest of Alice Springs in the south of the Northern Territory and covers an area of approximately 1,100km^2 along the east-west traversing Lasseter Highway (*Figure 8.1*). The tenements which constitute the KLPP are described in further detail in *Chapter 12*.

Figure 8.1. KLPP Site Location

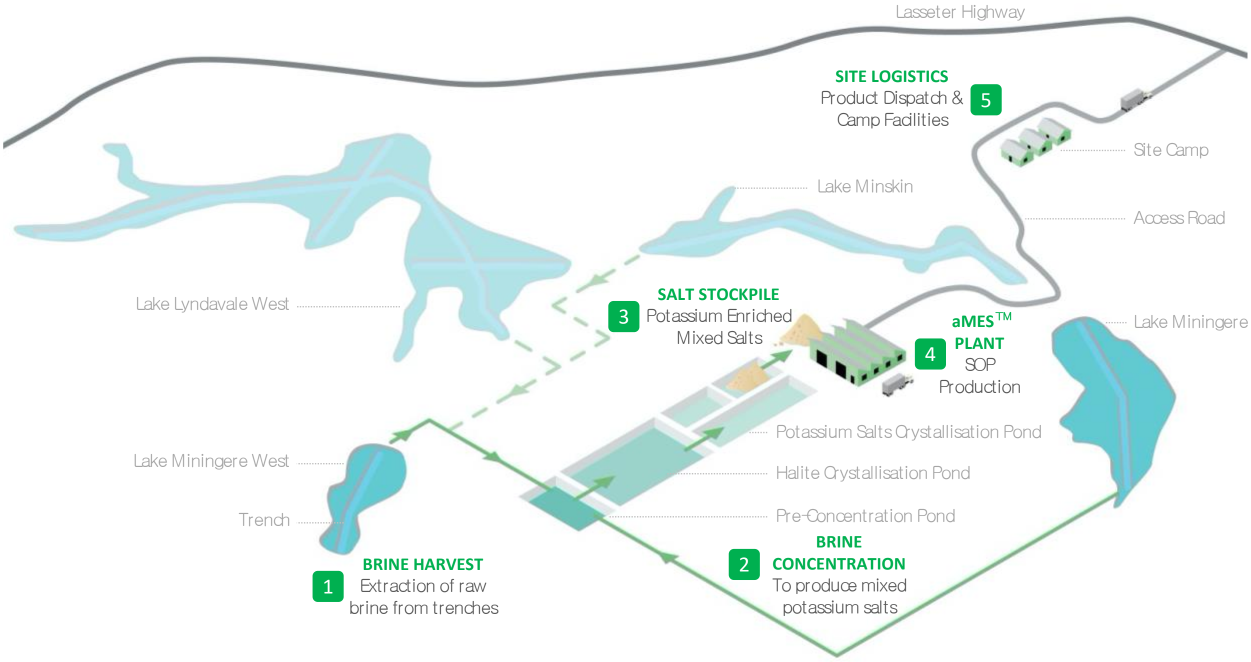


(A) KLPP Regional Infrastructure (Northern Territory). (B.i) Lake Miningere Trial Trench, (B.ii) Lake Miningere Brine & Salt Samples, (B.iii) SOP produced from Lake Miningere salts. (3) KLPP Exploration Licence Map. Maps and associated details are illustrative only and not to scale.

As Lake Miningere has been identified as the highest-grade potassium lake at the KLPP, as described in *Chapter 4*, this lake, together with Lake Miningere West has been deemed the most suitable starter lakes (as outlined in *Chapter 5*), to underpin project development. On this basis, and with consideration for other site-based constraints, an indicative site location, between Lakes Miningere and Miningere West has been identified as being suitable for the construction of the proposed KLPP processing plant (refer *Figure 8.2*).

The proposed KLPP processing plant location, is also proximal to a proposed access road, as well as, the proposed evaporation pond network, as outlined in *Chapter 7*, ensuring efficient production and transportation of potassium enriched mixed salts, from the potassium crystallisation ponds, to the processing plant.

Figure 8.2. KLPP Generalised Site Schematic



Simplified Site Description

The major site operations, as outlined in the KLPP Generalised Site Schematic (*Figure 8.2*), consist of the following key stages:

- **1 -** Brine Harvest – extraction of raw brine from trenches and pumping to evaporation ponds.
- **2** - Brine Concentration – the raw brine is concentrated, through a i) pre-concentration pond, then pumped to, ii) a Halite crystallisation pond, where waste sodium salts are precipitated, and then pumped to the, iii) final potassium salts crystallisation pond, where the potassium enriched mixed salts are harvested.
- **3** - Salt Stockpile - the harvested potassium enriched mixed salts, are then transported a short distance to a stockpile, near the processing plant, ready for processing in the SOP processing plant.
- **4** - Process Plant – the aMES™ based process plant, then processes the potassium enriched mixed salts, to produce SOP, which is then packaged on-site.
- **5** - Site Logistics – packaged SOP is then transported to key domestic markets, via the proposed access road leading to the Lasseter Highway to the north of the project area.

Potassium Enriched Mixed Salt Feedstock

Initial development of the KLPP will be based on a single trench through each of Lakes Miningere and Miningere West, with the produced brine being pumped to the pre-concentration pond. In subsequent years, Lakes Minskin and Lyndvale West will be used to underpin adequate brine production (refer *Figure*

8.2), followed by lakes Skinny, Curtin Boundary, Swansons and Swansons North, as outlined in the Production Plan (refer *Chapter 5*).

As the brine is progressively concentrated through the evaporation and crystalliser pond network, the final harvest is a potassium enriched mixed salt, with approximately 12.5% potassium (refer *Table 8.1*).

Table 8.1. Composition of Potassium Enriched Mixed Salts Harvested from the KLPP

Element	Composition (w/w%)
Potassium (K)	12.5%
Magnesium (Mg)	2.9%
Sodium (Na)	19.9%
Sulphate (SO_4)	21.8%
Chloride (Cl)	34.4%
Water (H_2O)	8.4%

Production of Salt Products

By processing the potassium enriched mixed salts, the KLPP process plant will produce four primary products:

- Sylvite (KCl), as an intermediate product.
- Leonite ($K_2SO_4.MgSO_4.4H_2O$), as an intermediate product.
- SOP (K_2SO_4), as a result of reacting the Sylvite and Leonite intermediate products.
- Halite (NaCl), as a waste product, to be returned to the lakes.

Additional details about the production of various salt products is provided in the *Mass Balance* section, below.

Plant Design Capacity

The KLPP processing plant has a nameplate capacity of 40,000t of net SOP production, annually, with a nominal mine life of 20 years (refer to *Chapter 5*).

The KLPP processing plant is expected to operate 8,060 hours per year, in order to allow for downtime and scheduled maintenance, based on the following assumptions:

- Availability of 95%.
- Utilization of 96.8%.
- Overall Operating Factor of 92%.

Utilities

The utilities required for the operation of the KLPP process plant are outlined in *Section 8.4* and include:

- Electricity – for operating key process equipment, amenities and infrastructure.
- Process Heat – in the form of hot water and low-pressure steam, for key processing functions in the process plant, including SOP synthesis from Sylvite and Leonite.
- Water – the majority of process water is required for non-process infrastructure and to a lesser extent, the dissolution of the potassium enriched mixed salts. The majority of water in the process is recycled and utilised for downstream processes, including the synthesis of SOP.

Additional details about the site utilities is outlined in *Chapter 9*.

Process Plant Technology

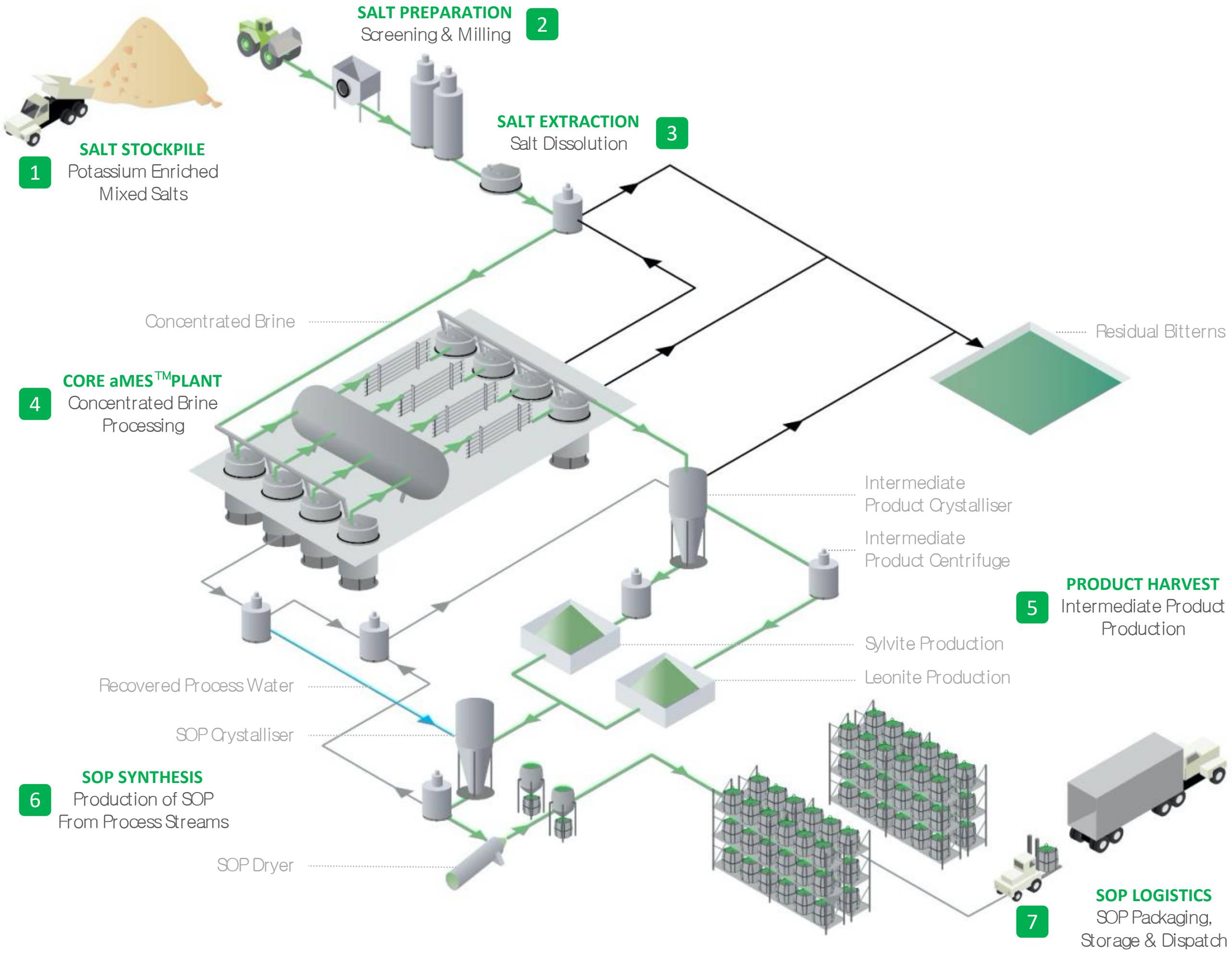
The proposed KLPP process plant, incorporates an aMES™ based processing route. A summary of the aMES™ based processing route proposed for the KLPP, and a summary of metallurgical test work, is outlined in *Chapter 6*.

8.2 Process Flow Diagram

As outlined in *Figure 8.3*, the KLPP process plant, incorporating an aMES™ based processing route, consists of the following key stages:

- **1** - Salt Stockpile – the downstream operations in the processing plant, commence with the potassium enriched mixed salts, harvested from the evaporation ponds, during upstream operations.
- **2** - Salt Preparation – the potassium enriched mixed salts are screened and milled, to ensure adequate dissolution of potassium minerals.
- **3** - Salt Extraction – the milled salts are dissolved in warm water, ensuring the transfer of potassium and sulphates from the mixed salts, into the warm leach solution, to form a concentrated brine.
- **4** - Core aMES™ Plant – the concentrated brine from the salt extraction step, is processed through a proprietary aMES™ based flowsheet, in order to:
    - Remove impurities (mostly sodium and magnesium chlorides).
    - Recover pure water.
- **5** - Produce intermediate products:
    - Sylvite (KCl).
    - Leonite ($K_2SO_4.MgSO_4.4H_2O$).
- **6** - SOP Synthesis - as a result of reacting the Sylvite and Leonite intermediate products, with the addition of recovered process water.
- **7** - SOP Logistics – the drying, packaging, storage and dispatch of the produced SOP product.

Figure 8.3. KLPP Downstream Processing Plant PFD (Simplified)



8.3 Mass Balance

As outlined in *Table 8.2*, the KLPP process plant, with 40,000tpa of nameplate SOP production capacity, will process approximately 157,000tpa of potassium enriched mixed salts, leading to the production of 37,187tpa of Sylvite and 51,778tpa of Leonite, respectively. These intermediate products will subsequently be reacted, through the reaction described in *Chapter 6*, to produce 41,090tpa of SOP, resulting in 40,000tpa of net SOP production, after allowing for losses associated with the drying and packaging of the final product.

As the SOP synthesis reaction has a potassium conversion efficiency (from intermediate product to SOP) of 69.4%, any unprecipitated SOP is recycled further upstream, together with incoming concentrated brine, within the aMES™ based processing train, to ensure maximum potassium recoveries. Given the various recycle streams associated with the aMES™ based processing route, a very high potassium recovery, in the order of 95.4%, is achieved within the processing plant. This is underpinned by a single bleed stream, ensuring minimal potassium is lost to the bittern stream, which is purged. On an annual basis, the total bleed purge stream amounts to 37,313tpa, containing only 2.4% of incoming potassium, however, is necessary to minimise the accumulation of undesirable salts within the process streams.

In addition to the production of intermediate products, the aMES™ based processing route also produces, 56,235tpa of Halite, as well as 198,300m^3/yr of fresh water, which is recycled within the plant operations.

Although the processing plant also produces roughly 56,235 tonnes of Halite, it is at this remote location, treated as a waste product. As the Halite is not saleable (given the transport costs from the KLPP exceed realisable price), it is sent to on-lake storage, however, the recovered fresh water is used to displace process water requirements, ensuring maximum overall water use efficiency for the processing plant.

Table 8.2. Mass Balance Summary

Component	Annual Production	Units
Potassium enriched mixed salts	157,000	tpa (feedstock)
Sylvite	37,187	tpa
Leonite	51,778	tpa
SOP (gross)	41,090	tpa
SOP (net)	**40,000**	**tpa**
Potassium Recovery	95.4%	% (K in SOP / K in feedstock)
Halite	56,235	tpa (waste salt)

8.4 Energy Balance

As outlined in *Section 9.5*, primary power generation is proposed to be provided through 3 gas engines, operating with compressed natural gas. In addition to meeting all site power requirements of 4.686 MW$_{(e)}$ (peak load), the primary power generation system incorporates an integrated waste heat recovery system, enabling the production and utilisation of hot water for key processes within the process plant.

In order to provide higher density thermal energy for additional processes, including the synthesis of SOP, a 4.639 MW$_{(th)}$ boiler is also utilised, to produce low-pressure steam. The process plant also requires cooling, which is achieved through a cooling tower which produces cooling water, as well as, a chiller for the production of chilled water, which is predominantly used for the cooling of the SOP crystalliser.

A summary of the energy balance is outlined in *Table 8.3*.

Table 8.3. Energy Balance Summary

Component	Capacity (Entire Project Site)	Units
Primary Power Generation - Electricity	4.686	MW$_{(e)}$
Thermal Energy – Hot Water & LPS	6.62	MW$_{(th)}$
Thermal Energy - Chilled Water Cooling	2.70 (removed by chiller)	MW$_{(th)}$

8.5 Water Balance

The production and availability of process water is described in *Section 9.7*. The processed raw water is stored in a tank, which is then used for onsite operations including amenities, to run the boiler, as well as, the aMES™ based process plant. The primary water requirement for the process plant is outlined in *Table 8.4*, with the net annual water requirement forecast to be 189,300m^3 per year (m^3/yr).

Table 8.4. Water Balance Summary

Water Consumption by Area	Capacity	Units
Total Project - Water Consumption	354,900 (gross)	m^3/yr
Non-Process Infrastructure	179,400	m^3/yr
Process Plant – water requirement	189,300 (net)	m^3/yr
Potable Water – other site requirements	5,300	m^3/yr
Total Project - Water Consumption	**194,600 (net)**	**m^3/yr**
Site wide requirements	Refer *Section 9.7 (Water), of Chapter 9* (*Non-Process Infrastructure*).	

The production of SOP is typically a relatively water intensive process, with reported water requirements in some cases exceeding 10m^3 for each tonne of SOP (i.e. >10m^3/t SOP) produced. The significant recycle streams within the aMES™ based processing route, enable the recovery of significant amounts of water, leading to a very efficient processing plant requiring approximately 4.87m^3 of water, for each tonne of SOP (4.87m^3/t SOP), as outlined in *Figure 1.2* and summarised in *Table 8.5*.

Table 8.5. Efficiency of Water Use

Component	Capacity	Units
Total Project - Water Consumption	194,600 (net)	m^3/yr
Specific water consumption	4.87	m^3/t (SOP)

Notwithstanding the efficiency of the proposed processing route, water consumption is anticipated to be improved further, by displacing up to 50% of the make-up water required for the processing plant during the potassium extraction phase (refer *Section 6.1*), with potassium rich brines directly from the crystallisation pond network. Whilst insufficient testwork has been performed to date in order adopt this additional enhancement as part of this study, should this approach be deemed suitable, this would result in a reduction in water consumption of approximately 94,650m^3/yr. The impact of this water consumption would result in specific water consumption of approximately 2.5m^3 of water, for each tonne of SOP (2.5m^3/t SOP, refer to *Figure 1.2*), positioning the KLPP as one of the most water efficient producers of SOP.

9. Non-Process Infrastructure (NPI)

9.1 Buildings, Amenities and Accommodation

As part of this study, a plan for determining the appropriate non-process infrastructure (NPI) required for the KLPP, has been developed.

A preliminary basis of design has been established comprising the following components:

- Roadways (both around the site and main access road for entry from Lasseter Highway).
- Administration buildings.
- Operations buildings.
- Workshops and storage facilities.
- Permanent camp (village) and amenities buildings.
- Layout and parking provisions.
- Security and fencing.

9.1.1 Administration and Operations Buildings and Amenities

Permanent administration NPI facilities will be required to be within a fenced compound and will consist of the following:

- Administration building including office accommodation, meeting and training rooms.
- Gate house and emergency response centre.
- Amenities.
- Laboratory for chemicals and biological assessment.

As a basis of design, a 10m^2 total space per person shall be considered, plus a meeting room, conference/training room, control room, storeroom, IT server and small kitchen for the operational staff.

The administration buildings shall comprise of transportable prefabricated interconnection modules each 14.4m by 3m.

9.1.2 Key Design Criteria

Key design criteria for the basis of design of NPI are outlined in *Table 9.1*, below.

Table 9.1. Key NPI Design Criteria

Facility / Parameter	Criteria
Design Life	▪ 25 Years (Buildings)
Entry Road and site roads	▪ Unsealed entry road for infrequent usage based on delivery vehicles and minimal site staff ▪ Unsealed single traffic access roads between ponds
Alternative entry road	▪ Not evaluated as the scope of work indicated that all material is currently proposed to be transported through the north east main entry road
Security	▪ Access regulated, ▪ Unmanned security gate at entrance ▪ Main NPI area and high value or dangerous assets to be fenced and other areas to be signposted
Administration	▪ Sized to suit anticipated staffing levels
Workshops	▪ Specification of size and location of the workshops for light vehicle maintenance and mobile equipment ▪ Inclusion of an oily water separation facility to service the workshop area ▪ Workshops based on 20ft sea containers with fabric dome shelters fixed in-between to from covered area
Crib Room	▪ Sized to suit anticipated staffing levels and based on purchase of pre-used (Dongas) with ensuite facilities ▪ Food to be catered
Amenities	▪ Sized to suit anticipated staffing levels based on open plan mess hall using sea containers placed side-by-side ▪ Main amenities building located near administration building ▪ Remote facilities as required
Sewerage Treatment Facilities	▪ Sized to suit anticipated staffing levels ▪ Treatment standard to allow effluent disposal to the local environment (e.g. irrigation, leach drains or similar)
Emergency Services	▪ On-site emergency services ▪ Helicopter landing facilities for emergency evacuations
Fire Services	▪ Fire services infrastructure at present level of study has only considered firewater supply and distribution main and hydrant requirements. A more detailed assessment is to be carried out in the next phase DFS.

9.1.3 Accommodation and Bedding Requirements

The accommodation village is required to facilitate an operational workforce with administration, management and operations personnel, to a total of 20 full-time equivalent (FTE) staff.

A further 10 beds are provided for contract or campaign maintenance, harvesting and/or construction crews at various times of the year. This represents a total of 30 beds available on site at any one time.

The staffing plan has been used as the basis of design for the administration building, amenities and accommodation camp and sized to accommodate a maximum total of 30 FTE operational personnel. The estimated manning levels are expected to consist of a 14-person day shift and 6-person night shift during normal steady-state operations, with additional staff required on site during construction, major maintenance and campaign harvesting of the potassium enriched mixed salts.

9.1.4 Workshop Facilities

Preliminary sizing of the NPI workshop facilities that has been considered for the KLPP-PFS is summarised below.

The vehicle wash facility is to be provided near the main workshop and parking area, which will be suitable for both mobile equipment and light vehicles. Drainage will be required to a common collection point and oily water separator.

The hydrocarbon waste shall be collected and disposed of off-site while separated sludge shall be periodically collected and disposed of off-site at a shire operated landfill.

The workshop facilities are based on the use of a series of 20ft sea containers with fabric dome shelter fixed between them to form two dome bays (refer *Figure 9.1*). The containers are fixed down to concrete foundations using hold down brackets, and will provide:

- A workshop for the service of mobile equipment.
- A light vehicle maintenance workshop for service of light vehicles.
- A general maintenance workshop for installed plant and equipment.
- Oily water separation facility to remove wash down water from each of the workshops and separate oil for disposal offsite.

Figure 9.1. Typical Maintenance Workshop Area

9.1.5 Amenities and Crib Buildings

The staffing plan has been used to estimate the required amenities and crib buildings. The impact of shifts on amenities and crib building demands have not been considered at this stage.

The workforce is planned to be residential in Alice Springs and therefore full kitchen facilities with catering will be provided. It also assumed that facilities provided in the crib room include fridges, microwaves and pie-warmers, etc.

The amenities building will comprise of a transportable prefabricated interconnecting modules each 14.4m by 3m. Small field ablution blocks are not required outside of process plant area, stores, workshop facilities and operations building.

9.1.6 Laboratory

The chemical laboratory will be supplied to enable monitoring of the production process. The laboratory is assumed to consist of one 40ft (12m x 3m) sea container. The Container is fixed down to concrete foundations, using hold down brackets, and includes the following facilities:

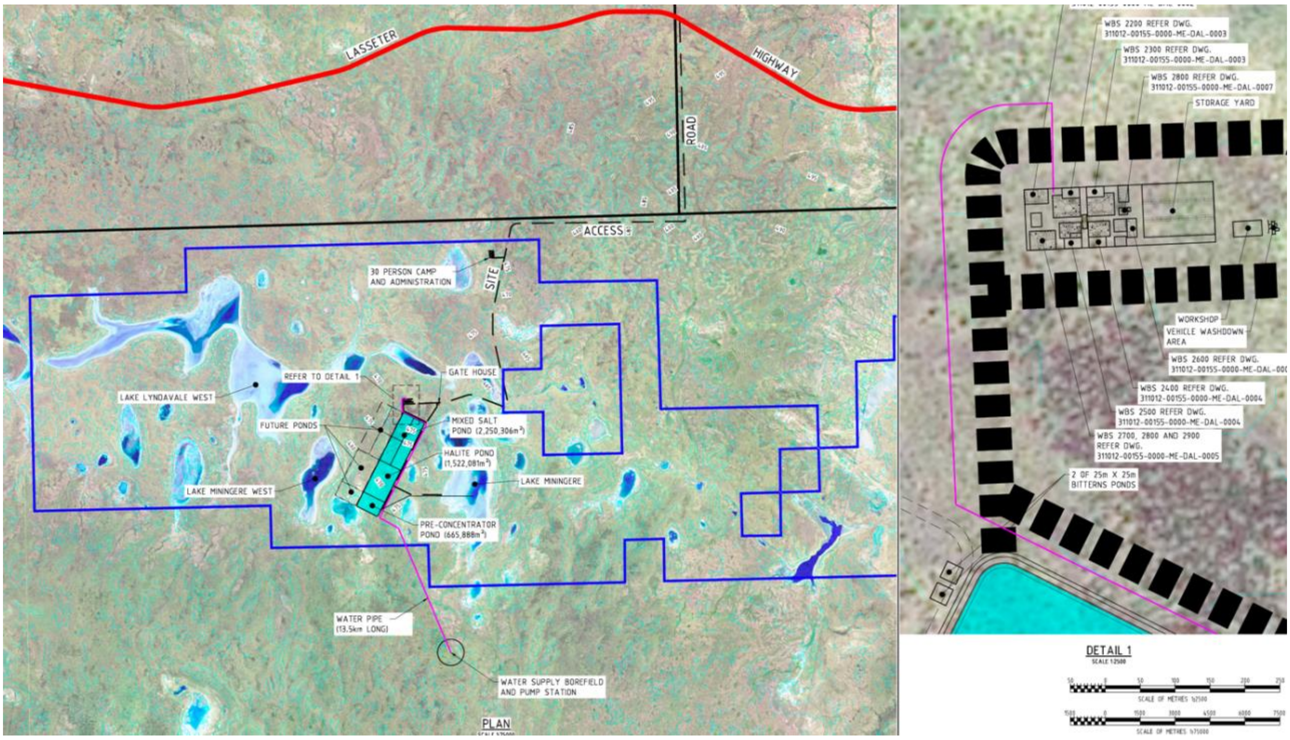
- Wet laboratory.
- Dry laboratory.
- Office and storage.

9.2 General Site Layout

The NPI facilities relating to the KLPP have been positioned with the following objectives and provided in the Generalised Site Layout Plan (*Figure 9.2*).

- The site layout has been arranged to take advantage of localised high ground to minimise site works and offer flood protection.
- The site facilities are located within the project area (tenure).
- Proximity to key process infrastructure, process plant and ponds, thereby minimising travel times and allowing staff interactions and a more efficient use of staffing between various facilities.
- To provide good alignment for conveying product to and from the stockyard facilities.

Figure 9.2. Generalised Site Layout Plan



9.2.1 Main Access Road

A main access road is required to facilitate construction of the site and to provide ongoing access to the project site from Lasseter Highway. The route for the site entry road was chosen based on the rationale to keep the main route shortest, as outlined in *Figure 9.2*.

The site entry road is based on a 10m wide unsealed roadway for approximately 29km to the village. This road will be designed to tie into the main Lasseter Highway, to ensure similar width and standard of construction.

Since a detailed survey, ground investigation data and detailed route mapping was not available as part of this study, the road selection is preliminary in nature and will be subject to further considerations during a more detailed stage of evaluation, and will include such factors as balancing cut and fill volumes and evaluation of geotechnical matters, sources of material etc.

9.2.2 Site Entry Road

The site entry road is based on an 8m wide unsealed roadway for this study. Access roads within the site are designed to the expected traffic requirements and whether there is a need for two-way traffic. A key consideration is to minimise the heavy and light vehicle/pedestrian interfaces for safety. Surface water flow and inundation is to be considered in the next phase of evaluation for roadways. Drainage channels adjacent to roadways are to be included as a standard design requirement. These will be further considered in the next phase of evaluation.

9.2.3 Utilities and Services

The following preliminary basis of design has been established for the utilities and services for the KLPP-PFS:

- Power generation and distribution.
- Potable, freshwater and firewater supply.
- Fuel storage.
- Sewerage.
- Site Communications.
- Lighting.

The KLPP is located approximately 400km from Alice Springs (by road) in a remote undeveloped area, and therefore will require utilities and services to operate self-sufficiently. The key high-level basis of design for the utility systems is summarised below in *Table 9.2*.

Table 9.2. Utilities Services

Facility/Parameter	Criteria
Design Life	25 years
Fuel Supply	On-site storage and distribution of diesel as the site preferred fuel for vehicles and other plant equipment.
Power Generation	On-site gas fired power generator (3 x 33.3% units) with a heat recovery system for heating water from exhaust gases. Containerised units for minimal infrastructure capital.
Potable and Process water	Generated on site using brackish water reverse osmosis plant (BWRO), supplied from a brackish water bore field previously established and utilised by the exploration team. Bore water quality is relatively good at 2-5 g/L total dissolved salts. BWRO will be containerised units to minimise capital costs.
Sewerage Treatment	A sewage treatment plant has been sized to suit 30 maximum full-time equivalent persons (FTE) on site at one time. Effluent will be suitable for localised irrigation, or possibility bitterns discharge. The bioreactor will be installed below ground as a typical BioMAX unit.

9.2.4 Other Services

A range of other services will be contracted out to specialist service providers, for purposes of minimising site capital and operating costs. These other services will include:

- Emergency services – helicopter service provider from Alice Springs; includes site visits for medical requirements and emergencies.
- Security services – provision of security monitoring systems and any intermittent D&A testing requirements onsite.
- Waste management services - rubbish collection and recycling to depot.
- Procurement & expediting courier - transport and delivery services to and from site.
- Catering and cleaning services – kitchen hands for meals preparation; cleaning services for amenities and general site hygiene requirements.
- A range of specialist operating equipment manufacturers (OEM) and other essential service providers, for inspection or remote monitoring or trouble shooting, potentially including:
  - Electrical and control systems.
  - IT and communications.
  - BWRO and bioreactor - water treatment and wastewater treatment plants;
  - Power station operation and maintenance.
  - Gas and diesel system inspections.
  - Mine planning services – hydrogeologists, geologists, etc.
  - Maintenance planning services – SAP or similar setup and routine planned and preventative maintenance scheduling.

9.3 Transport and Site Services

9.3.1 Salt Harvesting

Harvesting will be conducted on a campaigned contractor services basis, utilising plant and equipment and operators from specialised contractor services in the region.

The contractor services will include the provision and maintenance of, all plant and equipment, including:

- Harvester (Loadquip Type).
- Salt Haul Trucks (9 axle type).
- Tipper Trucks (8-10 Tonne tippers).

The services will include the general maintenance and earthworks repairs on ponds and pond walls from erosion, storm, wind and rains.

9.3.2 Major Maintenance

Major maintenance and scheduled servicing for the onsite plant and equipment (including mobile vehicles) will be conducted on a campaign basis, utilising specialised contractors from the region.

The contractor services will include the planned and preventative maintenance on all plant unit operations including pumps, heat exchangers, chillers, crystallisers, centrifuges, tanks and agitators, crushers and conveyor belts, dryer unit, and bagging plant. A crew of up to 10 persons is anticipated. This may also include a call out service.

The contractor services will include the general maintenance on diesel machinery including provision of spare parts, tools and equipment for the servicing of:

- Light vehicles (2WD and 4WD Utes).
- Medium vehicles (front-end loaders, small trucks, buses, water tanker).
- Portable pumps.
- Crane.
- Forklift.
- Grader.

9.3.3 Construction Works

Construction works will be provided by suitable construction contractors, and provide operators and plant and equipment including:

- Temporary works and facilities for mobilisation of workforce.
- Temporary workshops.
- Excavation equipment for civil and earthworks, including:
    - Water carts and compaction rollers.
    - Dozers and scrapers.
    - Haul trucks.
- Concrete batching plant and operators (over the fence supply).
- Steel fabrication and fitting requirements.
- Electrical and controls.
- Transportation to site of plant modules.

9.4 Mobile Plant and Equipment

In order to maintain effective site operations at the KLPP, plans for a suitable fleet of mobile plant and equipment has been prepared, to assist with harvesting, pond operations, civil maintenance and general site requirements.

A summary of mobile equipment required on site on a permanent basis is provided in *Table 9.3*, below.

Table 9.3. Summary of Mobile Plant and Equipment (permanent on site)

VEHICLE	SPECIFICATION	WEIGHT	NO OF AXLES	WIDTH	USE	UNITS REQUIRED	ASSUMPTIONS
Harvesting Fleet							
Harvester	Loadquip	62.5T	N/A	8.0m	Salt Harvesting	0	Campaign harvesting operation - hire / outsource to contractor
Grader	CAT 12	37.55T	3	3.1m	Ripping harvest salts and windrowing salt for harvesters.	1	Campaign harvesting operation - hire / outsource to contractor
Tipper Truck	NLR 275	8T	2	1.8m	Salt Harvesting - for hauling salts to stockpile	0	Campaign harvesting operation - hire / outsource to contractor
Salt Haul Truck	Attached	2 x 50T	9	3.5m	Salt Harvesting	0	Campaign harvesting operation - hire / outsource to contractor
Pond Operations							
Tipper Truck	NLR 275	15T	3		pond and plant maintenance	0	included above
Portable pumps (On Trailor)	Sykes or similar; 6" or 8" diesel with fuel for 24 hours. Trailer mounted.				Brine intake pumps from Lake Miningere trench. Also used for brine transfer from lakes and ponds	4	Flow rate required = 400m^3/hr brine intake

VEHICLE	SPECIFICATION	WEIGHT	NO OF AXLES	WIDTH	USE	UNITS REQUIRED	ASSUMPTIONS
Civil Maintenance							
Water Cart/Tanker					Road dust suppression	1	Cart only, use as a trailor on tipper truck . Could potentially also double as a fire truck also.
Grader	12 Cat or similar; Komatsu, John Deere, Hyundai				Road maintenance and grading, windrows, crystalliser batter formation	0	Included above
Small FEL	950 Cat or similar				Road maintenance, minor earthworks loading tip truck, loading salt plant and SOP plant solid waste	1	
Small tipper	6 wheel rigid	10T			Carting gravel for minor road repairs, removing salt during crystalliser prep, cleanup of crystalliser floors (mud etc). Moving salt and SOP plant solid waste. This is the minimum for simple site works (patching levees and roads), major works requires more	2	included above
Excavator	Cat 329 DL	30T	N/A	3.4m	Digging of trenches, crystalliser batters, crystalliser mud holes, salt plant settling pond	0	Hire as required.
Dozer	Cat D8T	40T	N/A	3.1m	earthworks and quarrying, salt batter work (after major rain), minor stockpile management	0	Hire as required.

VEHICLE	SPECIFICATION	WEIGHT	NO OF AXLES	WIDTH	USE	UNITS REQUIRED	ASSUMPTIONS
Maintenance Fleet							
Franna Crane	Franna AT22	24T	2	2.5m	General maint lifting including mobile pumps, fixed pumps, motors, shut down parts etc	1	
Truck (maintenance)		25T	3	1.8m	Cargo, moving large equipment such as pumps, loaded with Franna or forklift	1	Rigid flat-bed, with hydraulic crane mounted near cab.
Fork lift			2		Stores/maintenance, tyre handling	1	
Fuel/service truck	See below		4		Refueling portable pumps and harvesters. Field servicing of diesel engines for pumps (and potentially harvesters). Includes oil/grease and waste collection. Rigid truck with 2,000L fuel tank plus oil, grease and coolant and waste oil storage.	0	Utilise tank or cart.

VEHICLE	SPECIFICATION	WEIGHT	NO OF AXLES	WIDTH	USE	UNITS REQUIRED	ASSUMPTIONS
Site General							
LV	Ute 2wd	3.22T		1.9m	Sample runs, site access, maintain access around site. Pump stations, all acces roads, crystallisers, stockpile, camp,	2	Consider people transport, main transport, supervision. Use 2wd to keep costs down
LV	Ute 4wd	3.22T		1.9m	Sample runs, site access, maintainer access around site. Pump stations, all acces roads, crystallisers, stockpile, camp,	2	Supervisors, shift electrical and mechanical maintainers, plant and pond operators. Require 4WD capable vehicles for wet days.
Site bus					20 seater (assuming 20 staff at work any time)	0	not required for small operations like KLPP; utilise Utes etc.
Ambulance					Emergency	0	Outsource to Emergency Services (Helicopter services)
Fire Appliance					Emergency	0	Alternative is to make Water Cart compatible with firefighting, not sure if there are regulations to cover this.
					Total	16	

9.5 Power

Based on the KLPP-PFS process, the currenrly preferred power generation option for the KLPP is based on a proposal from Clarke Energy and comprises of three (3) containerised gas fired Jenbacher engines of the type outlined below.

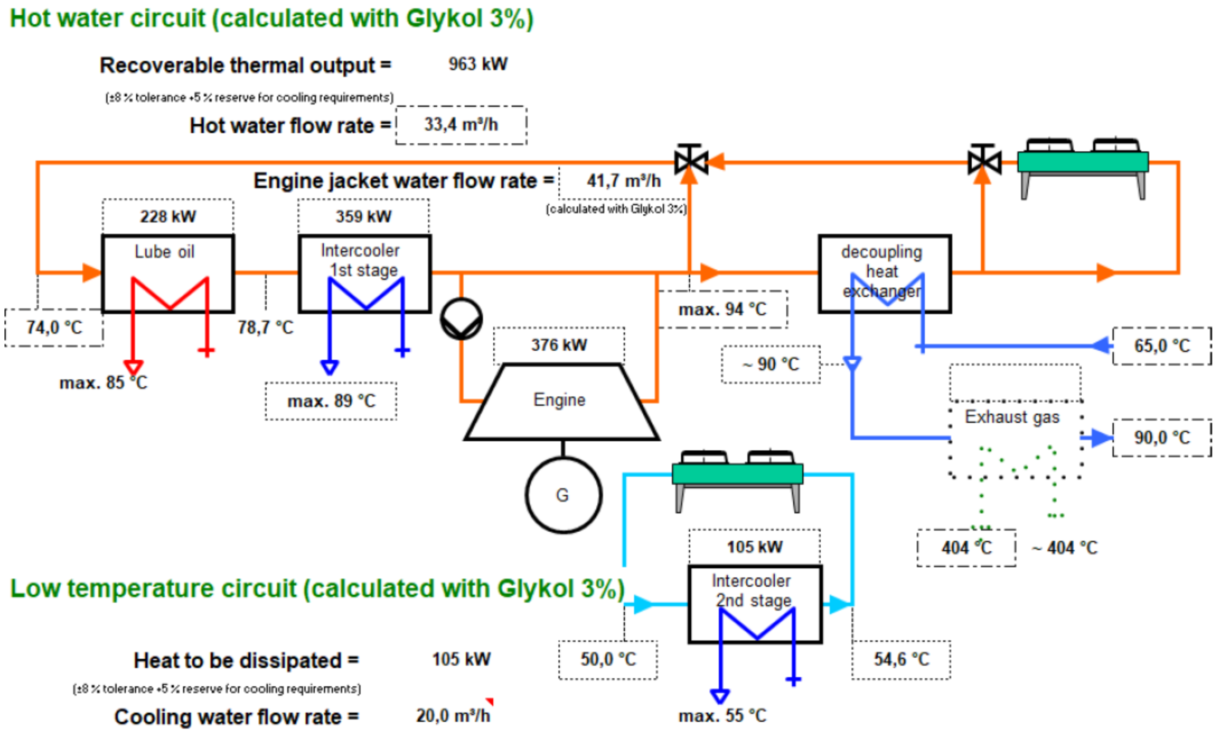
9.5.1 Power Generation

- Jenbacher Gas Engine Generating Set; JMC 420 GS-N.L 415V, 50Hz.
- Capacity: 3 units
  - 3 x 1.562 $MW_{(e)}$ = 4.686 $MW_{(e)}$.
  - 3 x 0.963 MW($_{th)}$ = 2.889 $MW_{(th)}$.
- Complete with:
  - Gas engines, 3 x 33.3% configuration.
  - Alternator – 415V.
  - Transformers – 415V.
  - Main fuel gas train, 120-200 mbarg, incl. shut off valve, pressure regulator, pressure safety valve, leakage detection system, pre-assembly of as pipe between gas train and engine.
  - Generator control system, incl. Module Interface Panel (MIP), module control Panel (MCP), colour graphics display, multi measurement device, as well as remote communication and operation tools.
  - Generator switchgear, incl. 415V circuit breakers, grid monitoring device, synchronizing and protection devices.
  - Engine cooling system, incl. lube oil cooler, heat exchangers, electric water heating and circuit pumps.
  - Engine enclosures, acoustic and ancillary equipment.
  - Ventilation system and noise attenuation.
  - Engine exhaust system, fire & gas detection system.
  - Factory Acceptance Testing (FATs) and commissioning.

9.5.2 Heat Recovery (Cogeneration Units)

In order to recover thermal energy during the power generation process, heat exchangers are installed in a vendor standard configuration for utilisation of the engine waste heat from the engine jacket, intercooler, and lube oil circuits, in the form of useable thermal output as hot water, which is available for use for process plant requirements.

Figure 9.3. Typical Containerised Gas Fired Engine & Cogeneration (Heat-Recovery) Circuit



9.6 Fuel

Based on the proposed development scenario outlined in this study, two fuel sources will be required on site at the KLPP, being:

- Diesel fuel for mobile equipment and remote pump sets, and
- Fuel gas for firing of the power station and steam boiler.

9.6.1 Diesel

Diesel fuel will be provided by a fuel transport contractor from Alice Springs, direct to site by road, and unloaded into on-site fuel storage tanks.

Diesel fuel will be provided for use in light vehicles and mobile equipment such as utes, trucks, cranes, forklift and other remote area equipment i.e. diesel pump sets at the brine recovery locations and the bore water field.

9.6.2 Gas

Gas fuel will be provided by a fuel transport contractor from Alice Springs or potentially Darwin, direct to the project site by road, and unloaded into site fuel storage tanks.

Gas bullets or tankers will be utilised to transport LPG/CNG to site and utilised primarily for the gas fired power generation units and the steam boiler.

9.7 Water

The water requirement for steady state, normal operations (i.e. after construction, and ignoring major maintenance or harvesting campaigns at the KLPP), is estimated to be 564 kL/day.

In order to meet project requirements, a Brackish Water Reverse Osmosis (BWRO) plant shall provide sufficient water to produce 579 kL/day permeate, for potable water uses, as well as, process plant requirements. The BWRO plant will be sized for a capacity of 0.6 ML/day. Whilst the actual bore water location has not been decided, the currently assumed location of the water bore location is to the south of Lake Miningere, which was previously used as a bore water supply for the exploration camp site in the area.

The bore water is of brackish salinity, with 2-5 g/L total dissolved solids (TDS). The BWRO plant will be designed for a single pass, two stage configuration, with 75% water recovery, and produce potable water <50 mg/L TDS. Subsequent chlorination and pH adjustment will be applied for the drinking water component of the produced water. As the salinity of this produced water shall be relatively low at 50 mg/L TDS, a demineralisation plant for boiler feed water or other steam generation, will not be required.

The BWRO concentrate shall be of approx. 10-20 g/L TDS and may be discharged to an onsite bitterns pond, with a number of other options, given the relatively small quantities of brine involved.

A higher water recovery RO water treatment plant may be considered, if justified by economics or required by regulatory requirements and approvals. However, at this stage a lower cost simpler operation is favoured for the purposes of this study.

The basis of design assumptions to derive the water balance are summarised below:

- Bore water is available nearby at the designated location, and of suitable quality i.e. less than 5 g/L TDS, and sustainable at this rate of extraction.
- Potable water for amenities and building services is based on an average daily steady state, normal operations consumption of 0.5 kL/person/day, for a maximum camp site of 30 persons (FTE).
- A peak surge demand load factor of 1.5 is applied to the daily average of 0.5 kL/person/day for drinking water made available to building services and safety showers and a further engineering factor of 1.2 is applied to size the final capacity of the BWRO WTP.

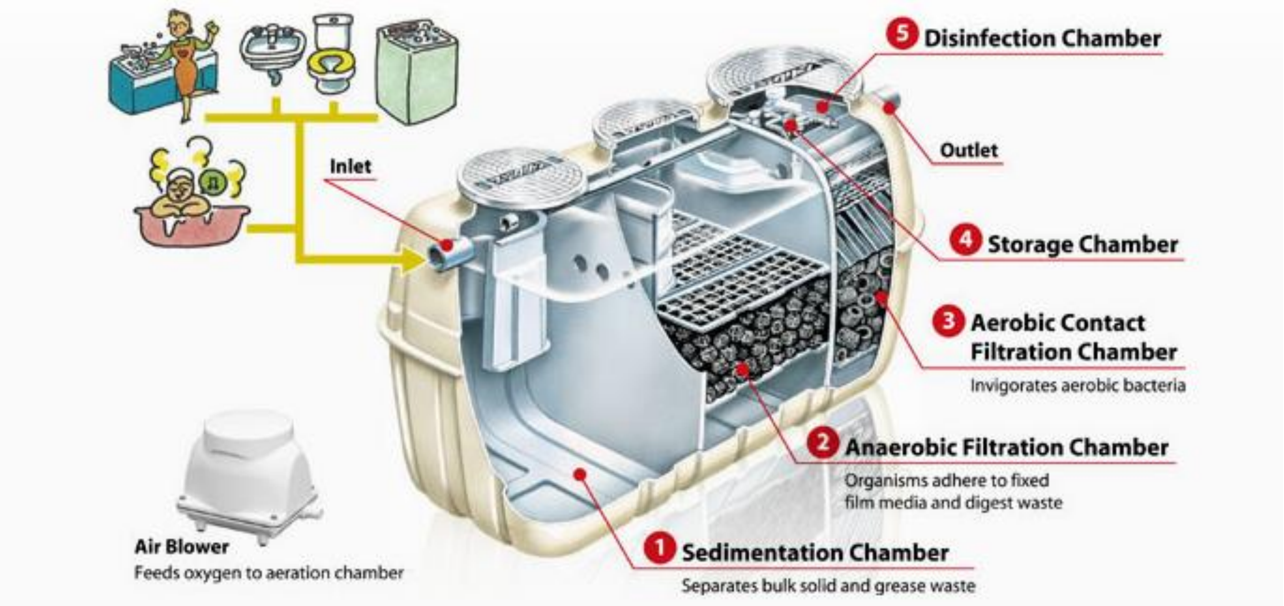
9.8 Wastewater Treatment and Reticulation

The proposed wastewater treatment plant (WWTP) for the KLPP involves a BioMAX type unit (aerobic / anaerobic digester) for the treatment of municipal wastewater from the accommodation camp and the processing plant amenities. Secondary treated effluent will be available for irrigation use on lawned areas or similar reuse applications at the project site.

The BioMAX type unit will be located underground in a typical configuration provided by the vendor, and have a capacity of 30 FTE, based on 250L/person/day, or 7,500 L/day in total.

The typical process stages for the type of proposed bioreactor wastewater treatment plant include intake of the influent, which undergoes treatment in a series of chambers, to perform a sequential series of functions, including, 1) sedimentation, 2) anaerobic filtration, 3) aerobic contact filtration, 4) storage, and finally 5) disinfection, before the treated water (effluent) is discharged. An example of a typical WWTP for this type of application, is outlined below in *Figure 9.4*.

Figure 9.4. Typical Bioreactor WWTP



10. Marketing Studies

10.1 Product Specification

The SOP market consists of three broad grades, standard, granular and soluble grades. The soluble grade, also referred to as fertigation grade, generally demands a significant price premium due to more desirable product specifications. This is directly related to the higher potassium content, lower chloride and a lower insoluble fraction, making it more suitable for fertilisation during irrigation, known as fertigation. Although the production of a range of potash products including SOP, SOPM and MOP from the KLPP is possible (confirmed through test work), the KLPP-PFS production scenario is based on the production of soluble-grade SOP product.

As outlined in *Chapter 6*, *Metallurgical Test Work Program*, the test work performed to date, confirms the potential of the aMES™ based processing route to produce a high-purity soluble SOP product from the KLPP.

The soluble grade SOP product specifications targeted by the KLPP are outlined in the below table (*Table 10.1*).

Table 10.1. Soluble SOP Product Specification – Targeted by KLPP

SOP PRODUCT SPECIFICATIONS Component	Chemical Formula	Indicative Weight (w/w%)
Potassium (measured as)	K	43% min
Potassium (calculated as)	K_2O	52% min
Sulphate (measured as)	SO_4	53% min
Sulphate (calculated as)	S	18% min
Chloride	Cl	1% max
Insolubles	-	0.1% max

10.2 General Marketing Strategy

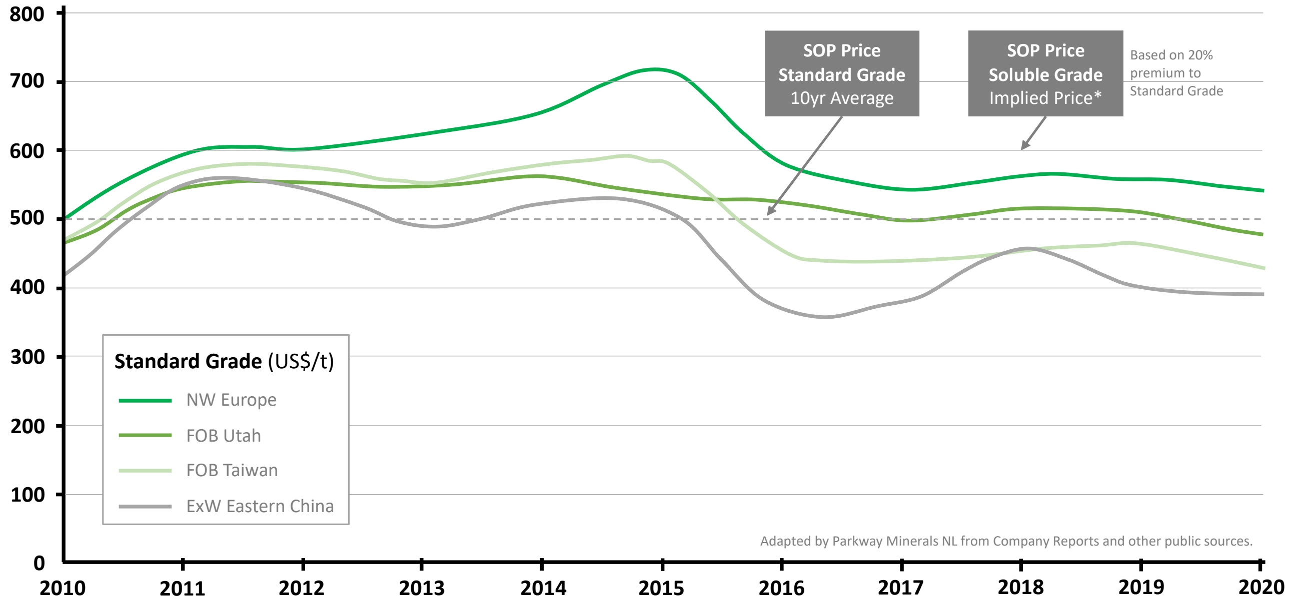
General Market Structure & Pricing

SOP is a premium form of potash fertiliser, particularly compared to the much more common muriate of potash (MOP). Its demand is driven by both organic market growth in high-value horticultural market segments, as well as, displacement of MOP, in more chloride sensitive crops. Approximately half of global

SOP production is produced by primary sources, mostly from brines in Chile, China and the USA, and from underground mines in Germany. Their production costs are typically at the bottom half of the cost curve. In contrast, the other half of SOP production is derived from the reaction of MOP with sulphuric acid, through the Mannheim process, which is more environmentally challenging due to waste acid disposal requirements. The costs for this type of production is concentrated in the top half of the cost curve. Given the market structure of global SOP production capacity, increased primary SOP production capacity, is expected to meet growing SOP demand, and progressively displace the more costly Mannheim production. Historically the latter has provided a floor for the SOP price, given the significant input costs.

As a specialty fertiliser, there is no traded or benchmark price for SOP as it is typically sold through bilateral contractual arrangements. However, given the structure of the market (particularly the steep cost curve for approximately half of global production capacity), the historical prices for SOP have been relatively stable compared to many other traded commodities. During the last decade, standard grade SOP prices have averaged approximately US$500/t, with NW Europe prices trading at a US$50 – 150/t premium to Asian prices (refer *Figure 10.1*, below), although the latter is often quoted as an ex-works price.

Figure 10.1. Standard SOP Prices in Key Markets (2010-2020)



Historical Market Studies

In the lead up to the preparation of the 2014 KLPP-Scoping Study, Verdant Minerals, with the assistance of several industry consultants, performed a number of market studies to better understand the market dynamics for SOP and SOPM, both domestically and as a potential export commodity into global markets.

Following the completion of their KLPP-Scoping Study, on 9 December 2015, Verdant Minerals announced[18] it had entered into an MOU with a major Japanese trading house, regarding offtake of SOP from the KLPP.

---

[18] Rum Jungle Resources, ASX Release, 9 December 2015.

Whilst the market dynamics for domestic SOP production have changed considerably during the last few years since these studies and commercial arrangements were finalised, they highlight the potential market opportunities for SOP production from the KLPP.

Potential Markets

The KLPP is located approximately 15km south of the Lasseter Highway (State Route 4), at which point the SOP production will need to be transported a further 90km east on the Lasseter Highway, to reach Erldunda, where the Lasseter Highway intersects the North-South traversing Stuart Highway (National Route 87). At this point, the SOP product has two primary options of being transported, north to the Port of Darwin, or south to Adelaide as a gateway to either export markets, or for distribution into regional horticultural markets of Eastern Australia. This includes the Riverina, one of Australia's most productive and agriculturally diverse regions. Due to its relatively reliable supply of water underpinning intensive irrigation, and therefore consumption of high value fertilisers, such as SOP. Although the KLPP is located in close proximity to the Adelaide-Darwin railway line (34km east of Erldunda), the relatively small scale of the KLPP is not expected to justify the logistics required to be able to handle and transport SOP product to either Adelaide or Darwin, by rail.

Domestic Markets

Although several SOP projects are currently under construction in Australia, with further SOP projects at earlier stages of evaluation, these projects are understood to be exclusively located in Western Australia, far from major horticultural markets of Eastern Australia. The KLPP therefore provides significant freight advantages in delivering SOP product into these Eastern Australian markets, including into the major horticultural regions, such as the Riverina. Standard grade SOP in these key markets is understood to be sold into major horticultural operations at approximately $1,000/t with soluble grade products attracting a premium above this price.

KLPP JV partner, Verdant Minerals, is also exploring the potential to establish an integrated compound fertiliser business in the Northern Territory, which would require a reliable source of SOP. Procuring SOP from the KLPP would likely provide a number of advantages, including reduced transport costs, compared to other sources of domestic production.

Given the proposed initial scale of SOP production from the KLPP (40,000tpa), and the scale of domestic markets, the KLPP proponents believe the KLPP is well placed to meet domestic supply, particularly in Eastern Australia, and will therefore be focused on selling SOP production, into Australian domestic horticultural markets.

Export Markets

Due to the initial scale of the KLPP, the export of SOP production from the KLPP is not anticipated, unless a potential, subsequently expanded project was sanctioned. At that point, consideration of export options would be warranted. The likely export routes for SOP production from KLPP involve road transport to either Adelaide, in South Australia (1,400km), or alternatively transported north to Darwin, in the Northern Territory (1,760km). Alternatively, CU-River Mining, a South Australia based company is understood to be proposing the construction of a bulk commodity export terminal in Port Augusta, South Australia, which would reduce the distance from the KLPP to an export port, to approximately 1,118km. As this represents a reduction of almost 300km compared to Adelaide, it could potentially provide significant future savings, due to reduced transport costs.

Pricing Expectations – SOP Soluble Grade

Given the unique SOP production method proposed for the KLPP, based on the aMES™ based processing route (as outlined in *Chapter 6 - Metallurgical Test Work Program*), the high-purity soluble SOP product will likely attract a significant premium over more common, but lower grade SOP products. Lower grade SOP products typically suffer from higher levels of impurities, including calcium and insolubles, which are problematic in fertigation related applications and equipment.

A leading industry consulting group, CRU, has been cited as estimating that soluble grade SOP trades at an average price premium of 20% higher than that of standard grade SOP (refer *Figure 10.1*).

On this basis, the realisable price for Soluble Grade SOP produced from the KLPP, assumed for the purposes of the KLPP-PFS, is A$857/t.

Key Assumptions in Cost Estimate:

- US$500 Standard Grade SOP price.
- 20% Effective Premium (for Soluble Grade over Standard Grade SOP).
- US$600 Soluble Grade SOP price.
- A$857.14 Soluble Grade SOP price (based on 0.70 USD:AUD).

11. Economic Evaluation

11.1 Capital Cost Estimate

The capital cost estimate for the KLPP-PFS report has been prepared to a Class 4 Level[19], which involves a typical estimate range of -20% to +30% and is considered appropriate for a study at this stage of evaluation.

The capital cost estimate has been developed by adopting a combination of estimating techniques including solicitation of budgetary proposals from vendors, benchmarking and commonly utilised factor-based approaches, as well as KLPP-JV partner input. The capital cost estimate (CAPEX) consists of 4 key components, the upstream, downstream, NPI and indirects, which collectively represent installed costs, as outlined, below.

Ponds & Lakes ("Upstream") – Described in *Chapters 4*, *5* & *7*.

The upstream component of the KLPP includes construction of all the evaporation and crystallisation ponds, pump stations as well as development of the brine supply, which at project start-up, consists of a single trench through Lake Miningere (as outlined in *Figure 1.1*).

CAPEX sub-total: $6,080,130.

As outlined in *Section 5.3*, throughout the project life, based on the production schedule (mine plan), additional lakes will be sequentially developed to ensure adequate supply of potassium enriched mixed salts, for the SOP process plant. The development of these additional lakes constitutes sustaining CAPEX, as the costs will not be incurred upfront, during the initial project development phase.

SOP Process Plant ("Downstream") – Described in *Chapter 8*.

The downstream component of the KLPP includes the aMES™ based SOP process plant and associated leach circuit, brine processing, crystallisation, centrifuging, drying, packaging, associated utilities including boiler and chiller packages, spares and first fills.

CAPEX sub-total: $46,030,518.

Non-Process Infrastructure ("NPI") – Described in *Chapter 9*.

The NPI component of the KLPP includes site development, roads, buildings and workshops, power generation, water supply, site accommodation, helipad, and associated infrastructure.

CAPEX sub-total: $14,577,115.

---

[19] As defined by AACE Class 4 project cost estimate methodology.

Indirect Costs ("Indirects") – Described in *Chapter 14*.

The indirects component of the KLPP consists of costs primarily associated with owners' costs (5% of direct costs) and project management (5% of direct costs), including EPCM/PMC services, based on the anticipated project delivery model, as described in *Section 14.1*. The indirects also include a contingency equivalent to 10% of direct costs, amounting to $6.7 million.

CAPEX sub-total: $13,337,553.

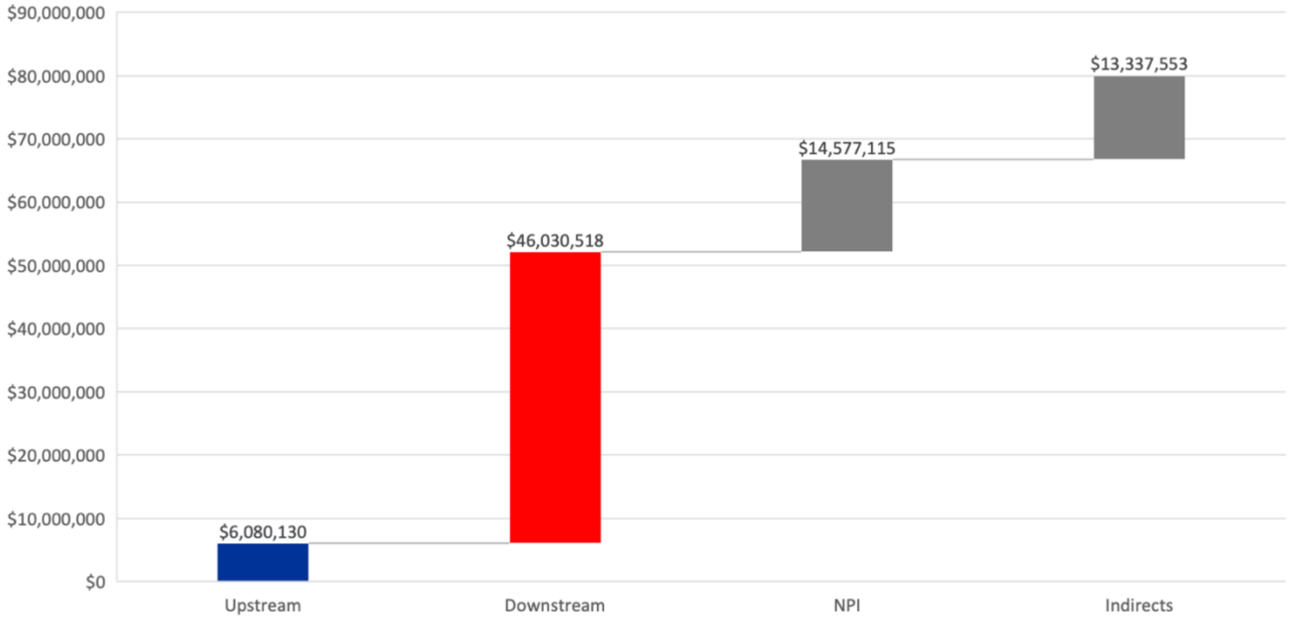
Capital Cost Estimate ("CAPEX") – Total

The total upfront capex for the KLPP, includes the upstream, downstream, NPI and indirects, which collectively represent the installed costs is outlined in *Figure 11.1*.

CAPEX total: $80,025,316 (inclusive of indirects, including $6.7 million in contingency)

Sustaining CAPEX: $6,082,150 (years 2 – 20)

Figure 11.1. KLPP CAPEX Breakdown



Financial Support from Government Agencies

Given the KLPP is located in remote Central Australia, development of the project would provide significant social and economic benefits to both local communities and the Australian economy more broadly, the KLPP-JV partners are of the view the KLPP represents an attractive candidate project for potentially securing financial support from a range of government agencies. Potential sources include the Northern Australia Infrastructure Facility (NAIF) and the Australian Renewable Energy Agency (ARENA), to assist in the funding of critical infrastructure, as well as, adopting renewable sources of energy, respectively.

11.2 Operating Cost Estimate

The operating cost estimate for the KLPP-PFS has been developed by utilising similar estimating methodology as the capital cost estimate, as outlined in *Section 11.1*.

The operating cost estimate (OPEX) consists of 3 key components, the O&M, fuel costs and transport, which collectively represent operating costs, as outlined, below.

Operations & Maintenance ("O&M") – Described in *Chapters 7*, *8* & *9*.

The O&M component of the KLPP includes labour, contractors (harvesting and essential services), leasing of mobile equipment, maintenance and consumables.

OPEX sub-total: $7,014,906/yr $175.37/t SOP

Fuel Costs ("Energy") – Described in *Chapter 9*.

The Energy component of the KLPP is made up of compressed natural gas used for power generation and steam generation, as well as diesel for the mobile equipment fleet, including vehicles.

OPEX sub-total: $4,704,748/yr $117.62/t SOP

Transport ("Transport") – Described in *Chapter 10*.

The Transport component of the KLPP consists of bulk transport by road into key domestic markets in Southern and Eastern Australia, with average assumed distance of 1,400km (distance to Adelaide), with other options, including potential export, described in *Section 10.2*.

OPEX sub-total: $3,920,000/yr $98/t SOP

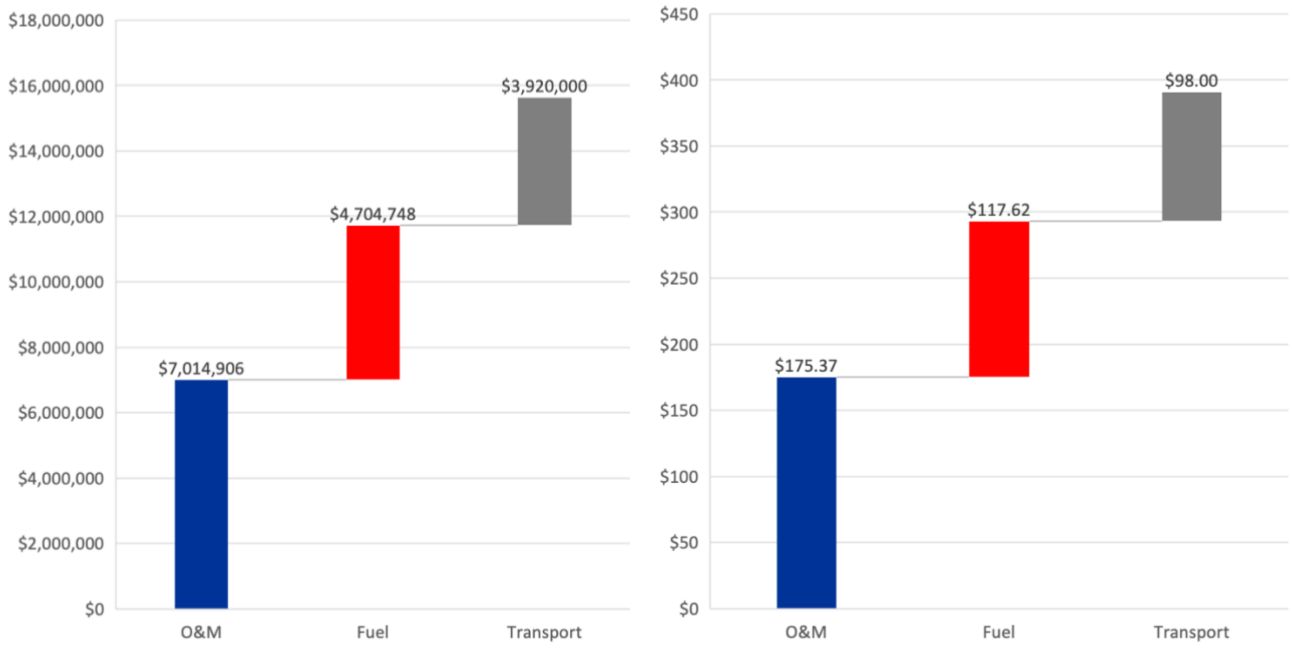
Operating Cost Estimate ("OPEX") – Described throughout report, including as described in *Section 11.3*.

The total OPEX for the KLPP, including O&M, energy and transport is:

OPEX sub-total: $15,639,654/yr $391/t SOP

A breakdown of the OPEX for the KLPP on an annual ($/year) and product ($/t SOP) basis, is outlined in *Figure 11.2*.

Figure 11.2. KLPP OPEX Breakdown (Annual) & KLPP OPEX Breakdown ($/t SOP)



11.3 Financial Analysis

In order to evaluate the financial feasibility of the KLPP, the CAPEX and OPEX items outlined above in *Sections 11.1* and *11.2*, respectively, together with key inputs outlined below, have been used as the basis of developing a comprehensive project financial model.

Key Inputs	Amount	Description
SOP Spot Price	$857/tonne	Refer to *Chapter 10*.
Exchange Rate	0.70	AUD:USD assumed for LOM.
Project Life	20 years	Project life based on 20 years of SOP production Refer to *Chapter 5*.
Inflation Index	2% pa	Based on 10-year average rate of inflation.
Depreciation	10% pa	Straight line over 10 years.
Corporate Tax Rate	25%	As total revenues are under $50 million pa.
Discount Rate	8% pa	Rate of discounting future cash flows.
Initial Capital	$80,025,316	Inclusive of $6.7 million contingency. Refer to *Section 11.1*.
Working Capital	$1,804,575	During construction and ramp-up.
Sustaining Capital	$6,082,150	Refer to *Section 11.1*.

Residual Capital	$8,000,000	At end of LOM, plan to extend production given available resource.
Royalties	$29,590,000	Indicative LOM estimate, including N.T. and Native Title related.

Outputs	**Unit**	**Description**
Annual Revenue	$34,285,714	From sale of SOP.
OPEX Annual	$15,639,654	Inclusive of annual transport costs of $3,920,000.
OPEX Unit	$391/t SOP	Inclusive of transport costs of $98/t SOP.
EBITDA	$18,646,060	Annual earnings, before interest, tax, depreciation & amortisation.
EBITDA Margin	54.4%	-
Payback Period	5.5 years	From production start-up, based on post-tax cash flows.
NPV_8 (pre-tax)	$158.6 million	-
IRR (pre-tax)	50.7%	-
NPV_8 (post-tax)	$80.15 million	-
IRR (post-tax)	20.4%	-

Sensitivity Analysis

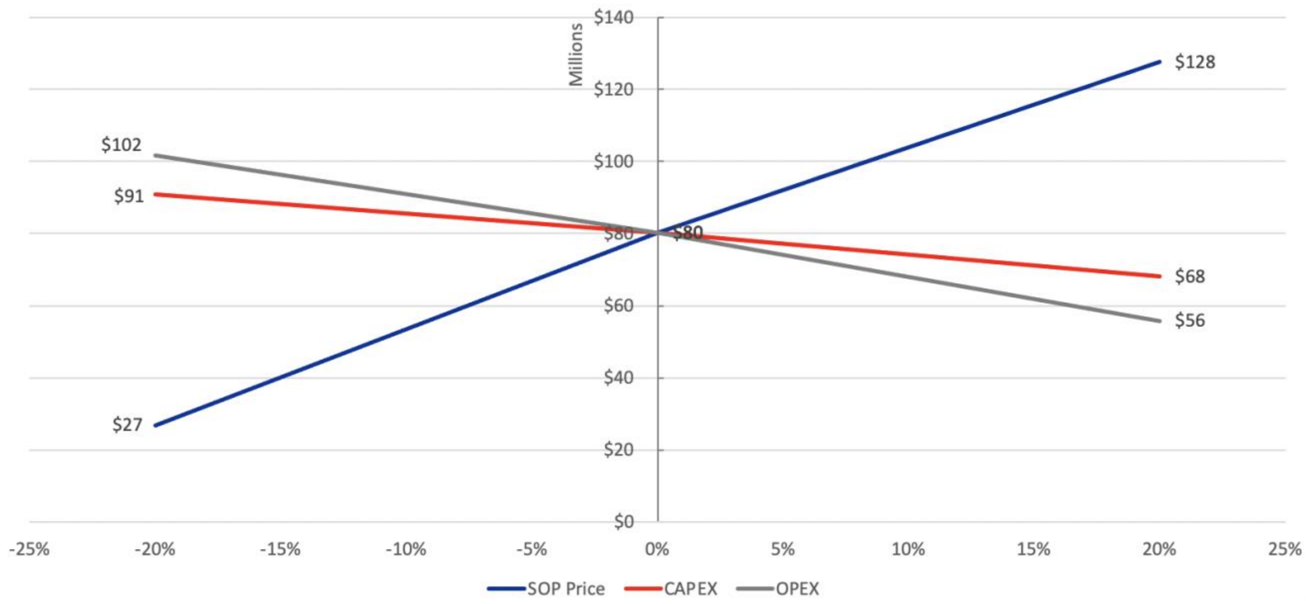
In order to explore the sensitivity of the KLPP-PFS project financial model, to a number of key variables, a sensitivity analysis (plus or minus 20%) was performed on the KLPP-PFS development scenario outlined above (based on post-tax NPV basis), against the following key variables:

- SOP price.
- Initial CAPEX.
- OPEX.

As outlined in *Figure 11.3*, the sensitivity analysis demonstrates the KLPP-PFS development scenario is most leveraged to the SOP spot price. A 20% increase in the SOP price, delivers a 59.3% increase in the NPV to $127,650,000.

In contrast, a 20% increase in either CAPEX or OPEX has a less significant impact, with the NPV of the KLPP being reduced by 14.9% and 30.3%, respectively.

Figure 11.3. KLPP Sensitivity Analysis (Post-Tax NPV)



Comparison to Prior KLPP Scoping Study

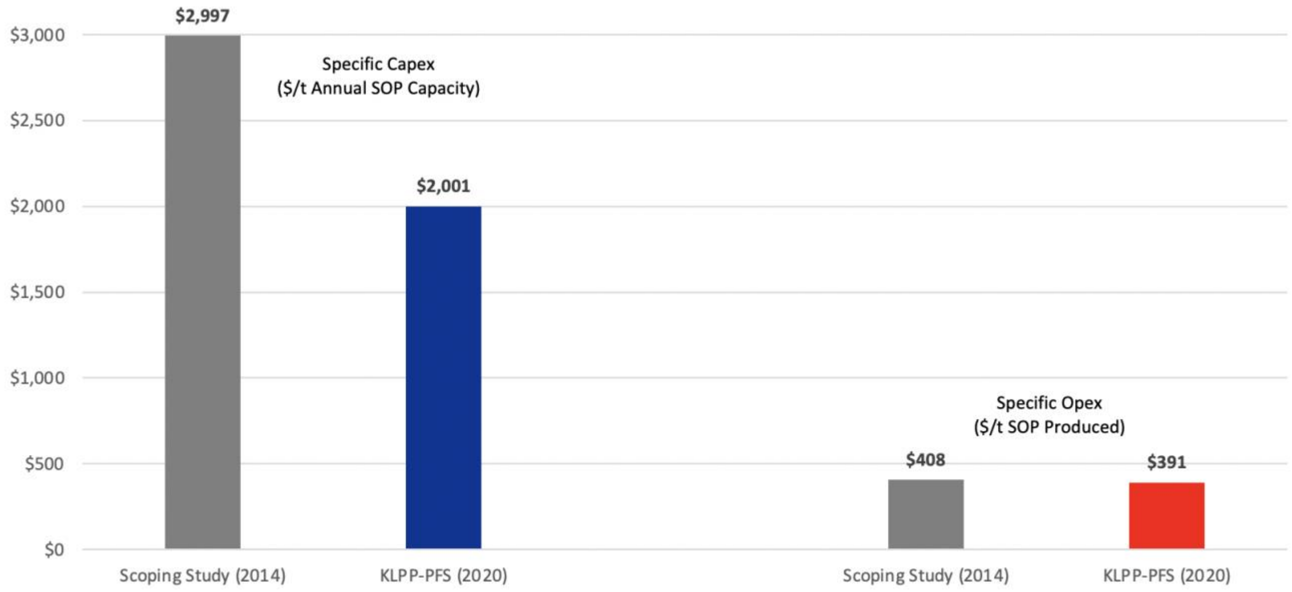
In December 2014, KLPP-JV partner Verdant Minerals (formerly Rum Jungle Resources), delivered a scoping study for the KLPP[20]. The 2014 scoping study outlined a 125,000tpa SOP production scenario ("Scenario 1"), with estimated total CAPEX of $340 million (in 2014 dollars). The CAPEX and OPEX numbers for this scenario have been indexed to 2020 dollars, and benchmarked against the KLPP-PFS study, in order to demonstrate the relative cost estimates, as outlined in *Figure 11.4*.

It should be noted there are a number of significant differences between the 2014 scoping study scenario and the KLPP-PFS development concept. One of the major differences is that the 2014 scenario contemplated a much larger development, consisting of 125,000tpa of SOP production, compared to the aMES™ based KLPP-PFS scenario of a more modest 40,000tpa of SOP production. The smaller development will require similar non-process infrastructure, such as roads which creates a proportionately higher burden for the smaller development, compared to the 2014 scoping study scenario. Notwithstanding the diseconomies of scale, the KLPP-PFS development concept compares favourably, with a lower OPEX profile, and a significantly lower CAPEX profile. A larger scale development of the KLPP-PFS development concept could reasonably be expected to achieve further improvements, however these are yet to be quantified and will be explored further during later stages of project evaluation.

---

[20] Rum Jungle Resources, Karinga Lakes Potash Scoping Study, ASX Release 22 December 2014.

Figure 11.4. KLPP Cost Estimate Comparison (CAPEX & OPEX, 2014 Scoping Study compared to 2020 PFS)



11.4 Next Steps & Funding

The KLPP-JV will perform a range of internal reviews in coming months to determine suitable options for the KLPP, before potentially advancing to a more detailed stage of evaluation, as outlined in *Chapters 15* & *16*. The satisfactory completion of these detailed evaluations, which would require a DFS (or similarly detailed study), as well as SOP offtake agreements, appropriate permitting as well as other requirements and consents (as outlined in *Chapters 12* & *13*), before a final investment decision (FID) is capable of being made by the KLPP-JV. Subject to these requirements, in the event (if) the KLPP-JV decides to make a FID to develop the KLPP, the KLPP-JV partners have sufficient capital markets experience to support the funding of the KLPP. In the last 12 months, Parkway Minerals has raised approximately $5 million (in multiple highly oversubscribed capital raisings) with the market capitalisation of the company growing to approximately $20 million. In the event FID was contemplated for the KLPP, Parkway Minerals would seek to farm-out its interest in the project, to Verdant minerals and/or third-party investors, therefore limiting any material funding obligation on Parkway Minerals. With regards to the other KLPP-JV partner, in April 2019, shares in Verdant Minerals not already owned by WH Soul Pattinson (ASX:SOL, a major Australian investment company) were acquired by CD Capital Natural Resources Fund III LP. CD Capital Asset Management Ltd (CD Capital) is the investment manager of CD Capital Natural Resources Fund III LP. CD Capital is a global natural resources and mining fund that has a proven track record of successfully identifying and investing in world-class mining resource assets and the growth equity stage where there are very few other institutional players. Based on the above, given the quality of the KLPP, and that any initial project development would likely be a relatively small-scale (<$100 million) development as envisaged by this KLPP-PFS, the KLPP-JV believes there is a reasonable basis to expect the KLPP capital cost can be funded following the continued achievement of key development milestones.

12. Land Tenure

12.1 Overview

The KLPP covers an area of approximately 1,100km^2, in the Northern Territory. As outlined in *Section 2.1 – History*, the KLPP has been the subject of evaporite mineral exploration, including potash mineral exploration since at least as early as the late 1980's. The current project operator, Verdant Minerals, has performed extensive resource exploration and appraisal activities at the KLPP since 2010. This resource appraisal activity occurred on the original tenements which constituted the project, consisting of 7 exploration licences (EL's), which are referenced, below in *Table 12.1*, with the Former EL Number of each tenement. In late 2019, Verdant Minerals embarked on a tenement consolidation process, described in further detail, below.

12.2 Tenement Consolidation Process

In order to reduce administrative costs associated with managing seven EL's and to simplify dealings with stakeholders, in September 2019 Verdant Minerals commenced a tenement consolidation process, with the objective of reducing the number of EL's from seven to three, to better match pastoral lease boundaries. In order to provide security of tenure during the tenement consolidation process, Verdant Minerals applied for exploration licences in retention (ELR's) for the areas covered by each of the EL's (refer *Table 12.1*), whilst new exploration licence applications (ELA) were also submitted in September 2019.

Table 12.1. KLPP Exploration Licence Retention Summary

Former EL Number	ELRA Number	Area (km^2)	Blocks	Holder
24987	**32208**	220.37	71	Territory Potash Pty Ltd
25080	**32206**	633.58	204	Territory Potash Pty Ltd
28205	**32207**	59.04	19	Territory Potash Pty Ltd
28272	**32211**	59.03	19	Territory Potash Pty Ltd
28872	**32212**	34.15	11	Territory Potash Pty Ltd
30381	**32209**	12.43	4	Territory Potash Pty Ltd
30382	**32210**	22.20	8	Territory Potash Pty Ltd

The three new ELA's (refer *Table 12.2*) cover 1,109km^2, a similar area (~1,040km^2) to the original EL/ELRA's and encompasses the entirety of mineral resources (as outlined in *Chapter 4* & *5*) which constitute the KLPP.

Table 12.2. KLPP Exploration Licence Application Summary

ELA Number	Area (km²)	Blocks	Application Date	Holder
ELA 32249	509.84	165	02/09/2019	Territory Potash Pty Ltd
ELA 32250	537.05	173	02/09/2019	Territory Potash Pty Ltd
ELA 32251	62.06	20	02/09/2019	Territory Potash Pty Ltd

The KLPP is within an area subject to a native title claim under *the Native Title Act 1993* (Cth) ("Act"), *Mumu v Northern Territory*, filed 13 February 2020. The granting of the replacement ELA's has been delayed as the result of objections raised by the native title claimants to granting the ELA's without them having first been provided to right to negotiate an agreement regarding impacts to native title.

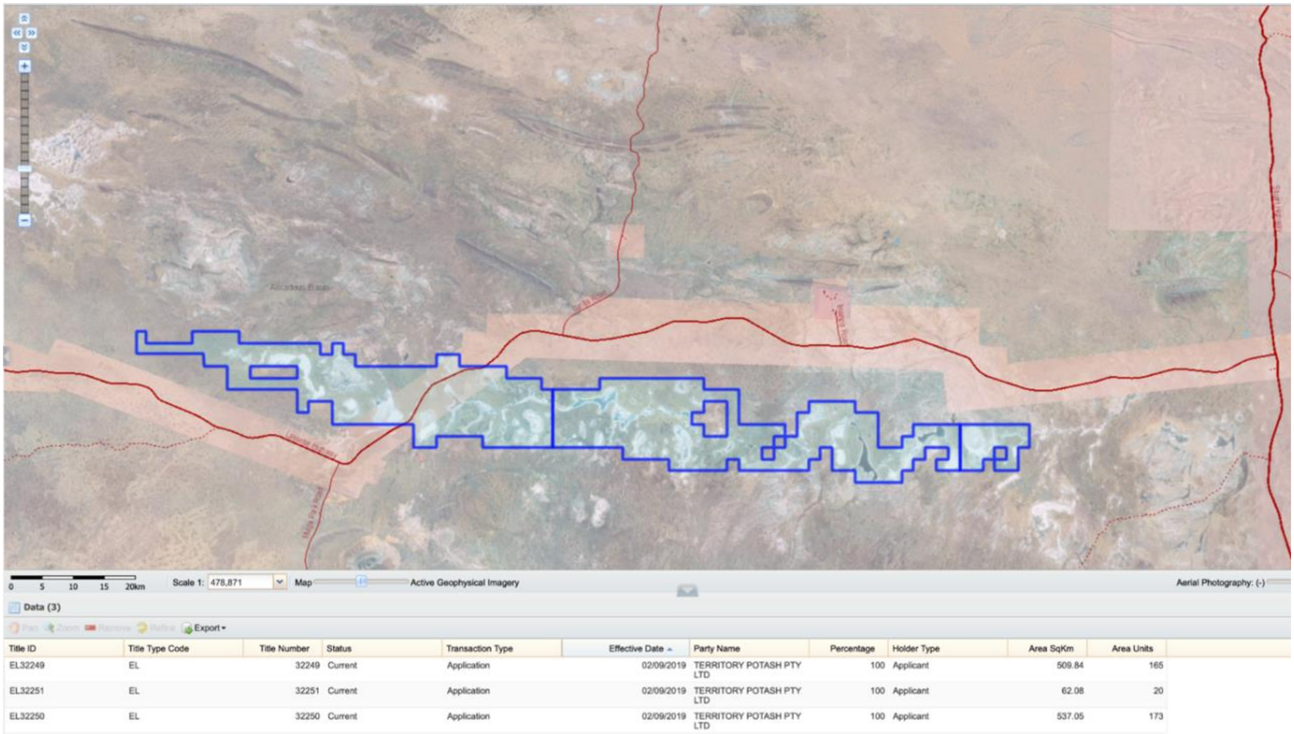
The Act recognises the rights and interests of Australia's Indigenous peoples in land and waters according to their traditional laws and customs. Where it has been judicially determined, native title grants claimants rights that can include, but are not limited to, the right to live and camp in an area, conduct ceremonies, hunt and fish, collect food, build shelters and visit places of cultural importance. Aboriginal people who hold, or have claimed, native title rights over land must be consulted about proposed activities on the land and formal agreement is for required for certain acts that will affect native title rights and interests. Those acts are referred to as 'future acts' and can include the grant of mining tenements.

As part of its consideration of the new ELA's, the Northern Territory asserts that the grant of the EL's attracts what is referred to in the Act as the expedited procedure. The result of applying the expedited procedure is that the native title claimants would not have the right to negotiate a formal agreement prior to the grant of an EL. That right would not accrue until a later date, when the KLPP seeks mineral leases to allow it to move from the exploration phase to the production phase. The native title claimants have challenged the Northern Territory's attempt to apply the expedited procedure. The effect of a successful challenge is that the claimants would have the right to negotiate an agreement regarding to impacts to native title at the EL phase, rather than at a later date. The right of the native title claimants to negotiate a formal agreement does not extend to the grant of ELR's (refer *Table 12.1*), applications for which have been lodged with the Northern Territory as an alternative to the ELA's.

12.3 Tenement Status in Relation to Mine Plan

As outlined in the KLPP - Mine Plan, in *Chapter 5 – Mineral Resource Estimates*, the initial phase of the KLPP is intended to commence with the development of the Miningere and Miningere West lakes, to the immediate east and west of the process plant, respectively. These two starter lakes, together with the Minskin and Skinny lakes to the north, which are anticipated to be the next lakes to be brought online, are all located within the central tenement, EL32250 (537.05km^2), as outlined in *Figure 12.1*. As the Mine Plan progresses through to subsequent years of the project, lakes situated further to the west, including several located within the western tenement, EL32249 (509.84km^2) are anticipated to be developed. It should be noted that whilst the eastern tenement, EL32251 (62.06km^2) also forms a part of the KLPP, none of the in-situ resources located within this EL form any part of the mineral resource which is reflected in the Mine Plan.

Figure 12.1. KLPP Exploration Licence Map Extract from STRIKE[21]



Title ID	Title Type Code	Title Number	Status	Transaction Type	Effective Date	Party Name	Percentage	Holder Type	Area SqKm	Area Units
EL32249	EL	32249	Current	Application	02/09/2019	TERRITORY POTASH PTY LTD	100	Applicant	509.84	165
EL32251	EL	32251	Current	Application	02/09/2019	TERRITORY POTASH PTY LTD	100	Applicant	62.08	20
EL32250	EL	32250	Current	Application	02/09/2019	TERRITORY POTASH PTY LTD	100	Applicant	537.05	173

Additional details regarding the permitting process for the KLPP, including the requirements for securing a Minerals Lease (ML), are outlined in *Chapter 13 – Environmental Studies, Social Impact & Permitting*.

---

[21] KLPP Tenement Map and Summary generated from STRIKE – Tenure and Geoscience Information system, of the Northern Territory, Department of Primary Industry and Resources, accessed at http://strike.nt.gov.au on 1 Oct 2020.

13. Environmental Studies, Social Impact and Permitting

13.1 Introduction

The aMES™ based development concept which forms the basis of this KLPP-PFS, seeks to not only improve the financial performance of the project, but also represents a significant opportunity to improve the sustainability profile of the KLPP, compared to conventional potash projects. In particular, the relatively small project footprint, recycled wastewater streams, elimination of reagents, all represents major improvements in the environmental sustainability of the KLPP and are expected to deliver positive impacts to key stakeholders.

As the KLPP advances through the various stages of appraisal and permitting, the project will need to satisfy a range of regulatory requirements, as summarised in this chapter.

13.2 Environmental Impact Assessment Requirements

The KLPP will not be subject to environmental impact assessment under the *Environmental Protection Act 2019* for the exploration activities proposed as part of the EL and ELR applications because those activities will not have a potentially significant impact on the environment.

As the KLPP moves from the exploration phase to production, however, the project will be referred to the Northern Territory Environmental Protection Agency (NTEPA) to determine what level of environmental impact assessment (EIA) will be necessary.

A referral to NTEPA is the first step in the formal EIA process. Based on the information in the referral, any identified information gaps, the potential significance of any environmental impacts and the likelihood of those impacts, NTEPA will determine the form of EIA that the project must undergo, generally ranging from an assessment based solely on the referral to an Environmental Impact Statement requiring significant additional information and public consultation. Based on the EIA, NTEPA recommends an Environmental Approval to the Minister for the Environment, which establishes the conditions and mitigation measures designed to minimise the KLPP's environmental impacts. The authority to grant an Environmental Approval rests with the Minister, and an Environmental Approval is necessary before mineral titles for production can be granted.

The *Environment Protection Act 2019* (EP Act) was enacted in September 2019 and commenced on 28 June 2020, providing a long-awaited transformation of the Northern Territory’s environmental impact assessment framework. The purpose of the EIA process is described in the EP Act itself, to ensure that:

- Actions do not have an unacceptable impact on the environment, now or in the future;
- All actions that may have a significant impact on the environment are assessed, planned and carried out taking into account:
  - The principles of ecologically sustainable development.
  - The environmental decision-making hierarchy.
  - The waste management hierarchy.

  - Ecosystem-based management.
  - The impacts of a changing climate.
- The potential for less environmentally damaging alternative approaches, methodologies or technologies for actions is considered.
- The community is provided with an opportunity to participate, and have its views considered, in decisions on proposed actions.
- The potential for actions to enhance or restore environmental quality through restoration or rehabilitation is identified and provided for to the extent practicable.

Since 2010, the KLPP operator has undertaken a number of studies and surveys in order to establish an environmental baseline, to better understand the local ecology, and to better identify and understand the potential impacts project development may have on the local environment. Once the KLPP-JV commences the EIA process, it is the intention of the KLPP-JV to use these studies and surveys as part of a more detailed evaluation of the project, and potentially as part of a definitive feasibility study (DFS) process.

13.3 Heritage & Exclusion Areas

In 2010 and 2011, prior to commencement of any onsite activities at the KLPP, the project operator secured two Authority Certificates from the Aboriginal Areas Protection Authority (AAPA) for the purposes of "Exploration of salt lakes for extraction of brine to produce potash (potassium) fertiliser, exploration will include digging holes, drilling holes and trenches to sample water".

An Authority Certificate will only be issued under the *Northern Territory Aboriginal Sacred Sites Act 1989* where the exploration activity can proceed without there being a substantive risk of damage to or interference with a sacred site on or near the land. The Authority Certificates set out where activity can occur and under what conditions.

The project operator has also previously performed AAPA Register searches as well as anthropological studies, to better understand any site related sensitivities which may relate to the KLPP. These studies did not identify any places or things protected under the *Heritage Act 2011* within the KLPP. These studies further confirm the proposed lakes within KLPP - Mine Plan, as described in *Chapter 5 – Mineral Resource Estimates*, do not fall within any identified sacred site or heritage exclusion zones.

As the KLPP progresses towards the requirement to negotiate a native title agreement or indigenous land use agreement (ILUA), further heritage surveys will be required to support these activities.

13.4 Licence & Permits

As outlined in *Chapter 12 – Land Tenure*, a tenement consolidation process is currently underway at the KLPP. Once the ELA's have been granted, the granting of a Mineral Lease will require either a Native Title Mining Agreement (NTMA) or an Indigenous Land Use Agreement (ILUA) before any activity under the Mineral lease can commence. An NTMA or ILUA are collaboratively developed with native title holders, to compensate for the impact of any development on native title rights and interests.

Mine Management Plan

The development of the KLPP will require a mining authorisation from the Northern Territory Government. To apply for a mining authorisation, the KLPP-JV will need to submit a mining management plan (MMP), providing key project details, including a description of the proposed nature of mining activities, as well as plans of proposed mine workings and infrastructure, details of environmental risks and management plans and a plan and costing of closure activities.

Access Agreements

As the KLPP is located on pastoral leases, appropriate access agreements will need to be secured with the relevant pastoral lease holders, to provide adequate access to the KLPP area.

Building Permits

As the KLPP is outside a declared building control area[22] of the Northern Territory, it is anticipated that a building permit would not be required. This requirement will be further evaluated during a future DFS planning program.

Fresh Water Abstraction Permit

As the KLPP is outside the water control district[23] in the Northern Territory, it is anticipated that a bore work permit would not be required. A Water Extraction Licence may be required depending on bore discharge rates. These requirements with be further evaluated during a future DFS planning program.

Other Permits

As the KLPP advances through the KLPP-PFS stage, to a more advanced stage of evaluation, a more comprehensive review of all regulatory requirements, including requisite licences and permits will be performed.

---

[22] Building Control Areas, https://nt.gov.au/property/building/build-in-a-controlled-area/building-control-areas/building-outside-of-building-control-areas

[23] Water Control District, http://www.ntlis.nt.gov.au/mpds/get_file?file_id=4072

14. Project Implementation

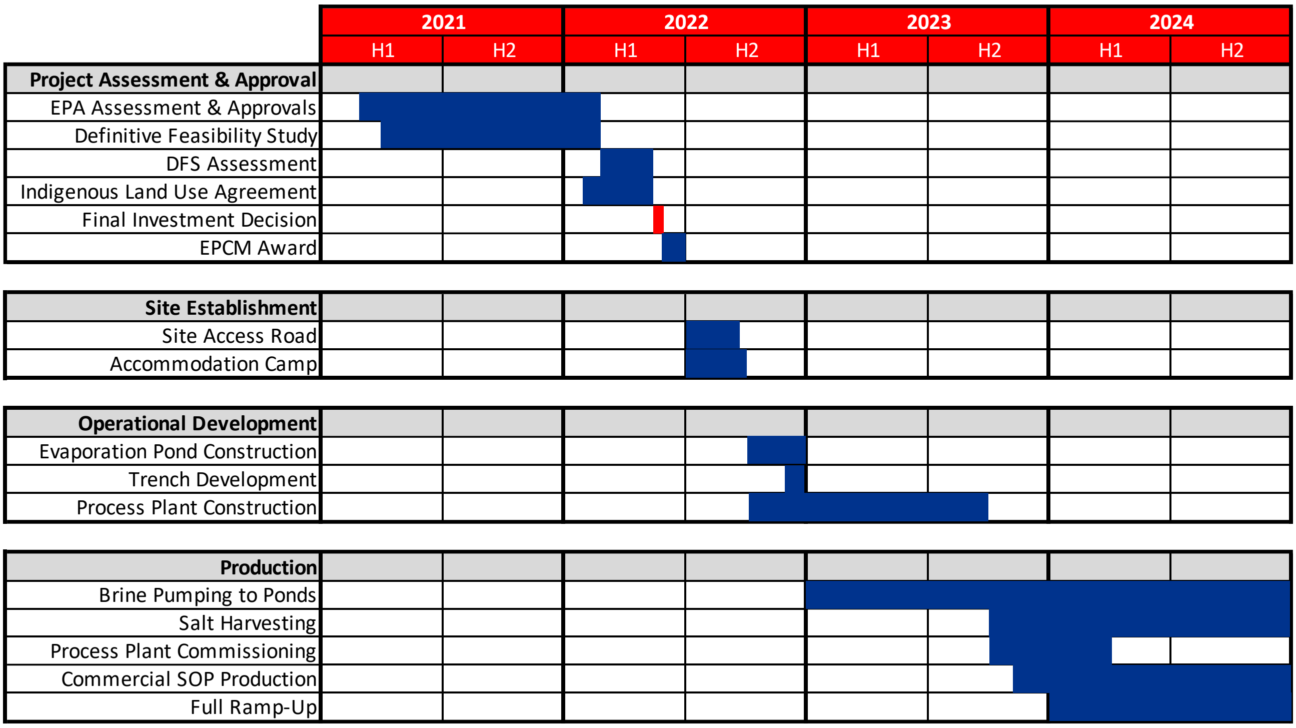
14.1 Project Delivery Model

The preferred project delivery model for the KLPP will be evaluated during a more detailed stage of project development, concept planning and evaluation. At present, the KLPP-JV partners contemplate establishing an owner's team during a more detailed stage of evaluation (potentially a definitive feasibility study, DFS), during which time detailed project execution plans will be developed. It is envisaged, the KLPP-JV will likely engage a suitable EPCM contractor to provide the owner's team, with project management support through a project management contract (PMC), or other suitable approach. An indicative outline of the sequencing of when an EPCM service provider may be engaged, is outlined in *Figure 14.1*.

14.2 Indicative Project Schedule

The KLPP-JV partners will consider the key findings of this study, including the proposed forward work (as outlined in *Chapter 16*), before determining the most suitable pathway for advancing the project. In the interim, an indicative project schedule (*Figure 14.1*) has been developed, to provide a high-level overview of a potential pathway to production. During the project assessment and approvals phase, a more detailed project schedule will be developed, based on more detailed regulatory and stakeholder engagement. It should be noted, that as of the date of this pre-feasibility study, the KLPP-JV partners, have not committed to advancing the project and/or completing a DFS.

Figure 14.1. Indicative Project Schedule



14.3 Manning Resourcing

The staffing plan has been used as the basis of design for the administration building, amenities and accommodation camp and sized to accommodate a maximum total of 30 FTE operational personnel. The estimated manning levels are expected to consist of a 14-person day shift and 6-person night shift during normal steady-state operations, with additional staff required on site during construction, major maintenance and harvest of the potassium enriched mixed salts. Additional details on manning are outlined in *Chapter 9*.

14.4 Mobile Equipment

An indicative breakdown of the mobile equipment fleet contemplated for the KLPP is outlined in *Table 9.3* (*Summary of Mobile Plant and Equipment*).

15. Risks

15.1 Cautionary Statements, Risk Factors and Disclaimer

Certain statements in this study include estimates or future events that are forward-looking statements. They include indications of, and guidance on, future earnings, cash flow, costs and financial performance. Such forward-looking statements are provided as a general guide only and should not be relied on as a guarantee of future performance. When used in this report, words such as, but are not limited to, “could”, “planned”, “estimated”, “expect”, “intend”, “may”, “potential”, “should”, “projected”, “scheduled”, “anticipates”, “believes", "predict", "foresee", "proposed", "aim", "target", "opportunity”, “nominal”, “conceptual” and similar expressions are forward-looking statements. Although the expectations reflected in these forward-looking statements are believed to be reasonable, such statements involve risks and uncertainties, and no assurance can be given that actual results will be consistent with these forward-looking statements. Forward-looking statements are provided as a general guide only and should not be relied on as a guarantee of future performance as they may be affected by a range of variables that could cause actual results to differ from estimated results and may cause actual performance and financial results in future periods to materially differ from any projections of future performance or results expressed or implied by such forward-looking statements. There can be no assurance that actual outcomes will not materially differ from these forward-looking statements.

The contents of this study are also subject to significant risks and uncertainties that include but are not limited those inherent in technology commercialisation, mine development and production, geological, mining, metallurgical and processing technical problems, the inability to obtain and maintain mine licenses, permits and other regulatory approvals required in connection with mining and processing operations, competition for among other things, capital, acquisitions of reserves, undeveloped lands and skilled personnel, incorrect assessments of the value of projects and acquisitions, changes in commodity prices and exchange rate, currency and interest rate fluctuations and other adverse economic conditions, the potential inability to market and sell products, various events which could disrupt operations and/or the transportation of mineral products, including labour stoppages and severe weather conditions, the demand for and availability of transportation services, environmental, native title, heritage, taxation and other legal problems, the potential inability to secure adequate financing and management's potential inability to anticipate and manage the foregoing factors and risks. There can be no assurance that forward-looking statements will prove to be correct. Where the KLPP-JV partners, directors, officers, employees and/or consultants express or imply an expectation or belief as to future events or results, such expectation or belief is expressed in good faith and on a reasonable basis. No representation or warranty, express or implied, is made that the matters stated in this study will in fact be achieved or prove to be correct.

15.2 Risks Identification

As outlined in *Section 15.1*, a range of risks exist in relation to the proposed development concept envisaged by this study, as well as, a range of currently unidentified or as yet undocumented risks which are likely to emerge for a project of this nature. Several key risks are outlined below, however these should not be taken to represent a complete or comprehensive list of risks, in relation to the KLPP and the envisaged plans outlined and/or envisaged in this study.

Resource Related Risks

- As the KLPP represents a concept which involves the development of a naturally occurring mineral resource, the presence, distribution, grade, recoverability, amongst other factors, represent important considerations and risks.
- These risks are addressed further throughout this report, in particular in *Chapters 4* & *5*, which relate to *Mineral Resource Estimate*, and *Production Plan*, respectively.
- Further details of potential resource related risks are outlined in the *Karinga Lakes Potash Project (KLPP) Sulphate of Potash Resource and Production Plan* (and corresponding Competent Persons Statement), *Appendix A*.

Tenure Risks

- Details relating to a Tenement Consolidation Process are outlined in *Section 12.2*.

Environmental, Social & Permitting Related Risks

- Details relating to Environmental, Social Impact and Permitting related risks are outlined in *Chapter 13*.

Project Development Risks

- Details regarding how the KLPP-JV partners are expected to address project development related risks are outlined in *Section 14.1*.

Technology Related Risks

- Details relating to aMES™ based metallurgical test work is described in *Chapter 6*, with details of future test work related studies outlined in *Section 16.3* (*Metallurgical Test Work*).

Project Operations

- Preliminary details relating to project operations have been envisaged in the design of upstream and downstream operations, including associated non-process infrastructure, as well as the mobile equipment fleet, accommodation and indicative manning levels.

Financial Risks

- Details relating to anticipated financial performance of the project are outlined in *Chapter 11*.

15.3 Risk Mitigation Strategies

In general, as the KLPP advances towards a more detailed stage of evaluation, which may include a definitive feasibility study (DFS), a range of risk identification, evaluation and mitigation strategies will be adopted to reduce the risk profile of the project.

Several planned work programs envisaged for improving overall project performance and reducing key project risks have been outlined in *Chapter 16* (*Forward Work*), with additional risk mitigation strategies likely to be identified and adopted before, during, or after more detailed stages of project evaluation.

16. Forward Work

16.1 Geotechnical Investigations

As referenced in *Section 3.8* (*Geotechnical Assessment*), Worley's Advisian Geoscience Group produced a geotechnical desktop report for the KLPP which provided the input data for design of the pond walls and general site construction aspects for civil and earthworks in the processing plant, amenities, facilities, accommodation camp and access roads. Preparation of the desktop report was preliminary in nature, as it relied on a range of assumptions, was not supported by detailed topographical or LiDAR, and was unable to be verified through a site visit, due to COVID-19 related travel restrictions. The desktop report was also limited in scope, as it does not address environmental or geo-environmental related issues including the presence of any contaminants or potential hazardous materials at the site.

During subsequent stages of project evaluation, the assumptions made, and the information provided in the desktop report, will need to be verified to ensure the observations and conclusions remain valid. In addition to a site visit, as outlined below, more detailed project evaluations will likely involve the performance of a LiDAR survey and relevant topographical investigations, to support the project development concepts.

16.2 LiDAR Survey and Topographical Investigations

In order to enable effective site related project planning, a high-resolution LiDAR survey is proposed, to provide detailed site information including 3D surface mapping, topography and other important information required to optimally plan and site infrastructure, including roads, ponds and processing plant. The KLPP partners have identified a number of potential contractors capable of performing a suitable drone-based LiDAR survey of the KLPP area, however, the project partners do not expect to finalise any survey parameters, until a more detailed stage of project evaluation.

16.3 Metallurgical Test Work

The potassium enriched mixed salts produced from the KLPP have undergone a range of metallurgical testwork, including through an aMES™ based processing route, as outlined in *Chapter 6*. This testwork has demonstrated a suitable processing route for the production of two intermediate potassium containing salts, Leonite and Sylvite, which are used to synthesise SOP. As the KLPP advances to a more advanced stage of evaluation, a more comprehensive metallurgical test program will be conducted, at a larger scale, to provide more detailed process data, to support further flowsheet optimisation. Additional opportunities for potential process improvements are outlined below.

16.4 Potential Process Improvements

This study has identified a number of potentially significant process improvement opportunities, which have the potential to improve the overall performance of the KLPP, significantly. These improvements include potential enhancements and optimisations in both upstream and downstream operations:

- Upstream Improvements – potential for evaporation and crystallisation pond optimisation, including the adoption of potential back-mixing stages, to further enhance the quality of potassium enriched mixed salts supplied to the processing plant. As upstream production costs are much lower than downstream processing costs, there is an opportunity to lower overall production costs by improving the potassium grade of the potassium enriched mixed salts, supplied to the processing plant.

- Downstream Improvements – opportunities for process plant optimisation include potential improvements in each of the three key downstream stages, i) potassium extraction, ii) brine processing, and iii) SOP synthesis. Details about each of these steps is provided in *Chapter 6 (Metallurgical Test Work)*. The potassium extraction step, whereby the potassium enriched mixed salts are dissolved in freshwater, is expected to be improved through the displacement of a proportion of the freshwater with potassium saturated brine (from the potassium crystallisation pond, refer *Chapter 7*). This proposed enhancement is likely to improve the chemistry of the brine (by displacing a proportion of sodium with magnesium) but will also reduce the freshwater requirement during this water intensive process, thereby further improving the overall efficiency of water use.

16.5 Water Resources (Bore Field)

The implications on the potential availability of process water have been addressed in the Non-Process Infrastructure (*Chapter 9*) section of this report. Depending on the overall success of a range of potential processing optimisation opportunities relating to displacement of freshwater, as well as improvements in non-process infrastructure design (specifically cooling related), there is a possibility the project could potentially be developed with a very limited freshwater requirement, however, as outlined above, additional studies are required before this can be confirmed.

16.6 Trial Mining

The KLPP Sulphate of Potash Resource and Production Plan (*Appendix A*) indicated that future feasibility studies, should incorporate trial mining in order to mitigate potential brine production related risks. The recommendation includes trial mining of a single lake (or portion of single lake), where the trial mining duration is long enough to:

- Achieve significant dewatering of the drainable porosity hosted fraction of the resource.
- Maintain production through a recharge cycle (summer rainfall and recharge season).

The recommendation indicates that the trial mining should be set up to measure, flow rate, brine grade and water level in the production trench, and an array of piezometers to measure the brine resource throughout the lake. The trial mining would also provide the opportunity to test evaporation pond performance, and to stockpile potassium within ponds, which may be used for future metallurgical test work related studies.

17. Appendices

Important Note

This summary form of the KLPP-PFS is based on a more comprehensive version of the KLPP-PFS which will not be released publicly for practical and commercial reasons.

Appendix A Karinga Lakes Potash Project – Sulphate of Potash Resource and Production Plan

Appendix A. Karinga Lakes Potash Project – Sulphate of Potash Resource and Production Plan

Report 2

Karinga Lakes Potash Project

Sulphate of Potash Resource and Production Plan (KLPP-SOPRPP)

KARINGA LAKES POTASH PROJECT (KLPP)

Sulphate of Potash Resource and Production Plan

Document number: PWM-20-1-R001d

Prepared for: Parkway Minerals 3/11/2020

Document Title

Karinga Lakes Sulphate of Potash Mineral Resource Estimate and Production Plan

Author

Ben Jeuken

Distribution List

Copies	Distribution	Contact Name
1	Electronic	Bahay Ozcakmak

Revision History

Revision	Issue date	Revision description	Author	Checked by	Approved by
1	16/10/2020	Progress Draft	B Jeuken		
B	28/10/2020	Final Draft	B Jeuken	M. Williams	
C	3/11/2020	Final	B Jeuken	P Magarey	B Jeuken
D	3/11/2020	Final – Minor Edits	B Jeuken		

Groundwater Science

ABN: 37 150 913 456
Level 7, 19 Grenfell St, Adelaide SA 5000
T: 08 7078 3515   F: 08 8121 1839

Contents

List of Figures

List of Tables

List of Appendices

1 Executive Summary

1.1 Mineral Resource Estimate

1.1.1 Project Description

The Karinga Lakes Potash Project is being evaluated by Verdant Minerals and joint venture (JV) partner Parkway Minerals for potential production of Sulphate of Potash (SOP, K_2SO_4). The current proposal is to concentrate brine by solar evaporation to a potassium enriched mixed salt and subsequent processing to SOP.

A mineral Resource Estimate of the dissolved potassium contained in the deposit has been prepared.

The deposit is a brine hosted potash deposit. The potassium minerals are dissolved in brine contained in the pore spaces of sediment beneath a string of playa salt lakes (Karinga Lakes) in the Northern Territory. The Mineral Resource is estimated for 24 Lakes in the lake chain which comprise an area of 125 km^2.

The project tenure comprises 3 Exploration License Application areas (ELA's) that are held in JV with Parkway Minerals and Verdant Minerals. Parkway Minerals hold a 15% interest in the JV with the right to earn up to 40%.

The geological setting comprises basement rock of Devonian Horseshoe Bend Shale and Idracowra Sandstone of the Finke Group overlain by a thin veneer of Quaternary Sediments. The recent cover forms lake bed sediments comprising silts, clays, sands and evaporite minerals. Material adjacent to the lakes comprise of gypsiferous dunes and unconsolidated shifting dune sands capped or underlain with discontinuous calcrete.

The Hydrogeological system within the Karinga Creek chain of salt lakes is part of the Central Australian Groundwater Discharge Zone (Jacobson et al, 1989). Groundwater within the greater Amadeus basin is understood to move toward the chain of Playa Lakes including the Karinga Creek chain and Lakes Amadeus, Hopkins, Mackay and Neale to discharge via evaporation from the shallow water table beneath the lake surfaces. The hydrogeological conceptual model of the lakes comprises a 2-layer system. The upper layer is the Lakebed Sediment (LBS) (Described in the data tables as "Strat 1") characterised as a high hydraulic conductivity aquifer with high specific yield and moderate total porosity. Underlying the LBS is the weathered Horseshoe Bend Shale formation (Described in the data tables as "Strat 2").

The salt lakes are terminal drainage features - there are no drainage lines that exit the lakes. Satellite data sets indicate that the Lakes are inundated up to approximately 20% of observations, indicating that they receive significant volumes of water by direct rainfall, and likely some limited run-off from the small catchments immediately adjacent to each Lake.

The Climate is arid. Annual rainfall averages 231 mm/year. Annual pan evaporation averages 3139 mm/year. Evaporation exceeds rainfall in all months. Temperatures range from 36.5 degrees average maxima in January to 4 degrees average minima in July.

1.1.2 Sampling Techniques and data

Data has been obtained from several investigation campaigns conducted by Rum Jungle Resources from 2010 to 2013. The data is summarised in Table 1.1.

Liquid brine samples were obtained by sampling from open drillholes, hand dug pits, trenches and boreholes. Depth specific brine samples were obtained by sampling yield during aircore drilling. Porosity, specific yield and total soluble potassium samples were obtained from sonic and vibracore drilling campaigns that yield intact samples of the deposit. Hydraulic properties of each stratigraphic unit were obtained by test pumping of 10 test bores and long-term pumping trials at three trenches and one bore. Geology was logged onsite by the supervising geologist.

No sub-sampling was undertaken. Brine samples are taken as composite samples for the full interval of each drillhole or trench from which the sample was taken. Brine is typically homogenous over short depth intervals and the mining method is not vertically selective. The exception was aircore drilling; brine samples were taken from the aircore rig cyclone at the end of each drill rod. This method produced depth specific samples, though downhole mixing cannot be excluded completely.

Brine assay was undertaken by inductively coupled plasma atomic emission spectroscopy (ICP-AES). Total porosity determination comprised gravimetric methods, weighing a sample before and after drying. Specific yield was determined gravimetrically by weighing a sample before and after dewatering by centrifuge. Specific yield was also determined in the field by pumping tests and trench pumping trials. The data from these trials was analysed by standard hydrogeological methods. QA/QC checks were undertaken to ensure a suitable data set.

In very general terms, 498 data points inform a mineral resource estimate with a 124 km extent providing a data density of 4 data points per square kilometre. This is a comparatively high data density for a brine resource. However, some data is clustered around trial trenches, and the data is generally located close to the lake edges due to access constraints to the centre of lakes.

Table 1.1: Source data sets

Data Sets	Number of Sample points	Stratigraphic Unit 1					Stratigraphic Unit 2		
		Brine Assay	Base Elevation	Flow Rate	Standing water level	Porosity	Brine Assay	Base elevation	Porosity
Hand dug pits 2010 and 2012	93	Y			Y				
Trenches 2010	4	Y			Y				
Vibracore Drilling 2011	8		Y			Total Porosity	Y		Total Porosity
Sonic and drilling 2011	55		Y				Y		
Sonic Piezos 2011	12	Y					Y		
Aircore Drilling 2012	98	Y	Y	Y			Y	Y	
Aircore Wells 2012	47	Y		Y			Y		
Aircore pumping tests 2012	10	Y		Y		Specific Yield	Y		
Sonic 2013	18		Y		Y	Total Porosity and Specific Yield	Y	Y	Total Porosity and Specific Yield
Aircore Drilling 2013	102	Y	Y	Y	Y		Y	Y	
Trenches 2013	3	Y		Y	Y	Specific Yield	Y		Specific Yield
Trench Piezometers 2013	48	Y		Y	Y				

1.1.3 Estimation and reporting of Mineral Resources.

The Mineral Resource is estimated as the product of the sediment volume, porosity and brine concentration of each stratigraphic unit beneath each salt lake.

Volume

The area of each salt lake is defined by the extent mapped in Geoscience Australia's 1:250,000 Topographic data set (Geoscience Australia, 2006) and checked against aerial imagery.

The thickness of each stratigraphic unit was calculated by developing a series of gridded surfaces as follows:

1. Collar elevation of all data points was assigned from geoscience Australia's 3 second DEM. All depth measurements were converted to elevation measurements by difference.
2. The water table elevation was calculated data points as the difference between the collar and the reported depth to water. (rSWL.grd)
3. The base of Strat Unit 1 elevation was interpolated from vibracore, sonic and aircore drilling data sets (Strat_2_B.grd).
4. The base of Strat Unit 2 elevation was interpolated from aircore drilling data (Strat_2_B.grd).
5. Thickness of Strat Unit 1 was calculated as the difference between the water table elevation and base of the stratigraphic Unit (Strat_1_Thickness.grd).
6. Thickness of Strat Unit 2 was calculated as the difference between the base of the stratigraphic Unit 1 and the base of Strat Unit 2. (Strat_1_Thickness.grd).

Solute Concentration

Solute concentration was determined by assay of brine samples from the drilling and sampling campaigns described above.

The data was treated as follows:

- Profiles of brine concentration with depth from air-core drilling indicate that brine concentration is relatively constant with depth. Multiple brine assays from depth intervals sampled during aircore drilling were averaged to provide one average assay value per sample location. All other samples from sonic holes, bores, trenches and hand dug pits were assumed to be a single composite of the full depth of the borehole or excavation. Vertical composites are considered warranted since the mining method is not vertically selective. All brine will drain to the trenches.
- Spatial distribution of solute concentration was interpolated in 2 dimensions using Ordinary Kriging interpolation using 1500 m search radius, minimum 1 data point per sector with one search expansion. Interpolation up to 3000 m is consistent with the conceptual understanding of a relatively homogenous brine resource. The brine resource is generated in-situ by evaporation of a consistent groundwater source which is subject to sporadic mixing and dilution due to infiltration of rainwater, and subsequent re-concentration by evaporation.

Parameter interpolation was checked by querying the interpolated data sets to extract the interpolated value for each data point (drillhole) and analysing the variance.

Porosity

The mineral tonnage is calculated for specific yield and for a proportion of total porosity that is considered to be recoverable by abstraction within the mine plan timeframe (and therefore within the definition "reasonable prospects for eventual economic extraction").

In 2013 sediment samples were obtained by sonic drilling for total porosity determination. The data are presented in Appendix A2. The median total porosity for Strat 1 and Strat 2 is 33 % and 36 % by volume respectively. These values are used in the mineral resource estimate. No spatial interpolation is undertaken on these parameters, they are applied as a constant value for each stratigraphic unit.

Specific yield (Sy) porosity has been measured by a range of methods at the Karinga Lakes Project as follows:

> <u>Bore Pumping trials</u>: In 2013 constant rate pumping tests were undertaken at ten bores at Karinga Lakes. Test duration was 24 hours at each bore. Five bores exhibited an un-confined response and the data enabled determination of Specific Yield. Tests in LBS return values of 0.14 and 0.16. Tests in siltstone returned values of 0.02, 0.05 and 0.011. Data analysis is reported in Groundwater Science, (2012).
>
> <u>Long term Trench Pumping Trials</u>: Long term (30 day) pumping trials were completed at 3 test trenches and one test bore in 2014. Specific yield determined from the trials ranged from 0.10 and 0.17 in LBS and 0.02 to 0.10 in siltstone. There is less certainty around the values for Strat 2 since this material was only slightly dewatered and the data analysis not overly sensitive to that parameter. Data analysis is reported in Groundwater Science, (2013).
>
> <u>Laboratory Determination</u>: In 2013 sediment samples were obtained by sonic drilling. Samples were subjected to Sy determination by weighing a saturated sample before and after removal of the drainable pore fluid by centrifuge. 71 samples were analysed.

LBS (Strat 1) exhibits a median specific value of approximately 0.10 whilst weathered siltstone/sandstone (Strat 2) exhibits a median specific yield value of approximately 0.05. These values are used in the mineral resource estimate. No spatial interpolation has been undertaken on these parameters as they are applied as a constant value for each stratigraphic unit.

Mineral Resource Estimation

The mineral resource estimate for each grid cell was calculated as the product of the interpolated brine concentration, volume (stratigraphic unit thickness x cell area) and a constant value for porosity applied to each stratigraphic unit.

The mineral tonnage was calculated using drainable porosity. This represents the static free-draining portion of the mineral resource prior to extraction.

The mineral tonnage was also calculated using total porosity and application of a modifying factor. The modifying factor produces the portion of the total porosity hosted mineral tonnage considered to be extractable. On the basis of the production modelling reported in Section 3, a modifying factor of 0.34 is applied to the mineralisation hosted in total porosity. This proportion of mineralisation is considered to meet requirements of reasonable prospects of economic recovery and is reported as the Mineral Resource Estimate.

Results

The specific yield hosted mineral tonnage at the Karinga Lake Potash Project comprises 520 kt of potassium as detailed in Table 2.3. This drainable porosity mineral tonnage represents the static free-draining portion of the total porosity mineral tonnage prior to extraction. It does not take into account the impact of any groundwater recharge or solute transport which increases the amount of extractable brine above the static free-draining component over time.

The total porosity hosted Mineral Resource Estimate at the Karinga Lake Potash Project, after application of a modifying factor contains 1,000 kt of potassium as detailed in Table 2.4. This is the portion of the total porosity hosted mineralisation considered to exhibit reasonable prospects for economic extraction based on the transient groundwater flow affecting the deposit during extraction. Rainfall and run-off recharge is particularly relevant to the upper zones of the Mineral Resource and has been assessed as a component of the dynamic hydrogeological modelling which was used to determine the KLPP-PFS mine plan.

The reported Mineral Resource Estimate is inclusive of the drainable porosity fraction of the mineral resource.

Discussion of the relative accuracy/confidence

Brine resources are very different to solid mineral resources.

Brine production rate to a bore or trench is proportional to the hydraulic conductivity (permeability) of the host rock. This places a physical limitation on production rate that cannot be exceeded. The production rate will decline over time as the brine resource is depleted in proximity to a bore or trench. The production rate over longer time periods will be dependent on the rate of rainfall and run-off infiltration to the brine aquifer.

The brine concentration reported in the mineral resource is the starting point for production. This concentration will decline over time as the brine body is depleted and replaced by infiltrating recharge from rainfall and run-off and lateral inflow of lower concentration groundwater.

The capacity to mobilise a fraction of the potassium hosted in bound porosity is dependent on chemical equilibration of recharge from rainfall and run-off. The degree of equilibration is assumed from laboratory test work and has inherent uncertainty.

The cumulative effect of these characteristics is that the accuracy and confidence in a brine mineral resource declines with duration of mining. Over time:

- Flow rate will decline and is dependent on variable and uncertain recharge.
- Brine grade will decline and is dependent on variable and uncertain recharge.
- The final proportion of the resource that can be recovered is dependent on chemical equilibration of recharge and on the duration of mining.

The Resource Estimate is classified as an Indicated Resource on the basis that the estimate is adequate to inform mine planning and the application of modifying factors.

Table 1.2: Mineral Tonnage at the Karinga Lakes Systems – Drainable Porosity

Lake			Strat 1					Strat 2					Total
Lake	Area (km²)	K Average (kg/m³)	Thickness (m)	Bulk Volume (Mm³)	Drainable Porosity	Brine Volume (Mm³)	Potassium Tonnage (kt)	Thickness (m)	Bulk Volume (Mm³)	Drainable Porosity	Brine Volume (Mm³)	Potassium Tonnage (kt)	**Potassium Tonnage (kt)**
Corkwood	2.1	4.2	5.0	10.5	0.10	1.0	4.4	10.4	21.9	0.05	1.1	4.6	**9.0**
Curtin Boundary	5.2	4.3	2.2	11.2	0.10	1.1	4.9	17.5	90.1	0.05	4.5	19.5	**24**
Curtin North	14.3	3.4	2.8	40.3	0.10	4.0	13.9	17.5	249.8	0.05	12.5	43.1	**57**
Curtin West	1.0	5.7	5.2	5.4	0.10	0.5	3.1	12.6	13.0	0.05	0.7	3.7	**6.8**
Erldunda Boundary	10.2	3.3	1.0	10.0	0.10	1.0	3.3	10.5	107.3	0.05	5.4	17.9	**21**
Highway	3.0	3.1	0.8	2.5	0.10	0.3	0.8	14.7	44.2	0.05	2.2	6.8	**7.5**
Island 2	0.6	6.5	5.1	2.9	0.10	0.3	1.9	13.3	7.6	0.05	0.4	2.5	**4.4**
Island 4	1.4	5.2	4.3	6.2	0.10	0.6	3.2	13.9	19.9	0.05	1.0	5.2	**8.4**
Island 1	0.8	8.2	5.9	4.5	0.10	0.4	3.7	10.5	8.0	0.05	0.4	3.3	**6.9**
Island 5	0.7	5.3	5.2	3.6	0.10	0.4	1.9	14.1	9.7	0.05	0.5	2.6	**4.5**
Jetts	1.7	2.4	4.5	7.7	0.10	0.8	1.8	10.5	18.0	0.05	0.9	2.1	**4.0**
Lyndavale West	18.6	3.2	8.8	162.9	0.10	16.3	52.8	9.0	168.0	0.05	8.4	27.3	**80**
Main North Road	3.9	4.7	5.3	21.0	0.10	2.1	9.8	8.0	31.7	0.05	1.6	7.4	**17**
Mallee Well East	4.1	6.1	2.6	10.7	0.10	1.1	6.5	9.6	39.3	0.05	2.0	12.0	**18**
Miningere	7.8	7.7	3.0	23.9	0.10	2.4	18.4	16.1	126.2	0.05	6.3	48.7	**67**
Miningere West	3.0	5.6	2.3	6.9	0.10	0.7	3.9	21.6	64.4	0.05	3.2	18.0	**22**
Murphys	2.7	3.8	10.7	29.0	0.10	2.9	11.1	0.3	0.8	0.05	0.0	0.1	**11**
Mygoora South	1.2	4.8	1.2	1.5	0.10	0.1	0.7	10.6	12.7	0.05	0.6	3.0	**3.7**
Mygoora North	10.1	2.9	2.3	23.6	0.10	2.4	6.8	7.9	79.8	0.05	4.0	11.5	**18**
Pulcurra	5.8	3.9	4.7	27.3	0.10	2.7	10.8	10.9	63.1	0.05	3.2	12.4	**23**
Skinny	4.1	4.1	2.1	8.5	0.10	0.9	3.5	18.3	74.8	0.05	3.7	15.2	**19**
Swansons	8.8	4.3	7.1	62.8	0.10	6.3	27.1	10.1	89.0	0.05	4.5	19.2	**46**
Swansons North	9.0	3.3	2.2	19.6	0.10	2.0	6.5	16.1	145.0	0.05	7.3	24.0	**31**
Minskin	4.4	3.4	2.9	12.8	0.10	1.3	4.3	13.6	59.5	0.05	3.0	10.0	**14**
Total	125												**520**

Notes: 1) This drainable porosity hosted mineral tonnage represents the static free-draining portion of the total porosity hosted mineral tonnage prior to extraction. It does not take into account the impact of any groundwater recharge or solute transport which increases the amount of extractable brine above the static free-draining component over time.

Table 1.3: Mineral Resource Estimate at the Karinga Lakes System – Total Porosity

Lake			Strat 1					Strat 2					Total		
Lake	Area (km^2)	K Average (kg/m^3)	Thickness (m)	Bulk Volume (Mm^3)	Total Porosity	Brine Volume (Mm^3)	Potassium Tonnage (kt)	Thickness (m)	Bulk Volume (Mm^3)	Total Porosity	Brine Volume (Mm^3)	Potassium Tonnage (kt)	Potassium Tonnage[1] (kt)	Reasonable Prospects Modifier[2]	**Mineral Resource Estimate[3]** (kt)
Corkwood	2.1	4.2	5.0	10.5	0.33	3.4	15	10.4	22	0.36	7.9	33	48	0.34	16
Curtin Boundary	5.2	4.3	2.2	11.2	0.33	3.7	16	17.5	90	0.36	32.4	140	160	0.34	54
Curtin North	14.3	3.4	2.8	40.3	0.33	13.3	46	17.5	250	0.36	89.9	310	360	0.34	120
Curtin West	1.0	5.7	5.2	5.4	0.33	1.8	10	12.6	13	0.36	4.7	27	37	0.34	13
Erldunda Boundary	10.2	3.3	1.0	10.0	0.33	3.3	11	10.5	107	0.36	38.6	129	140	0.34	48
Highway	3.0	3.1	0.8	2.5	0.33	0.8	3	14.7	44	0.36	15.9	49	51	0.34	17
Island 2	0.6	6.5	5.1	2.9	0.33	1.0	6	13.3	8	0.36	2.7	18	24	0.34	8.2
Island 4	1.4	5.2	4.3	6.2	0.33	2.0	11	13.9	20	0.36	7.2	37	48	0.34	16
Island 1	0.8	8.2	5.9	4.5	0.33	1.5	12	10.5	8	0.36	2.9	23	36	0.34	12
Island 5	0.7	5.3	5.2	3.6	0.33	1.2	6	14.1	10	0.36	3.5	19	25	0.34	8.5
Jetts	1.7	2.4	4.5	7.7	0.33	2.6	6	10.5	18	0.36	6.5	15	21	0.34	7.1
Lyndavale West	18.6	3.2	8.8	162.9	0.33	53.7	174	9.0	168	0.36	60.5	196	370	0.34	130
Main North Road	3.9	4.7	5.3	21.0	0.33	6.9	32	8.0	32	0.36	11.4	53	85	0.34	29
Mallee Well East	4.1	6.1	2.6	10.7	0.33	3.5	22	9.6	39	0.36	14.1	86	110	0.34	37
Miningere	7.8	7.7	3.0	23.9	0.33	7.9	61	16.1	126	0.36	45.4	351	410	0.34	140
Miningere West	3.0	5.6	2.3	6.9	0.33	2.3	13	21.6	64	0.36	23.2	130	140	0.34	48
Murphys	2.7	3.8	10.7	29.0	0.33	9.6	37	0.3	1	0.36	0.3	1	38	0.34	13
Mygoora South	1.2	4.8	1.2	1.5	0.33	0.5	2	10.6	13	0.36	4.6	22	24	0.34	8.2
Mygoora North	10.1	2.9	2.3	23.6	0.33	7.8	22	7.9	80	0.36	28.7	82	100	0.34	34
Pulcurra	5.8	3.9	4.7	27.3	0.33	9.0	36	10.9	63	0.36	22.7	89	120	0.34	41
Skinny	4.1	4.1	2.1	8.5	0.33	2.8	11	18.3	75	0.36	26.9	110	120	0.34	41
Swansons	8.8	4.3	7.1	62.8	0.33	20.7	89	10.1	89	0.36	32.1	138	230	0.34	78
Swansons North	9.0	3.3	2.2	19.6	0.33	6.5	21	16.1	145	0.36	52.2	173	190	0.34	65
Minskin	4.4	3.4	2.9	12.8	0.33	4.2	14	13.6	60	0.36	21.4	72	86	0.34	29
Total	125														**1000**

Notes:
1) The total porosity tonnage is not presented as a mineral resource estimate. Only a proportion of the mineralisation might be recovered by mining.
2) The reasonable prospects modifier is that proportion of the total porosity resource for which there are reasonable prospects for economic recovery. This proportion is based on simulation of a 15 year production duration and incorporates recharge and dilution of brine by rainfall and run-off recharge.
3) The Mineral Resource Estimate is that proportion of the total mineralisation for which there are reasonable prospects for economic recovery. It is not reported as an Ore Reserve since a mine plan and schedule has not been developed to incorporate all Lakes. Totals are rounded to two significant figures.

.

1.2 Production Plan

1.2.1 Production Trench design

Production planning and simulation has been undertaken to provide an estimated yield from production trenches to inform the production design. The production plan comprises the trench layout and production schedule.

Trenches are planned with a nominal water level at 6 m depth. A single trench axial to each lake will meet the optimum spacing requirement such that the required volume of brine will flow to the trench.

Total trench depth will range from 6 to 8 m. The designed brine level in the trench is 6 m below surface, minimum brine depth at the base of the trench is 0.65m and the trenches will require up to 1.3m fall from one end of the lake to another (0.1m per km).

1.2.2 Brine production simulation.

Brine production from each playa lake was simulated by development of a groundwater flow and solute transport model. The model objective is to provide an estimate of the brine flow rate over time and the brine concentration over time for each lake.

A two-dimensional slice model of each lake was implemented. Model properties and boundary conditions are summarised in Table 1.4. Aquifer hydraulic conductivity is the geometric mean of the values from pumping tests in each stratigraphic unit. Specific yield and total porosity are the median values of field and laboratory tests. Recharge is a significant component of the production model. The recharge estimate was based on monitoring of rainfall and recharge at 3 sites over a 16 month period to establish a recharge model. Analysis of 65 years rainfall data from Curtin Spring BOM station was used to develop a long-term average and an understanding of variability in recharge.

Table 1.4: Brine Production Model Properties

Aquifer Unit	Hydraulic conductivity (m/day)	Specific Yield (v/v)	Total Porosity (v/v)	Recharge	Evaporation	Drain Boundary (trench simulation)
Strat 1	25 (Horizontal) 2.5 (Vertical)	0.10	0.33	0.0004 m/day	0.004 m/day 0.6 m extinction depth.	6 m depth. 25 m/day conductance
Strat 2	3 (Horizontal) 3 (Vertical)	0.05	0.36			

Simulations were run for eight lakes summarised in Table 1.5. The average fetch was implemented as the width of the model. The thickness of the model was defined by the average thickness of Stat 1 and Strat 2 in the Resource Model. Simulations were run for 10 to 15 years as a single stress period with constant boundary conditions. Four lake simulations were extended to 15 years to allow for additional production.

Solute (dissolved potassium) was simulated with an initial concentration of 100. Recharge was applied with a solute concentration of zero. Solute is removed from the model by the drain cell that simulates trench production. No additional solute is added to the model and the solute concertation decreases over time as the solute is diluted by recharge.

Table 1.5: Production Simulation

Lake	Area (km^2)	Potassium Concentration (kg/m^3)	Trench Length (m)	Average Fetch / Model Width (m)	Base Stat 1 (m)	Model Base (m)	Simulated Production Duration (years)
Miningere	7.8	7.3	6,000	650	3.5	19.5	15
MinSkin	4.4	3.2	8,000	275	3.5	17.0	15
Lyndavale West	18.6	3.2	17,000	547	9.5	18.5	15
Skinny	4.1	4.1	8,000	256	6.0	24.5	10
Curtin Boundary	5.2	4.3	3,500	743	2.5	20.0	10
Miningere West	3.0	5.6	4,000	375	3.0	24.5	15
Swansons North	9.0	3.3	17,000	265	3.0	19.0	10
Swansons	8.8	4.3	6,600	667	7.5	17.5	10
Totals	**61**		**70,100**				

Total production is summarised in Table 3.6. On average 22% of the Potassium contained in total porosity is recovered from each lake in 10 years of production and 25-33 % when mining is extended to 15 years for the selected lakes.

Table 1.6: Production Summary

Lake	Area (km^2)	Potassium Concentration (kg/m^3)	Tonnage Potassium in Total Porosity[1]	10 Year Production (Tonnes Potassium)	10 year Recovery	15 Year Production (Tonnes Potassium)	15 year Recovery
Miningere	7.8	7.3	411,467	92,100	0.22	122,323	0.30
MinSkin	4.4	3.3	86,238	22,054	0.26	28,717	0.33
Lyndavale West	18.6	3.2	370,563	77,991	0.21	91,975	0.25
Skinny	4.1	4.1	121,182	26,985	0.22		
Curtin Boundary	5.2	4.3	156,458	34,941	0.22		
Miningere West	3.0	5.6	142,567	27,110	0.19	36,440	0.26
Swansons North	9.0	3.3	193,106	47,248	0.24		
Swansons	8.8	4.3	227,380	51,148	0.22		
Totals	**61**		**1,708,962**	**379,578**	**0.22**		

Notes: 1) The total porosity mineral tonnage is not presented as a mineral resource estimate. Not all the potassium can be recovered by mining. The data is presented here to calculate the percentage that is estimated to be recovered by mining.

Uncertainty analysis was undertaken by simulating seasonably variable recharge and different rates of recharge based on different wetting thresholds in the recharge model. The outcome was that predicted production can decline to approximately 60% of the base case for different recharge scenarios.

The model is designed to allow planning and scheduling of brine production from the Playas comprising the Karinga Project to a pre-Feasibility standard. The model is un-calibrated. This is of necessity at this stage of project development since there is no medium-term pumping data available for calibration. The model is set up with carefully specified parameters based on extensive test work. However, any multiparameter groundwater flow model exhibits considerable uncertainty, and the uncertainty increases with simulation time.

The model also represents all lakes as a homogenous aquifer with consistent aquifer properties for each stratigraphic unit, and consistent unit thicknesses for each lake. This is a necessary simplification of the real system. It is likely that specific lake performance will vary from that predicted by the model, but that the model provides a reasonable prediction of the average performance of all lakes over time.

The model assumes that all bound solutes (solutes hosted in specific retention, or undrainable porosity) will equilibrate with infiltrating recharge and will mobilise to the trenches over time.

The model is intended to inform a Pre-feasibility Study. Work to progress to a Definitive Feasibility Study should include a trial mining exercise where a portion of a lake is trenched and the trench is pumped for a duration that encompasses significant primary drainage of the lake sediments, and includes a recharge season so that the medium term brine yield is demonstrated, and so that the interaction between infiltrating recharge, and the in-situ brine can be demonstrated.

1.2.3 Production Plan and Schedule

The estimated production profiles from each lake have been incorporated in a production schedule. The basis for the schedule is the production of 40,000,000 kg Sulphate of potash per year from a brine feed of 42,000,000 kg SOP. The brine feed specified for this production is 18,843,000 kg Potassium.

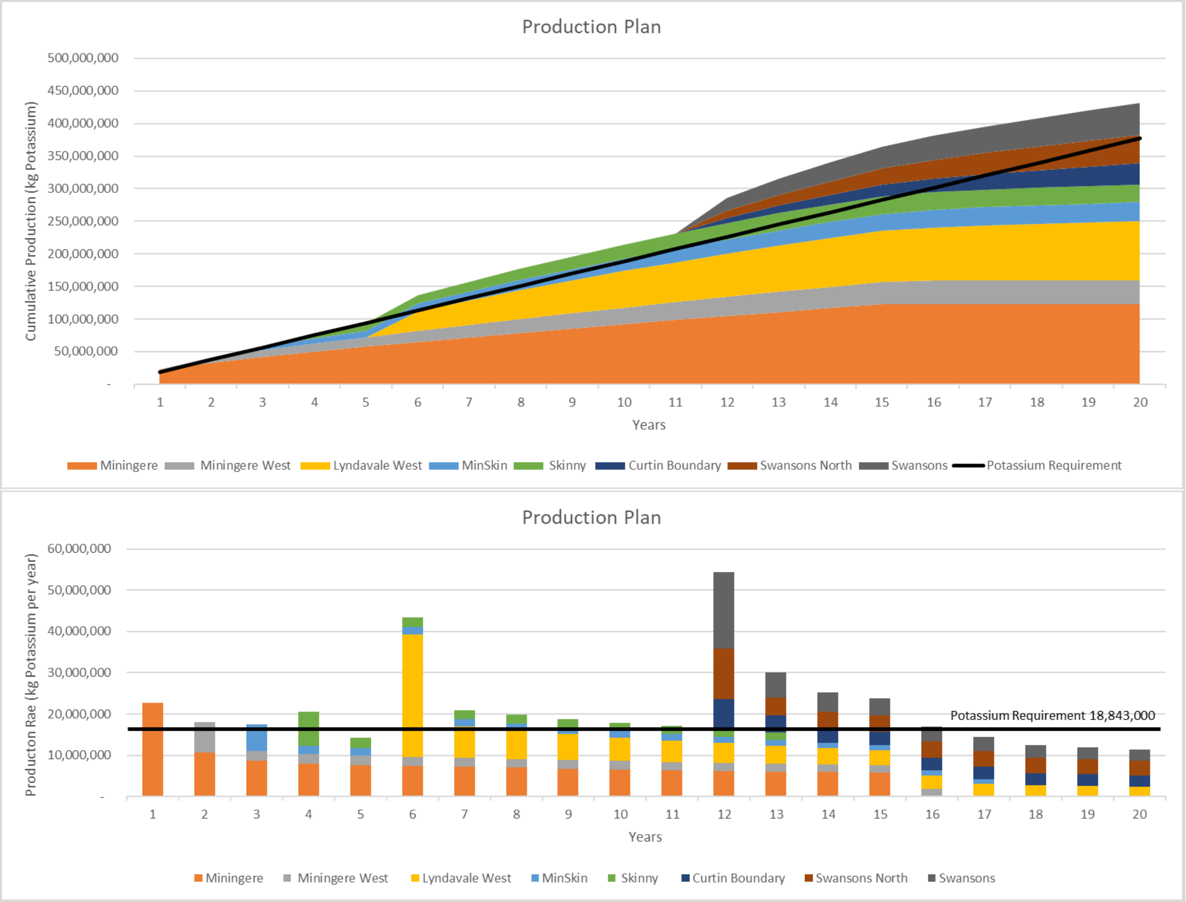


Figure 1.1: Production Schedule – Potassium Production

The production plan is reported at the point of delivery to the first evaporation pond. There is no allowance in the production plan for subsequent recovery from the evaporation ponds or processing plant.

In total the production plan comprises approximately 430 kt potassium dissolved in approximately 130 Mm^3 brine at an average life of mine grade of approximately 3.3 kg/m^3. The total production is summarized in Table 1.7.

Table 1.7: Potassium Production Summary

Lake	Tonnage Potassium (kt)	Brine Volume (Mm^3)	Brine Grade (kg potassium / m^3)
Miningere	120	20	6.1
Miningere West	36	7.7	4.8
Lyndavale West	92	46	2.0
MinSkin	29	11	2.5
Skinny	27	7.6	3.5
Curtin Boundary	32	8.3	3.9
Swansons North	44	15	3.0
Swansons	49	16	3.1
Total	**430**	**130**	**3.3**

Brine resources are very different to solid mineral resources and the accuracy / confidence in a production plan is much lower.

- The production rate is naturally constrained and will vary over time with uncertainty also increasing over time and is subject to uncertain rainfall recharge.
- The brine grade will decline over time at a rate that is subject to uncertainty. The uncertainty increases with mining duration and is subject to uncertain rainfall recharge which will vary due to climatic factors.
- The overall recovery of the Resource is dependent on the mining duration, and the mobilisation of brine by recharge which is subject to uncertainty.

Production in the first few years of production is quite predictable, however the production over longer periods becomes more uncertain due to all the factors above. The uncertainty increases with duration of mining.

Contingency options for this project to maintain brine production in later years are extremely important for managing the higher risk associated with a brine resource. Contingency options if required include:

- Additional lakes to maintain production. There are a further 16 Lakes in the Karinga Lakes chain with a total additional estimated Mineral Resource of approximately 431 kt Potassium. Some of these can be developed if required.

- Deepening of trenches. Trenches can be deepened to extract the brine more efficiently at depth.

The project is currently at a Pre-Feasibility level of study. The study aims to evaluate development options for the project.

Feasibility Studies for the project should be designed to mitigate the production risks described above. The recommended approach is trial mining of a single lake (or portion of a single lake). The trial mining duration should be long enough to:

- Achieve significant dewatering of the drainable porosity hosted fraction of the Mineral Resource.

- Maintain production through a recharge cycle (summer rainfall and recharge season).

The trial mining should be set up to measure flow rate, brine grade and water level in the production trench, and an array of piezometers to measure the brine resource throughout the lake.

Trial mining also provides the opportunity to test evaporation pond performance and to stockpile potassium within the ponds.

Resource Utilization.

Resource Utilization is detailed in Table 1.8. For the eight lakes included in the mine plan, the Mineral Resource Estimate is 580 kt. Of this the production schedule over the 20 year mine plan incorporates mining 440 kt. The Resource Estimate is reported inclusive of the Resources that a produced in the production plan.

Table 1.8: Resource Utilisation.

Lake	Mineralisation Contained in Drainable Porosity	Indicated Mineral Resource contained in Total Porosity that meets reasonable prospects of economic extraction	Production
	Potassium Tonnage	Potassium Tonnage	Potassium Tonnage
	(kt)	(kt)	(kt)
Lakes included in the mine plan			
Miningere	67	139	122
Miningere West	22	48	36
Minskin	14	29	29
Skinny	19	41	27
Lyndavale West	80	126	92
Curtin Boundary	24	54	35
Swansons	46	78	51
Swansons North	31	65	47
Sub Total	**300**	**580**	**440**
Remaining Lakes			
Corkwood	9.0	16	
Curtin North	57	122	
Curtin West	6.8	13	
Erldunda Boundary	21	48	
Highway	7.5	17	
Island 2	4.4	8.2	
Island 4	8.4	16	
Island 1	6.9	12	
Island 5	4.5	8.5	
Jetts	4.0	7.1	
Main North Road	17	29	
Mallee Well East	18	37	
Murphys	11	13	
Mygoora South	3.7	8.2	
Mygoora1	18	34	
Pulcurra	23	41	
Sub total	**220**	**430**	
Totals	**520**	**1000**	**440**

Note: Totals are rounded to 2 significant figures

2 Mineral Resource Estimate

2.1 Introduction

2.1.1 Objectives

The current report provides an estimate of the brine potash resource beneath the Karinga Lakes chain of salt lake playas in the Northern Territory (The Karinga Lakes Potash Project). The resource estimate is reported in accordance with the JORC Code 2012. The report is consistent with the Brine Guidelines (AMEC 2018).

The Australian Institute of Mining and Metallurgy (AUSIMM) provided recent guidance to the authors (AUSIMM pers comm 20/8/2020) as copied below. The current resource is reported in accordance with that guidance.

> *Public Reporting of Brine Mineral Resources must include only that portion of Total Porosity that is technically substantiated to be recoverable by abstraction within the mine plan timeframe (and therefore within the definition "reasonable prospects for eventual economic extraction");*

The Karinga Lakes Potash Project is being evaluated by Verdant Minerals and JV partner Parkway Minerals for potential production of Sulphate of Potash (SOP, K_2SO_4) by solar evaporation to a potassium enriched mixed salt and subsequent processing to SOP.

2.1.2 Background

Pre-Verdant Minerals

The project was evaluated in the late 1990's by Northern Territory Evaporites. Evaporation trials to produce Mirabilite ($Na_2SO_4 \cdot 10H_2O$) were undertaken before uncertainty regarding tenure resulted in project abandonment in 1999.

2012 Maiden Resource Estimate

Rum Jungle Resources (RJR, now Verdant Minerals) began evaluation of the project for production of potash in 2010. A maiden resource estimate of 0.24 Mt of potassium was announced in May 2013 (RJR ASX 1/5/2012). This estimate was reported in accordance with the JORC Code 2004 and was based on the total mineral content of the rock at 16 Lakes to an average depth of 3.2 m.

2012 Resource Upgrade

Further drilling and testing, and a change in focus to the mineral content dissolved in liquid brine culminated in an Inferred Resource estimate reported in November 2012 of 1.1 to 2.5 Mt potassium (RJR ASX 5/11/2012). The resource was reported for 20 Lakes to an average depth of 15 m.

2014 Resource Upgrade

From 2013 to 2014 an extensive program of hydrogeological test work was undertaken including:

- **Aircore Drilling** – 200 Aircore holes were drilled up to 40 m depth in 2012 and 2013. Sediment samples were taken and logged at 1 m intervals. Brine samples were obtained from airlift yield taken at 3 m intervals. Brine flow rates were determined from airlift yields.
- **Sonic Drilling** – 17 Sonic drillholes were completed up to 20 m depth. Samples were taken for laboratory determination of total porosity and drainable porosity (specific yield).
- **Bores – 12** sonic and 47 aircore drillholes were completed as cased bores. Sonic bores were completed with 50 mm casing and sampled using 12v submersible pumps to recover brine samples, whilst aircore bores were completed with 100 mm casing and airlifted to provide brine

samples. Ten bores were pumped using a submersible electric pump to provide additional brine samples and aquifer testing data.
- **Trenches** – 4 Trenches were excavated up to 4 m in depth to facilitate medium term brine pumping tests.

This work culminated in an upgraded resource estimate reported in February 2014 (RJR ASX 20/2/2014). The estimate comprised 3.8 Mt potassium reported as Measured, Indicated and Inferred to an average depth of 17 m beneath 25 Lakes. The estimate was reported in accordance with the JORC Code 2012 on the basis of minerals dissolved in brine contained in the total porosity of the host rock.

2014 Production Plan and Scoping Study

Hydraulic testing was undertaken in 2013 and 2014 and comprised:

- Ten 24-hour constant rate tests of bores, and
- Four long term (30 day) pumping trials from three trenches and one bore.

The data was used to generate a hydrogeological model of the playa lakes. A production plan (GWS, 2014) was developed comprising trench spacing and design for 28 Lakes that yielded 15 to 21 gigalitres (GL)/yr brine. The data was used to inform a Scoping Study released in December 2014 (RJR ASX 22 Dec 2014).

2.1.3 Tenure

The project tenure comprises three Exploration License Applications (ELA) submitted by Verdant Minerals effective 2/9/2019; ELA32249, ELA32250 and ELA32251 (Figure 2.1). Parkway Minerals holds a 15% interest in this tenure through its JV with Verdant Minerals.

2.2 Project Description

2.2.1 Location

The project is located in the Northern Territory of Australia, adjacent the Lasseter's Highway which is located to the west of Eudunda (Figure 2.1).

2.2.2 Geological Setting

The geological setting comprises basement rock of Devonian Horseshoe Bend Shale and Idracowra Sandstone of the Finke Group overlaid by a thin veneer of Quaternary Sediments. The recent cover forms lake bed sediments of silts, clays, sands and evaporite minerals. Material adjacent the lakes comprises gypsiferous dunes and unconsolidated shifting dune sands capped or underlain with calcrete in places.

On a broad scale the Playa string follows paleodrainage of the Amadeus basin, flanked to the north by outcropping Neoproterozoic sediments of the Amadeus Basin and to the south by outcropping and thinly covered Proterozoic granite and gneiss of the Musgrave Block.

2.2.3 Hydrogeological Setting

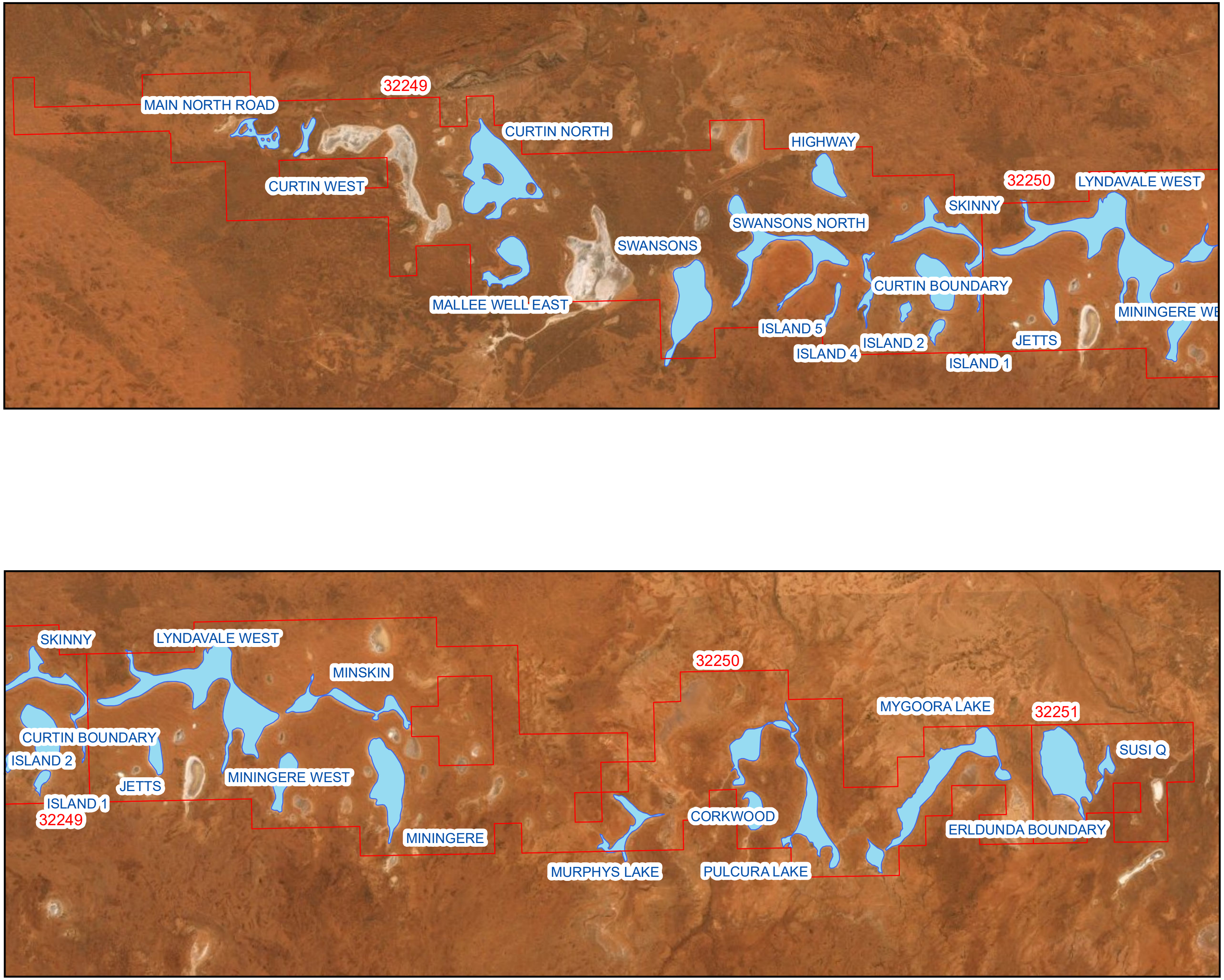
The Hydrogeological system within the Karinga Creek chain of salt lakes is part of the Central Australian Groundwater Discharge Zone (Jacobson et al, 1989). Groundwater within the greater Amadeus basin is understood to move toward the chain of playa lakes including the Karinga Creek chain and Lakes Amadeus, Hopkins, Mackay and Neale to discharge via evaporation from the shallow water table beneath the lake surfaces.

On a local scale, within the Karinga Creek chain, the lakes exhibit a relatively thin surficial deposit of lakebed sediments, comprising evaporite minerals in a silt and clay matrix with some sand intervals. The hydraulic conductivity of these materials is surprisingly high, much higher than would be expected on the basis of the fine grained lithology. The high conductivity is understood to be derived from porosity developed by growth and displacement during evaporite mineral formation, and from shrinkage fissures in the matrix. These features exhibit high rates of seepage during test pumping from trenches. This high hydraulic conductivity of lakebed sediments is consistent with the properties reported for similar salt lake settings in the Goldfields region of Western Australia and the Basin and Range geological province in the USA.

Underlying the lake bed sediments, the regional bedrock comprises the sedimentary Horseshoe Bend Shale. The thickness of this unit is poorly defined but typically exceeds 200 m in petroleum exploration well intersections and correlated seismic survey. Beneath the salt lakes this unit exhibits variable hydraulic conductivity, dependant on the intersection of fractures and weathering features. Pumping tests in wells indicate transmissive zones.

Analysis of long duration pumping test data indicate low transmissivity boundaries roughly coincide with the lake edges. Hydraulically the lakes appear to act as a highly transmissive “drain” of enriched brine with both the high brine concentration and high transmissivity caused be the intense evaporation beneath the lake surface. This drain feature is hosted within a less transmissive regional aquifer system.

Beneath the Horseshoe Bend Shale a deeper regional aquifer is hosted within the Carmichael Sandstone. This unit is intersected at approximately 570 m depth beneath Murphy Lake. Groundwater salinity is reported at 20 grams per litre (g/L) and potassium concentration of 0.1 g/L (Pacific Oil and Gas Ltd, 1991). Closer to outcrop, at the margins of the Amadeus Basin, groundwater in the Carmichael Sandstone is less saline and suitable for stock and domestic use. The hydraulic connection between the deeper Carmichael Sandstone aquifer and the Karinga Creek salt lake chain is not known.



Legend

□ Tenements

🟦 Lakes

GROUNDWATER
SCIENCE

Job Number: PWM-20-1

Client: Parkway Minerals

Version: 1 Date: 20/10/2020

Drawn by: BJ

N

0 3.25 6.5 13
Kilometers

Coordinate System: GDA 1994 MGA Zone 53

Karinga Lakes
Tenements and Lakes

Figure 2.1

Document Path: C:\Users\Ben Jeuken\Dropbox (Groundwater Science)\Groundwater Science Team Folder\Project Files\PWM\PWM-20-1-Production Plan\GIS\Maps\PWM-20-1 Fig2.1 Tenements.mxd
Document Name: PWM-20-1 Fig2.1 Tenements

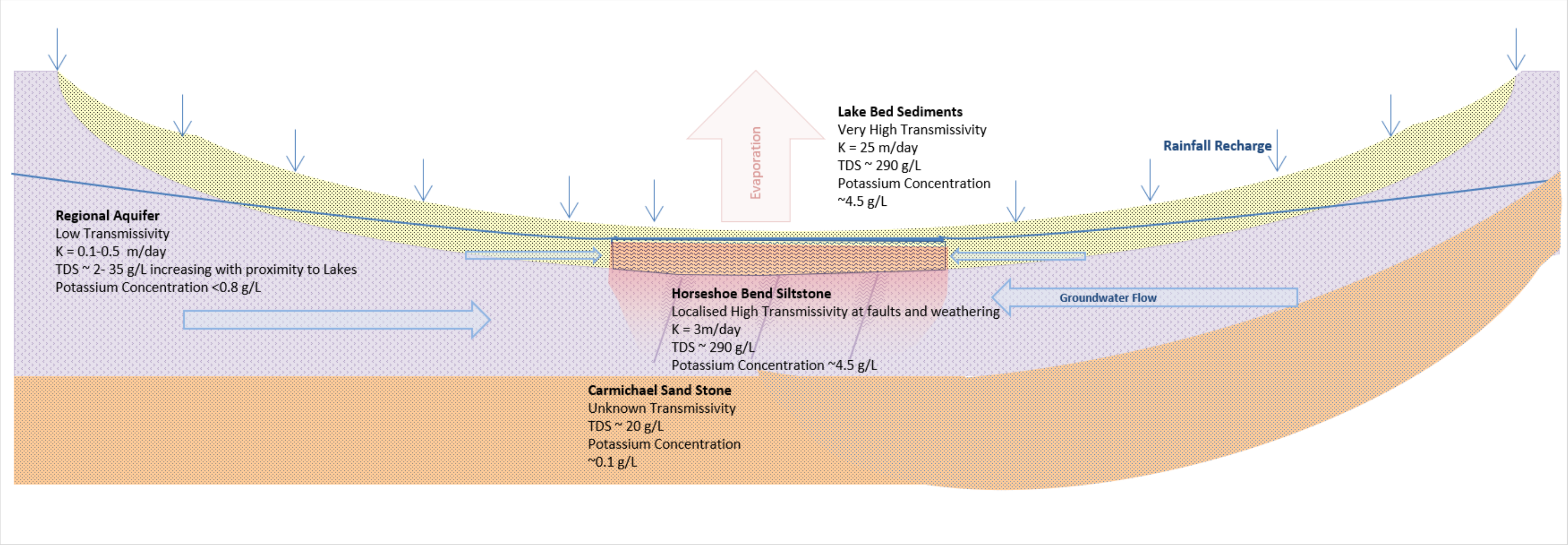


Figure 2.2: Conceptual Hydrogeological Model

2.2.4 Lake description

2.2.5 Climate

The Climate is arid. Annual rainfall averages 231 mm/year (Curtin Springs BOM station - #015551). Annual pan evaporation averages 3139 mm/year (Alice Springs Airport BOM Station # 015590). Evaporation exceeds rainfall in all months. Temperatures range from 36.5 degrees average maxima in January to 4 degrees average minima in July.

2.2.6 Hydrology

The salt lakes are terminal drainage features - there are no drainage lines that exit the lakes.

The morphology of the salt lakes shape and surface is consistent with the classification system described by Bowler, (1986)[1], shown in Figure 2.3. The lakes exhibit morphology typical of some degree of surface water influence and periodic inundation (smooth lake edges, few islands).

The Inundation frequency datasets developed by Geoscience Australia (Neuller Et al 2016)[2] are presented as Figure 2.4. The data show that parts of the lake are inundated with surface water for over 20% of observations. This demonstrates a significant quantity of surface water within the system. If surface water persists for more than 20% of the year, then the available water in those areas is more than 20% of evaporation (i.e applying winter evaporation rates: 3.7 mm/day x 365 days x 20% = 270 mm/year)

Inspection of aerial imagery and digital terrain data shows that there relatively small catchments that will deliver run-off to these lakes. Surface run-off may be derived from small catchments immediately adjacent the Lakes. Surface run-off in this environment is typically low, in the order of 5% of rainfall (Bowler, 1986) or around 11 mm per year at this site.

Further analysis of rainfall and aquifer recharge is presented in Section 3.3.3.

---

[1] Bowler, J.M., 1986. Spatial variability and hydrologic evolution of Australian lake basins: analogues for Pleistocene hydrologic change and evaporite formation. Palaeogeography, Palaeoclimatology, Palaeoecology, 54, 21-41.

[2] N. Mueller, A. Lewis, D. Roberts, S. Ring, R. Melrose, J. Sixsmith, L. Lymburner, A. McIntyre, P. Tan, S. Curnow, A. Ip, 2016. Water observations from space: Mapping surface water from 25 years of Landsat imagery across Australia. Remote Sensing of Environment 174, 341-352, ISSN 0034-4257.

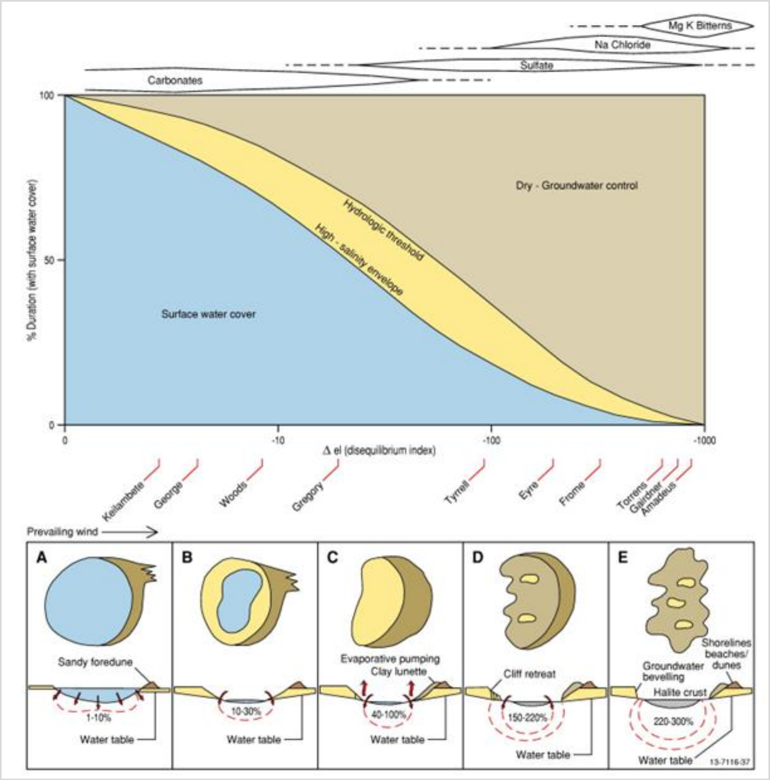
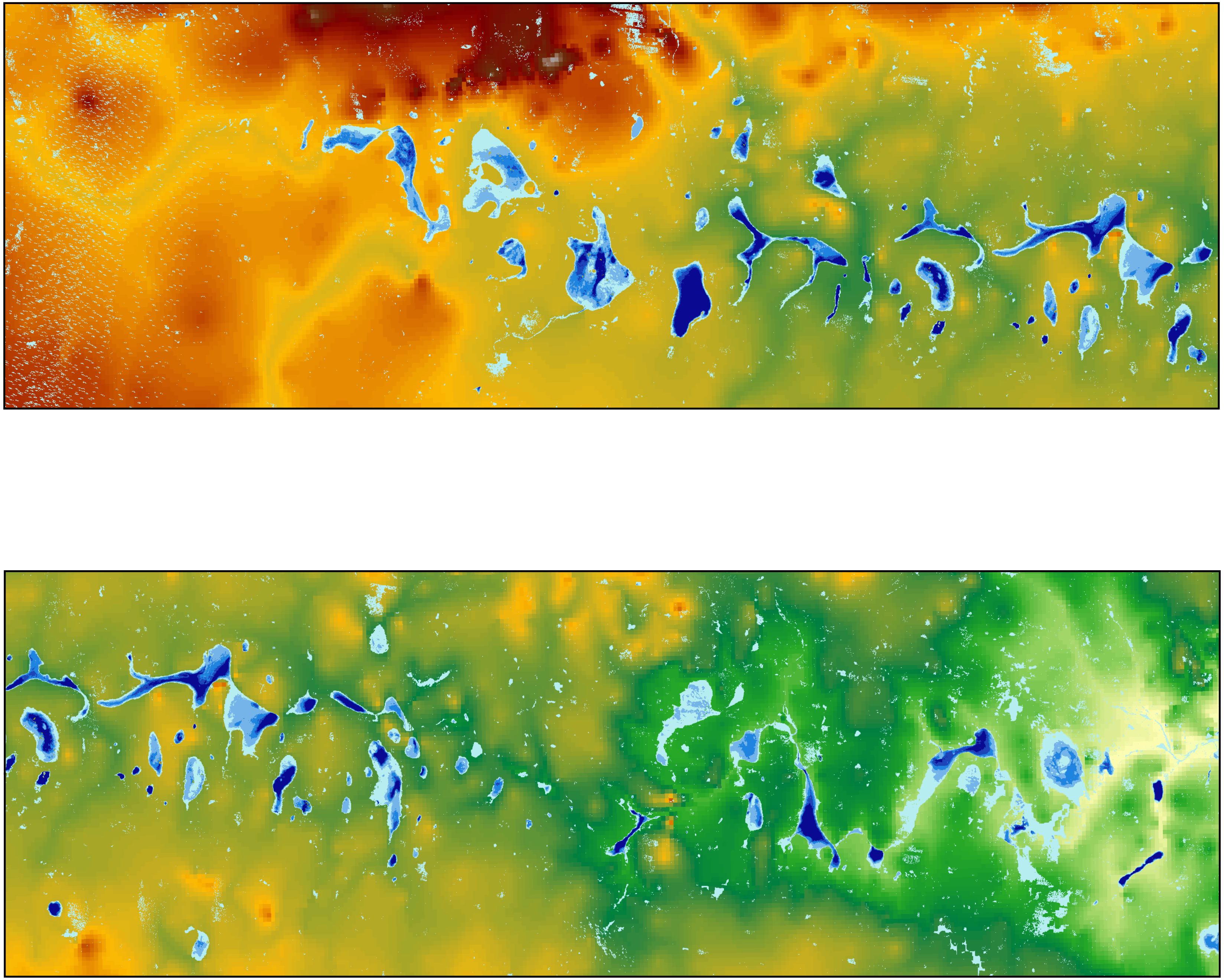


Figure 2.3: Lake Morphology. From GA, (2013)[3], originally developed by Bowler, (1986).

---

[3] Geoscience Australia (2013) A Review of Australian Salt Lakes and Assessment of their Potential for Strategic Resources. Geoscience Australia Record 2013/39



Legend

Innundation Fequency

%

🟦	<5
🟦	6 - 10
🟦	11 - 15
🟦	16 - 20
🟦	>20

Topography

Elevation mAHD

High : 600

Low : 400

GROUNDWATER
SCIENCE

Job Number: PWM-20-1

Client: Parkway Minerals

Version: 1 Date: 20/10/2020

Drawn by: BJ

N

0 3.25 6.5 13

Kilometers

Coordinate System: GDA 1994 MGA Zone 53

Karinga Lakes Hydrology

Figure 2.3

Document Path: C:\Users\Ben Jeuken\Dropbox (Groundwater Science)\Groundwater Science Team Folder\Project Files\PWM\PWM-20-1-Production Plan\GIS\Maps\PWM-20-1 Fig2.1 Hydrology.mxd
Document Name: PWM-20-1 Fig2.1 Hydrology

2.3 Sampling Techniques and Data

2.3.1 Drilling and Sampling Techniques

Samples have been obtained by a number of methods as follows:

1. Hand dug pits – Shallow pits hand dug to a depth of up to 1 m. Brine samples are obtained from natural inflow to the pits.
2. Trenches – Deeper, larger pits dug using machinery. Brine samples are obtained from natural inflow.
3. Shallow Sonic and Vibracore drilling -55 Sonic and 8 vibracore holes were drilled in 2011 and complete core samples were obtained.
4. Aircore Drilling – 98 Aircore holes were drilled up to 40 m depth in 2012 while 102 were drilled in 2013. Sediment samples were taken and logged at 1 m intervals. Brine samples were obtained from airlift yield taken at 3 m intervals at the end of each drill rod.
5. Cased Bores - 12 sonic, and 47 aircore drillholes were completed as cased bores. Sonic bores were completed with 50 mm PVC casing and sampled using 12v submersible pumps to recover brine samples, whilst aircore bores were completed with 100 mm PVC casing and airlifted to provide brine samples. Ten bores were pumped using a submersible electric pump to provide additional brine samples and to determine aquifer properties.
6. Deep Sonic Drilling – 17 Sonic drillholes were completed to up to 20 m depth. Geological samples were submitted for total porosity and specific yield (drainable porosity) determination. Brine samples were obtained by bailing from the open holes.
7. Trenches and piezometers–
    a. 4 Trenches ranging up to 50 m length were excavated to up to 4 m depth to facilitate medium term brine pumping tests.
    b. Trench Piezometers – A total of 48 piezometers were installed in arrays around each trench to facilitate water level measurement during brine pumping tests. Each peizometer was sampled to obtain brine samples using a 12v submersible pump.

2010 - 2011 Hand Dug Pits

From 2010 – 2011, 91 Hand dug pits were excavated into the lake surface to approximately 0.5 m depth. Shallow brine samples were obtained and sent for assay.

2011 Sonic drilling

55 vertical drillholes were drilled using sonic core methods. Sonic drill rod outer diameter was 86 mm and inner diameter of inner tube was 75 mm. Core was geologically logged and complete core intervals were obtained. Core diameter was 75 mm. Sonic core samples were submitted for laboratory determination of total porosity and total soluble mineral content by leaching with distilled water and assay of the leachate.

2012-2013 Aircore drilling.

A total of 200 aircore drill holes were drilled using aircore methods. Bit size was 75 mm. Drill cuttings were geologically logged every metre. Brine samples were obtained every 3 meters, at the end of each drill rod by airlifting through the drill rods. Samples were collected at the cyclone while brine flow rate was recorded. This method provides approximate brine samples with depth though some mixing down the hole cannot be excluded. 47 aircore holes were completed as bores with 100 mm PVC casing. Of these, 10 were test pumped for 24 hours to obtain brine samples and aquifer parameters.

2012 Aircore Bore Pumping Tests

10 Air core holes drilled in 2012 were cased as bores and test pumped for 24 hours at a constant rate. Each bore had two piezometers installed at 10 and 20 m distance from the bore. Flow rate and drawdown were recorded during the pumping tests at the pumped bore and the piezometers. The data were analysed by standard aquifer testing methods to derive aquifer properties. The tests and results are reported in detail in Groundwater Science (2012) and summarised in Appendix A5.1.

2013 Sonic Drilling.

18 vertical drillholes were drilled using sonic methods. Sonic drill rod outer diameter was 86 mm and inner diameter of inner tube was 75 mm. Core was geologically logged while completed core intervals were also obtained. Samples for porosity and drainable porosity testing were sampled in 15 cm lengths. Samples were wrapped in plastic to ensure no moisture loss during transport. 12 Sonic bores were completed with 50 mm PVC casing and sampled using 12v submersible pumps to recover brine samples.

71 Samples were sent to E-Precision Laboratory, Beckenham Perth and analysed for; Bulk density, dry density, moisture content, specific gravity, void ratio, and porosity. Analysis was undertaken in accordance with AS1289 2.1.1, 3.5.1, 5.1.1 & an In-house Method.

An additional 71 samples from the 2013 Sonic sample set were sent to The British Geological Survey, Hydrogeological Properties and Processes Laboratory, Oxfordshire, UK for total porosity and drainable porosity determination.

2013 Trenches and Trench Piezometers

4 Trenches were dug at Pulcurra, Island 5, Miningere and Curtin Boundary Lakes. Trenches were dug between 2 and 4 meters depth and up to 100 m long. Trenches were pumped for between 25 and 30 days. Brine samples were obtained daily. The trench at Island 5 Lake was unstable and pumping from an adjacent test bore was undertaken. The initial brine sample was elevated due to evaporation in the open trench prior to sampling. The sample used for the resource estimate was obtained following 1 day of pumping to ensure a fresh brine sample. Brine samples were sent for analysis to Bureau Veritas Petroleum Laboratory (AMDEL) in Thebarton, South Australia.

48 piezometers were installed around the trenches and bore piezometers were installed by hand auguring to a depth up to 4 m. Piezometers were cased with 50 mm PVC casing and slotted screens. Brine samples were obtained after purging piezometers with a suitable pump to ensure a representative aquifer sample was obtained. Brine samples were sent for analysis to Bureau Veritas Petroleum Laboratory (AMDEL) in Thebarton, South Australia.

3 Trenches and one bore were test pumped for 25 to 29 days. The flow rate and drawdown were measured at the trenches and at the surrounding piezometer array. The data was analysed through calibration of a numerical model for each test to derive aquifer properties. The work is reported in detail in Groundwater Science (2013), and the data is summarised in Appendix A5.2.

Data sets are summarised in Table 2.1. Details are presented in the sections that follow.

Table 2.1: Source data sets

Data Sets	Number of Sample points	Stratigraphic Unit 1					Stratigraphic Unit 2		
		Brine Assay	Base Elevation	Flow Rate	Standing water level	Porosity	Brine Assay	Base elevation	Porosity
Hand dug pits 2010 and 2012	93	Y			Y				
Trenches 2010	4	Y			Y				
Vibracore Drilling 2011	8		Y			Total Porosity	Y		Total Porosity
Sonic and drilling 2011	55		Y				Y		
Sonic Piezos 2011	12	Y					Y		
Aircore Drilling 2012	98	Y	Y	Y			Y	Y	
Aircore Wells 2012	47	Y		Y			Y		
Aircore pumping tests 2012	10	Y		Y		Specific Yield	Y		
Sonic 2013	18		Y		Y	Total Porosity and Specific Yield	Y	Y	Total Porosity and Specific Yield
Aircore Drilling 2013	102	Y	Y	Y	Y		Y	Y	
Trenches 2013	3	Y		Y	Y	Specific Yield	Y		Specific Yield
Trench Piezometers 2013	48	Y		Y	Y				

2.3.2 Drill sample recovery

Drilling by aircore, virbra-core and sonic core generally achieves complete sample recovery.

2.3.3 Logging

All drill holes are geologically logged by qualified geologists, noting in particular: moisture content of sediments, lithology, colour, structural observations and flow rates of brine from each 3 m interval. Log sheets were developed specifically for this project.

Air core sediment samples are generally discarded and not sampled directly for brine. Instead, brine is sampled from the rig cyclone, with duplicates taken periodically immediately following the previous sample. Sample bottles are rinsed with brine and discarded prior to sampling. Labelling is done on the shoulder of the sample bottle as well as the cap in a permanent marker or paint marker.

2.3.4 Sub-sampling techniques and sample preparation

Brine samples were taken as follows:

- Hand dug pits – brine samples were taken immediately upon excavation.
- Aircore drilling – sample taken at the end of each drill rode (where water was produced) by sampling from the cyclone.
- Vibracore and sonic drilling – brine samples were taken at the end of the hole by bailing or pumping with a small submersible pump at the completion of drilling. Sonic core solid samples were cut into 15 cm long lengths using a spatula or knife and then double wrapped in plastic lay flat tube, labelled and stored in a core tray for transport.
- Trenches – Samples were taken at daily intervals during pumping trials in 2013.

2.3.5 Quality of assay data and laboratory tests

Total Leachable Potassium Content

Total leachable potassium was determined from 117 samples taken from 52 sonic drillholes, drilled in 2012. Intact samples were wrapped to preserve moisture and submitted for total porosity and total leachable minerals determination as follows:

- Moisture content was determined by weighing the wet core, drying and then weighing the dry core.
- Total Porosity (volumetric) is calculated from moisture content assuming a solid particle density of 2.6.
- Total potassium was determined by leaching the core with distilled water and leachate assay.
- Leachable Potassium is expressed as Kg of K per m^3 of sediment.
- Leachable Potassium is also back calculated and reported as equivalent brine concentration by dividing leachable solute by the moisture content of the samples. These values are treated with caution since all solute will be reported as dissolved. Some samples exhibited markedly elevated sulphate. The cause is unknown but likely to be oxidation of sulphide minerals to produce soluble sulphate. These outliers were removed from the data set.

Porosity Determination

Porosity was determined by three methods:

Total Porosity was determined gravimetrically by analysis of 117 vibracore samples drilled in 2012 as described above.

Total porosity and specific yield was determined from samples taken from 17 Sonic Core holes drilled in 2013. Sample were sent to two laboratories:

- Total Porosity was determined by The British Geological Survey, Hydrogeological Properties and Processes Laboratory gravimetrically by weighing wet then dry samples. Specific Yield was determined gravimetrically by weighing before and after centrifuge. 71 samples were analysed.
- Total Porosity was determined gravimetrically by Precision Laboratories in Perth WA. 71 samples were analysed. Bulk density, dry density, moisture content, specific gravity, void ratio and porosity analysis was undertaken by E-Precision Laboratory in accordance with AS1289 2.1.1, 3.5.1, 5.1.1 & an In-house Method.

Specific Yield was determined from analysis of 24-hour pumping trials at ten bores installed in 2013, and by analysis of 30-day pumping trials of three trenches and one bore undertaken in 2013. The data analysis is reported in GWS, 2012 and GWS, 2014.

Brine Assay

Brine assay was undertaken by inductively coupled plasma atomic emission spectroscopy (ICP-AES).

Quality Control Procedures

Brine sample assay data has been provided by RJR in spreadsheet format.

Data quality checks comprised:

1. Calculation of the ionic balance for each sample where a full suite of major ions was analysed. 23 samples with an ionic balance error greater than +/- 5% were excluded from the data set.

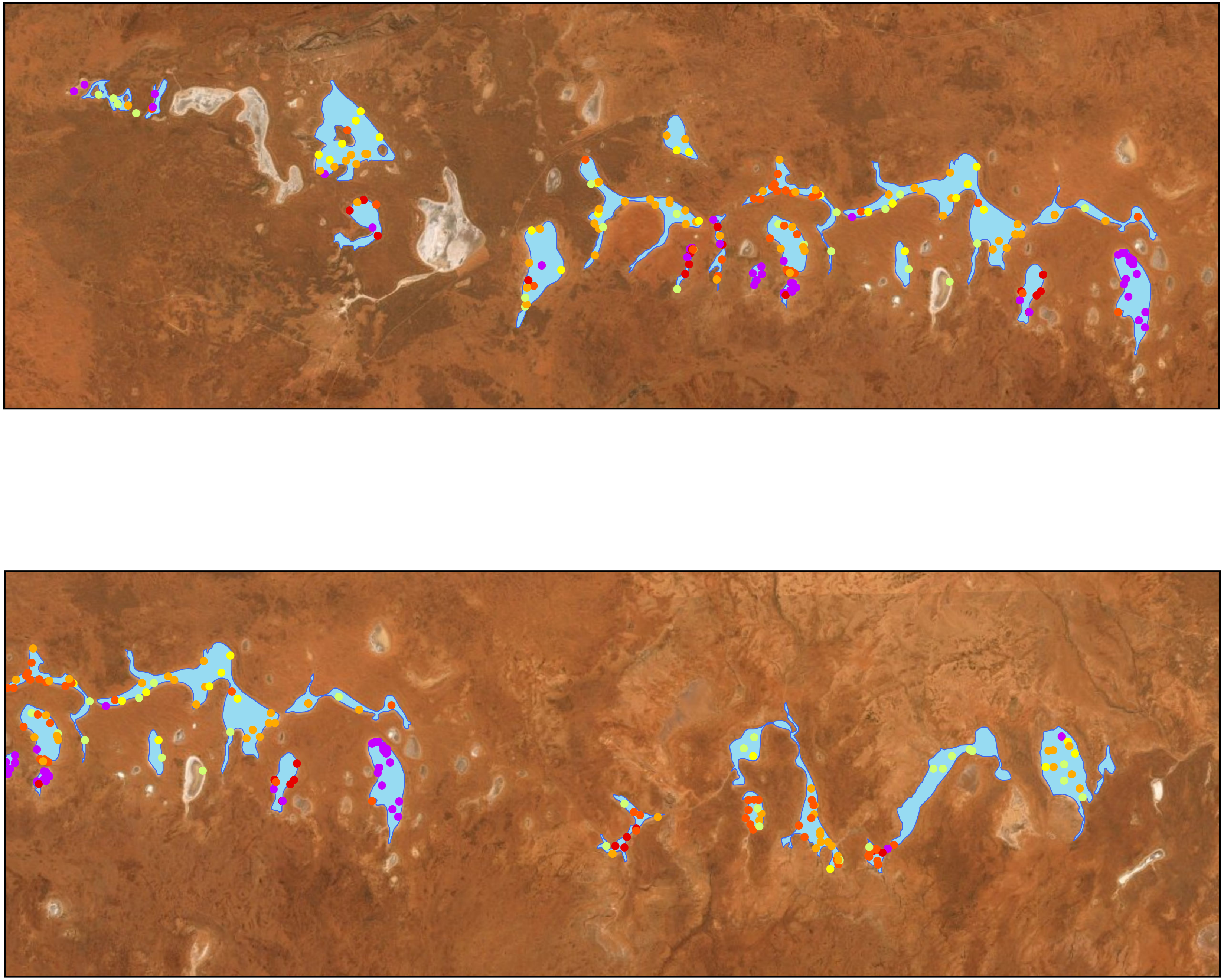
2. Histograms and descriptive statistics of potassium concentration were generated to identify data trends and outliers. No data were excluded on this basis as all elevated potassium concentrations were consistent and reasonable. For instance, the 4 highest potassium concentrations above 10,000 mg/L were recorded at Island 1 Lake and Miningere Lake. These high concentrations are supported by generally high concentration at these lakes recorded from multiple samples obtained during multiple sampling campaigns. Similarly, the lowest concentrations of potassium were consistent and reasonable.
3. Potassium vs Density scatter plots were generated to identify anomalous high potassium in low density brines. No data were excluded on this basis. A slightly higher ratio of K:SG is observed at Main North Road Lake, however this trend is consistent for all data points on this lake, and indicates a slightly different brine composition, rather than analytical error.
4. Duplicate inter-lab assays were undertaken for 32 samples obtained from 2013 aircore drilling and trench pumping tests. The Primary Laboratory was NTEL Laboratories in Darwin. Duplicate samples were sent to Bureau Veritas Laboratory in Perth. Good inter-lab correlation is observed for potassium, magnesium, and calcium assay. Poor correlation is observed for sulphate assay. The cause of the discrepancy is unknown. The comparison is presented as Appendix A3.3.

The accuracy of the data set is considered acceptable for calculation of the Potassium resource.

2.3.6 Data point location, spacing and distribution

The distribution of data is presented on Figure 2.5 to Figure 2.9

In very general terms 498 data points inform a mineral resource estimate with a 124 km^2 extent providing a data density of 4 data points per square kilometre. This is a comparatively high data density for a brine resource. However, some data is clustered around trial trenches, and the data is generally located close to the lake edges due to access constraints to the centre of lakes.



Legend

K (mg/L)

● <2500

● 2501 - 3000

● 3001 - 4000

● 4001 - 5000

● 5001 - 6000

● >6000

▭ Lakes

GROUNDWATER
SCIENCE

Job Number: PWM-20-1

Client: Parkway Minerals

Version: 1 Date: 20/10/2020

Drawn by: BJ

N

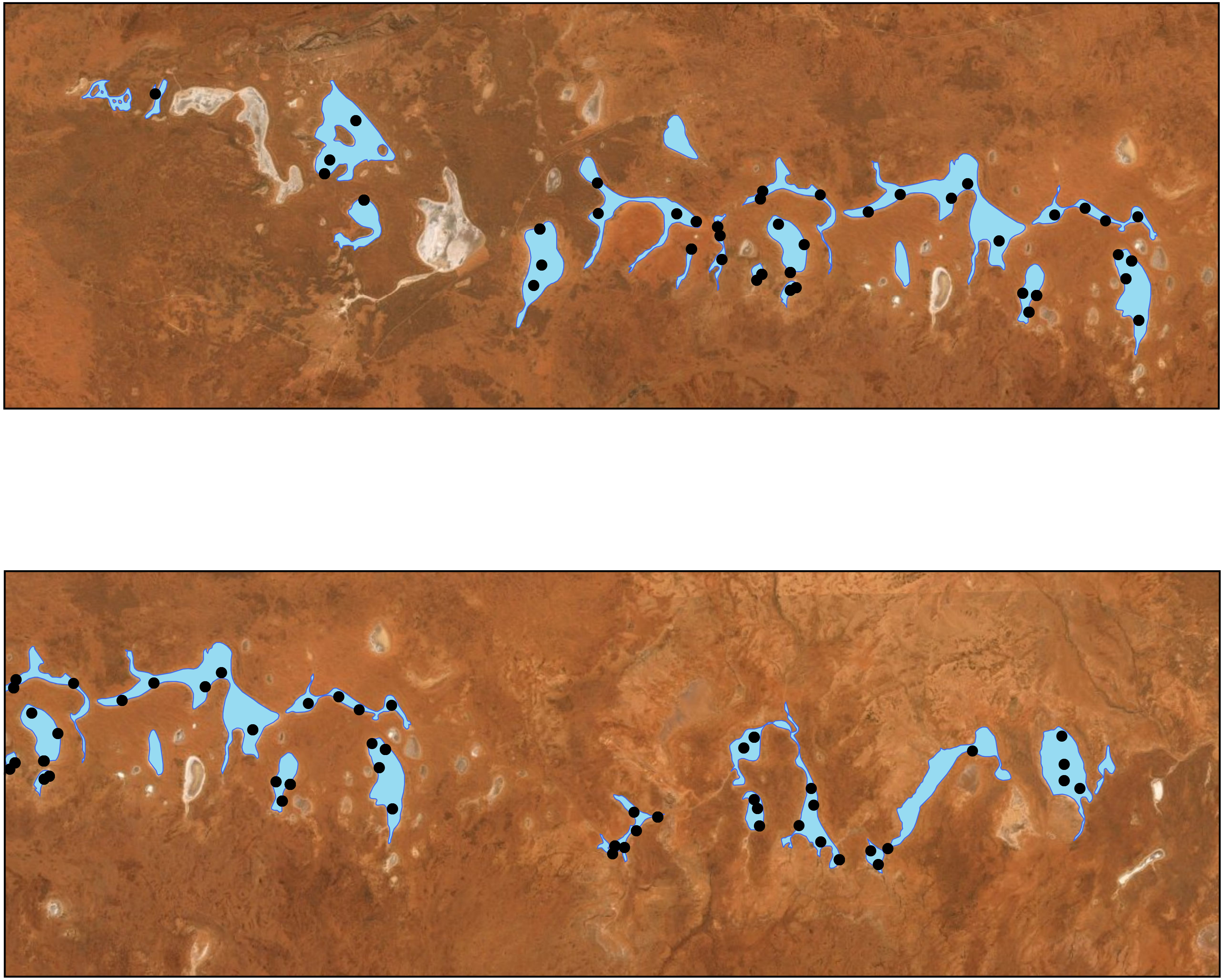
0 3.25 6.5 13
Kilometers

Coordinate System: GDA 1994 MGA Zone 53

Karinga Lakes
Brine Assay

Figure 2.5

Document Path: C:\Users\Ben Jeuken\Dropbox (Groundwater Science)\Groundwater Science Team Folder\Project Files\PWM\PWM-20-1-Production Plan\GIS\Maps\PWM-20-1 Fig2.5 Brine Assay.mxd
Document Name: PWM-20-1 Fig2.5 Brine Assay



Legend

● Porosity Data Points

🟦 Lakes

GROUNDWATER
SCIENCE

Job Number: PWM-20-1

Client: Parkway Minerals

Version: 1 Date: 20/10/2020

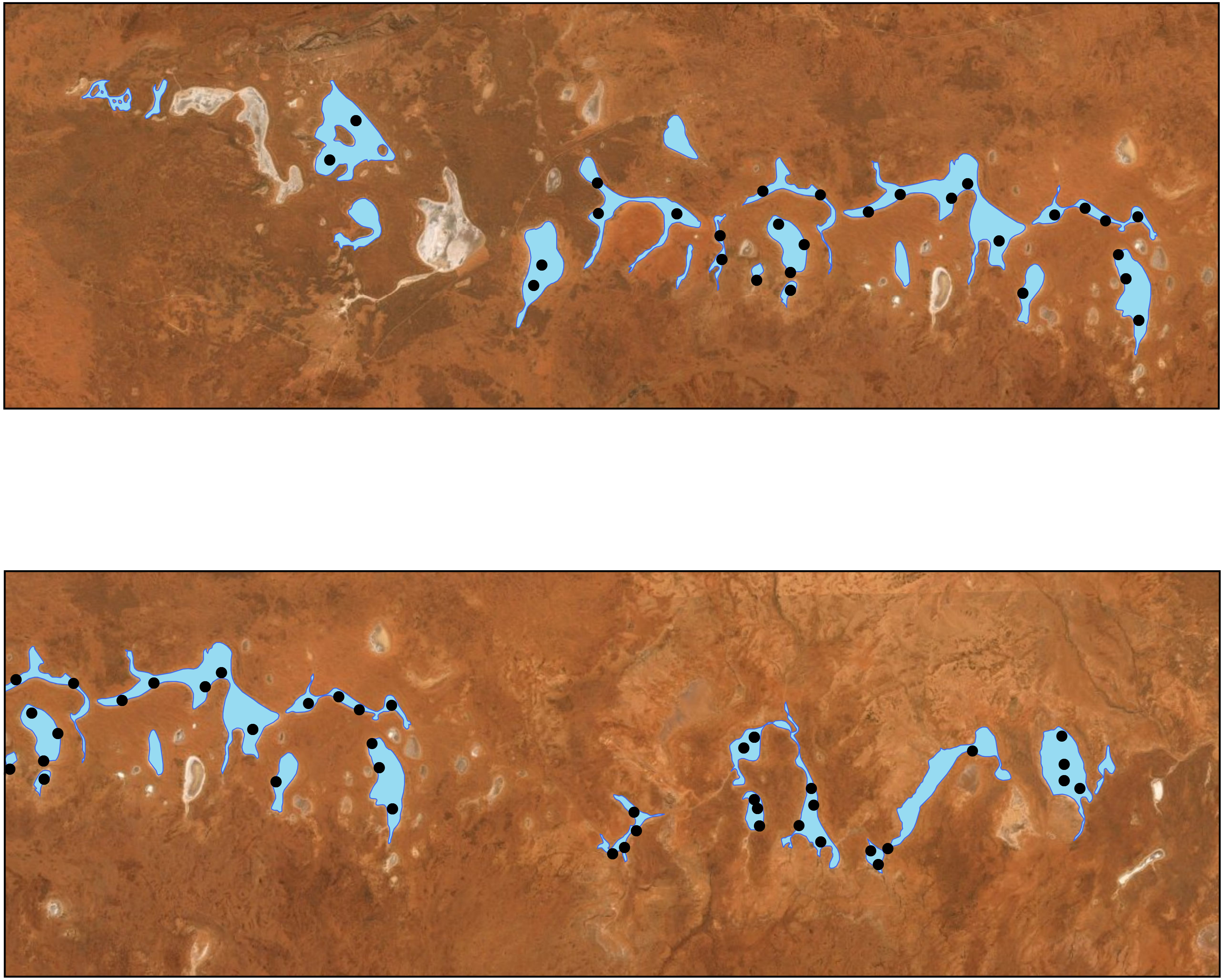
Drawn by: BJ

Coordinate System: GDA 1994 MGA Zone 53

Karinga Lakes
Porosity Data Points

Figure 2.6

Document Path: C:\Users\Ben Jeuken\Dropbox (Groundwater Science)\Groundwater Science Team Folder\Project Files\PWM\PWM-20-1-Production Plan\GIS\Maps\PWM-20-1 Fig2.6 Porosity Data.mxd
Document Name: PWM-20-1 Fig2.6 Porosity Data



Legend

● TLP Data Points

▨ Lakes

GROUNDWATER
SCIENCE

Job Number: PWM-20-1

Client: Parkway Minerals

Version: 1 Date: 20/10/2020

Drawn by: BJ

N

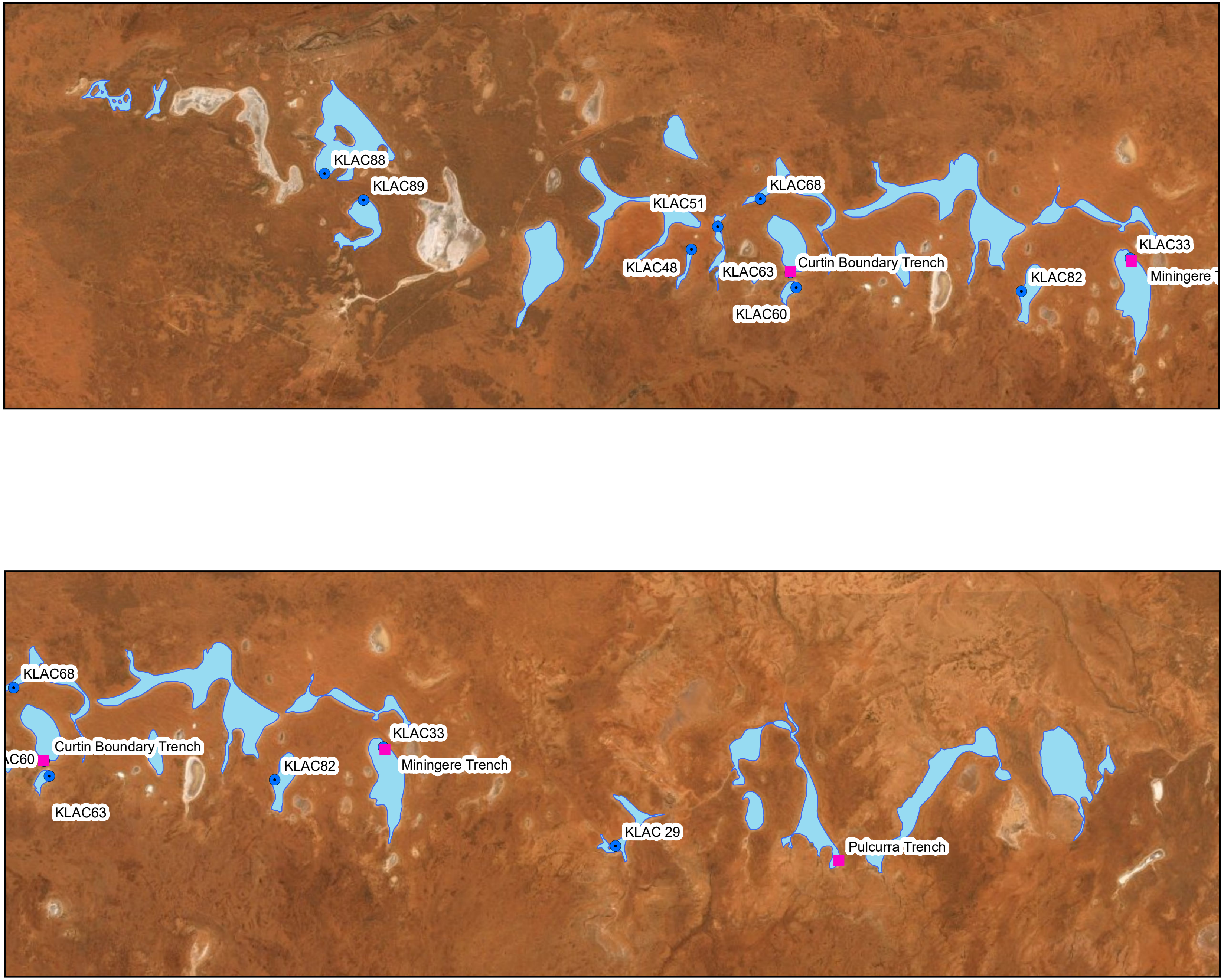
0 3.25 6.5 13
Kilometers

Coordinate System: GDA 1994 MGA Zone 53

Karinga Lakes
Total Leachable Potassium
Data Points

Figure 2.7

Document Path: C:\Users\Ben Jeuken\Dropbox (Groundwater Science)\Groundwater Science Team Folder\Project Files\PWM\PWM-20-1-Production Plan\GIS\Maps\PWM-20-1 Fig2.7 Total Leachabe Potassium.mxd
Document Name: PWM-20-1 Fig2.7 Total Leachabe Potassium



Legend

● Bore Pumping Test

■ Trench Pumping Trial

▨ Lakes

GROUNDWATER SCIENCE

Job Number: PWM-20-1

Client: Parkway Minerals

Version: 1 Date: 20/10/2020

Drawn by: BJ

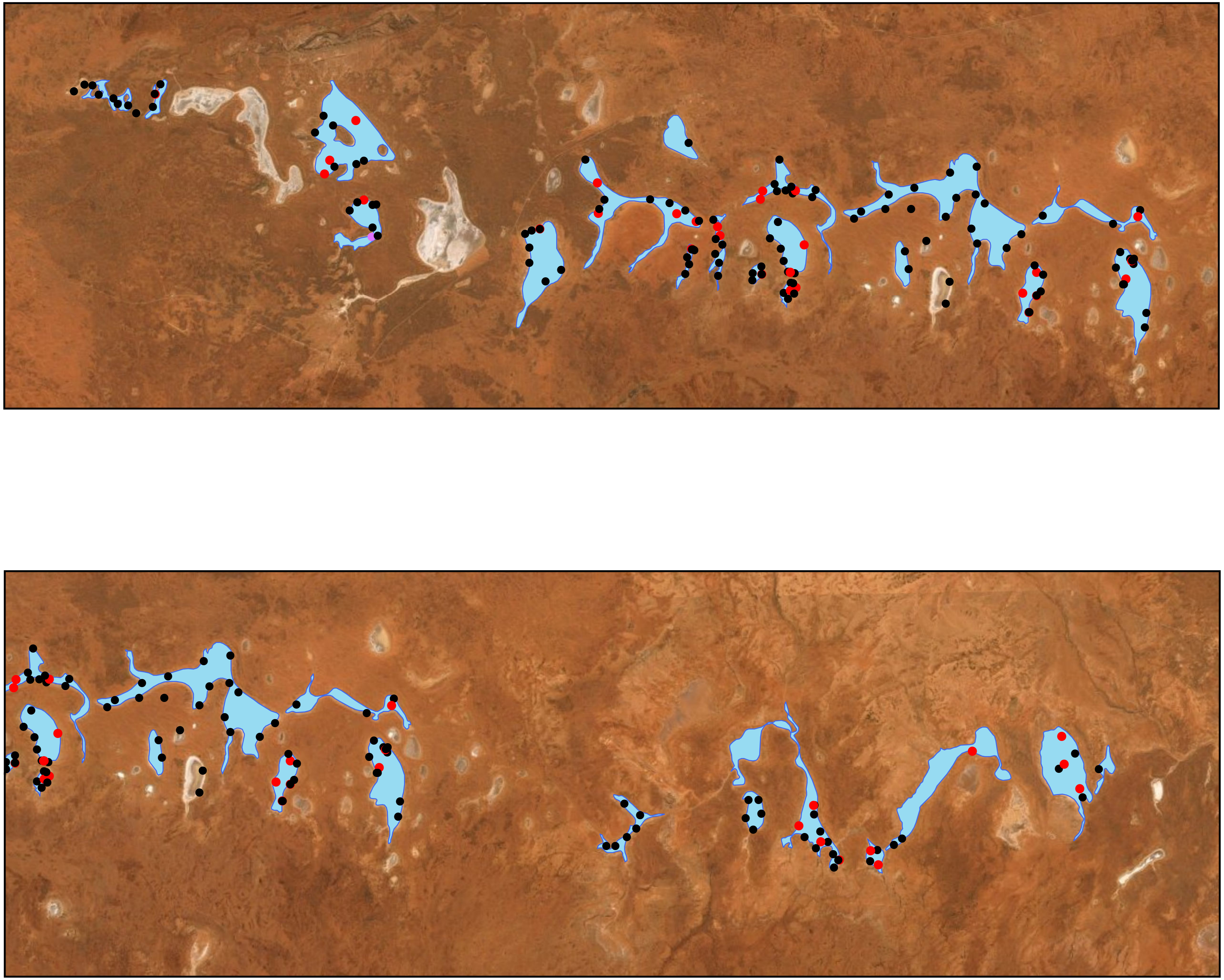
N

0 3.25 6.5 13
Kilometers

Coordinate System: GDA 1994 MGA Zone 53

**Karinga Lakes
Trench and Bore
Pumping Test Sites**

Figure 2.8



Legend

● Aircore Drillhole

◼ Trench

🔴 Sonic Core Drillhole

🟣 Vibracore Drillhole

🟦 Lakes

GROUNDWATER
SCIENCE

Job Number: PWM-20-1

Client: Parkway Minerals

Version: 1 Date: 20/10/2020

Drawn by: BJ

N

0 3.25 6.5 13
Kilometers

Coordinate System: GDA 1994 MGA Zone 53

Karinga Lakes
Geological Data Points

Figure 2.9

Document Path: C:\Users\Ben Jeuken\Dropbox (Groundwater Science)\Groundwater Science Team Folder\Project Files\PWM\PWM-20-1-Production Plan\GIS\Maps\PWM-20-1 Fig2.7 Geological Data.mxd
Document Name: PWM-20-1 Fig2.7 Geological Data

2.3.7 Orientation of data in relation to geological structure

The deposit is flat lying and all data are vertical. The logged thickness at each hole is equivalent to the true thickness.

2.3.8 Sample Security

Samples were labelled, sealed and sent to the laboratory under standard sample handling protocols.

2.3.9 Audits or Reviews

No Audits or reviews were undertaken.

2.3.10 Database integrity

Data was received in digital format to reduce transposition errors. Data checks are described in Section 2.3.5.

2.4 Estimation and Reporting of Mineral Resources

2.4.1 Site Visits

The Competent Person, Mr Ben Jeuken has undertaken multiple site visits from 2012 to 2014. These included management and supervision of bore pumping tests in July and August 2012, management and supervision of trench pumping trials in July to October 2013, and site reconnaissance for scoping studies in March 2014.

2.4.2 Geological Interpretation

The geological setting comprises basement rock of Devonian Horseshoe Bend Shale and Idracowra Sandstone of the Finke Group overlaid by a thin veneer of Quaternary Sediments. The recent cover forms the lake bed sediments comprising silts, clays, sands and evaporite minerals. Material adjacent to the lakes is gypsiferous dunes, and unconsolidated shifting dune sands.

On a broad scale the playa string follows paleodrainage of the Amadeus basin, flanked to the North by outcropping Neoproterozoic sediments of the Amadeus, and to the south by outcropping and thinly covered Proterozoic granite and gneiss of the Musgrave Block.

The deposit is a brine hosted resource. The chemicals of interest, Potassium, Magnesium and Sulphate are dissolved within the brine. The brine is contained within the pores and structural features of the host rock.

Brine is hosted within the lake bed sediments labelled as “Strat Unit 1” in the data sets and in the underlying weathered siltstone of the Horseshoe Bend Shale and Idracowra Sandstone labelled as “Strat Unit 2”.

The geological interpretation is based on logging of aircore, vibracore and sonic core drilling. The inferred geological structure comprises reasonably consistent sedimentary fill over weathered basement rock. Due to the fairly predictable nature of this structure, the geological interpretation can be relied upon with a high degree of confidence.

2.4.3 Relationship between mineralisation widths and intercept lengths

Brine concentration variation with depth was evaluated using data from the 2012 and 2013 aircore drilling campaigns. Brine samples were taken at the end of each drill rod from the inside return at the cyclone. While some vertical contamination can occur during sampling, the brine samples are taken to be adequate to identify trends with depth.

Depth profiles are presented as Appendix A3.1. In general, brine concentration was constant with depth. KLAC117 at Miningere lake was an exception and exhibit an increase with depth from approximately 5,000 to 7800 mg/L.

2.4.4 Estimation and modelling techniques

Area

The brine resource area was constrained by the area of each salt lake. The area of each salt lake is defined by the extent mapped in Geoscience Australia’s 1:250,000 Topographic data set (Geoscience Australia, 2006) and checked against aerial imagery.

Thickness

The Thickness of each stratigraphic unit was calculated by developing a series of gridded surfaces as follows:

1. Collar elevation of all data points was assigned from geoscience Australia's 3 second DEM. This data set has a pixel size of approximately 70 m. The absolute reported accuracy of the DEM is 0.5 m however in flat terrain the shape (relative elevation of adjacent data pixels) is more accurate. All depth measurements were converted to elevation measurements by difference.

2. The water table elevation was calculated data points as the difference between the collar and the reported depth to water. (rSWL.grd).

3. The base of Strat Unit 1 elevation was calculated from vibracore, sonic and aircore drilling data sets as the difference between the collar elevation and depth to the base of the unit. (Strat_1_B.grd).

4. The base of Strat Unit 2 elevation was calculated aircore drilling data sets as the difference between the collar elevation and depth to the base of the drillhole. (Strat_2_B.grd).

5. Thickness of Strat Unit 1 was calculated as the difference between the water table elevation and base of the stratigraphic Unit (Strat_1_Thickness.grd).

6. Thickness of Strat Unit 2 was calculated as the difference between the base of the stratigraphic Unit 1 and the base of Strat Unit 2. (Strat_1_Thickness.grd).

Porosity

There are three measurements of porosity that apply to an aquifer:

- Total Porosity (Pt), and
- Specific Yield, or Drainable Porosity (Sy).
- Specific Retention or Retained Porosity (Sr).

Total Porosity (Pt) is the volume of pores contained within a unit volume of aquifer material. Only part of the porosity may be drained under gravity during the pumping process. This part of the porosity is known as the "specific yield", or sometimes the "drainable porosity" (Sy). A portion of the fluid in the pores is retained as a result of adsorption and capillary forces to the host rock and is known as specific retention (Sr). These parameters are related thus:

$$Pt = Sy + Sr$$

The relationship between Sy and Sr depends largely on lithology (Figure 2.10). In fine-grained sediments Sy << Sr, whereas in coarser-grained sediments Sy >> Sr.

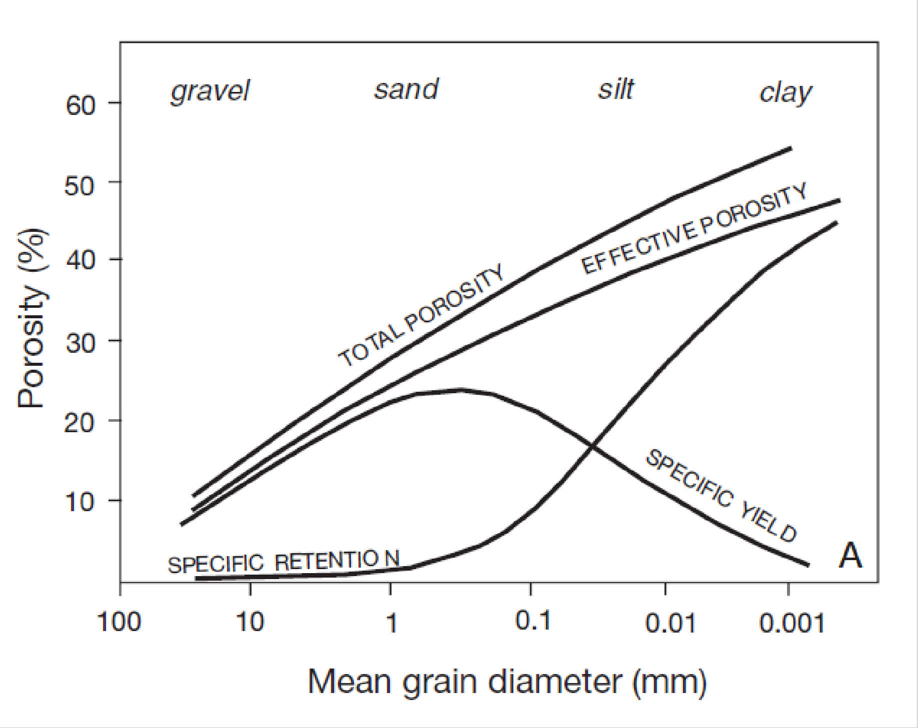


Figure 2.10: Relationship between Porosity measurements and grainsize.

The mineral tonnage is estimated and reported using specific yield as recommended in the AMEC Guidelines for reporting Brine hosted mineral resources. This specific yield hosted mineralisation represents the static free-draining portion of the total porosity mineralisation prior to extraction. It does not take into account the impact of any groundwater recharge or solute transport which increases the amount of extractable brine above the static free-draining component over time.

The mineral tonnage is also estimated using total porosity after application of a modifying factor. A portion of the total porosity mineral tonnage, in addition to the drainable porosity mineral tonnage, is considered to be extractable depending on the transient groundwater flow and transport conditions affecting the mineralisation during extraction. This fraction is reported as the Mineral Resource Estimate. The potassium grade of the Mineral Resource Estimate is effectively the starting grade of the mine plan and is not comparable to the life of mine grade determined for an Ore Reserve.

Total Porosity

In 2013 sediment samples were obtained by sonic drilling. Sample treatment and handling is described in Section 2.3.1. The data are presented in Appendix A2 and Figure 2.11. The median total porosity for Strat 1 and Strat 2 is 33 % and 36 % by volume respectively. These values are used in the mineral resource estimate. No spatial interpolation is undertaken on these parameters, they are applied as a constant value for each stratigraphic unit.

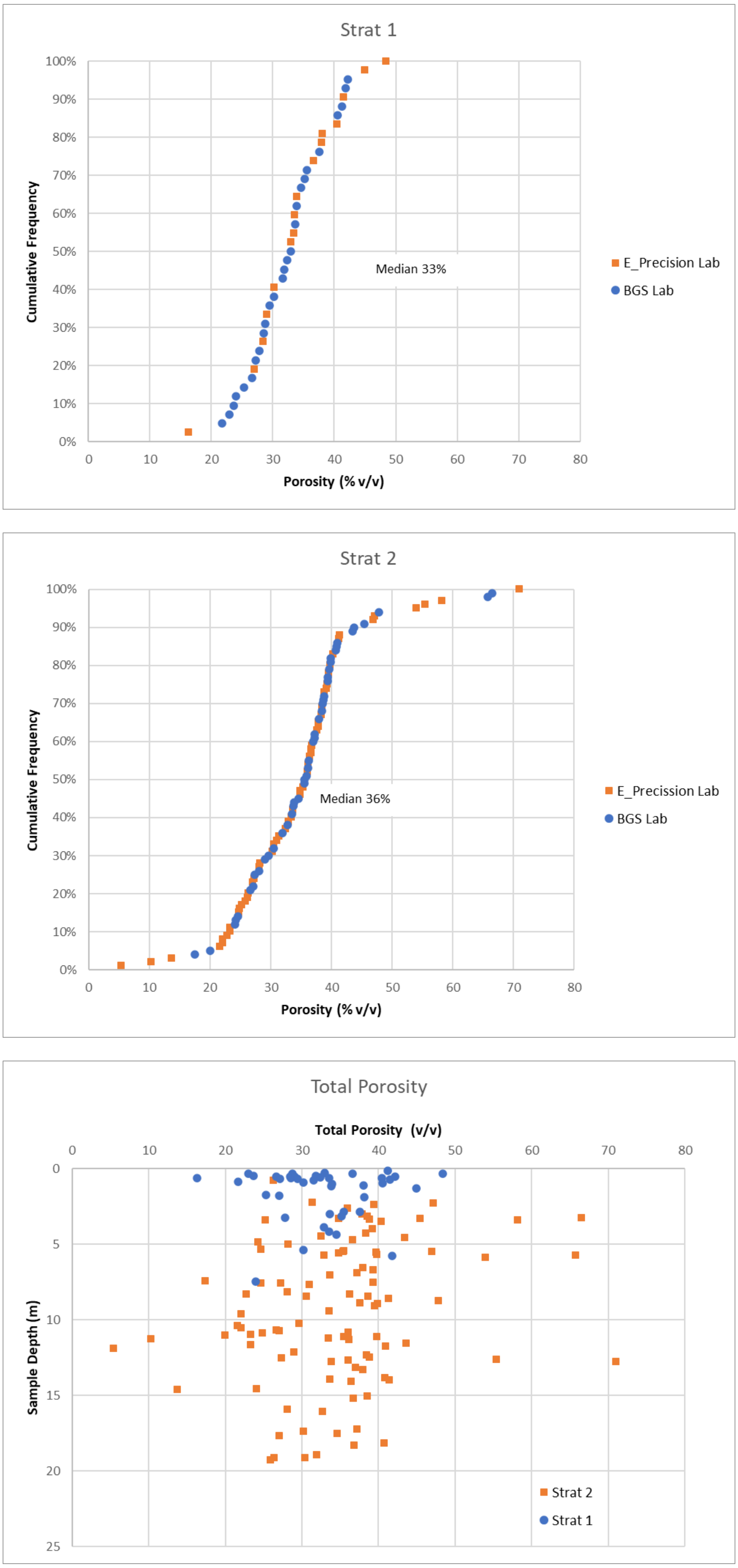


Figure 2.11: Total Porosity Data

<u>Specific Yield</u>

Specific yield has been measured by a range of methods at the Karinga Lakes Project as follows:

> <u>Bore Pumping trials</u>: In 2013 constant rate pumping tests were undertaken at ten bores at Karinga Lakes. Test duration was 24 hours at each bore. Five bores exhibited an un-confined response and the data enabled determination of Specific Yield. Tests in Lake Bed Sediments returned values of 0.14 and 0.16. Tests in siltstone returned values of 0.02, 0.05 and 0.011. Data analysis is reported in Groundwater Science, (2012).
>
> <u>Long term Trench Pumping Trials</u>. Long term (30 day) pumping trial were completed at 3 test trenches and one test bore in 2014. Specific yield determined from the trials ranged from 0.10 and 0.17 in Lake Bed Sediments and 0.02 to 0.10 in siltstone. There is less certainty around the values for Strat 2 since this material was only slightly dewatered and the data analysis not overly sensitive to that parameter. Data analysis is reported in Groundwater Science, (2013).
>
> <u>Laboratory Determination</u>: In 2013 sediment samples were obtained by sonic drilling. Samples were subjected to Sy determination by weighing a saturated sample before and after removal of the drainable pore fluid by centrifuge. 71 samples were analysed.

The full dataset is presented as a cumulative frequency plot on Figure 2.12. Lake bed sediment (Strat 1) exhibits a median value of approximately **0.10** whilst weathered siltstone/sandstone (Strat 2) exhibits a median value of approximately **0.05**. These values are used in the mineral resource estimate. No spatial interpolation is undertaken on these parameters.

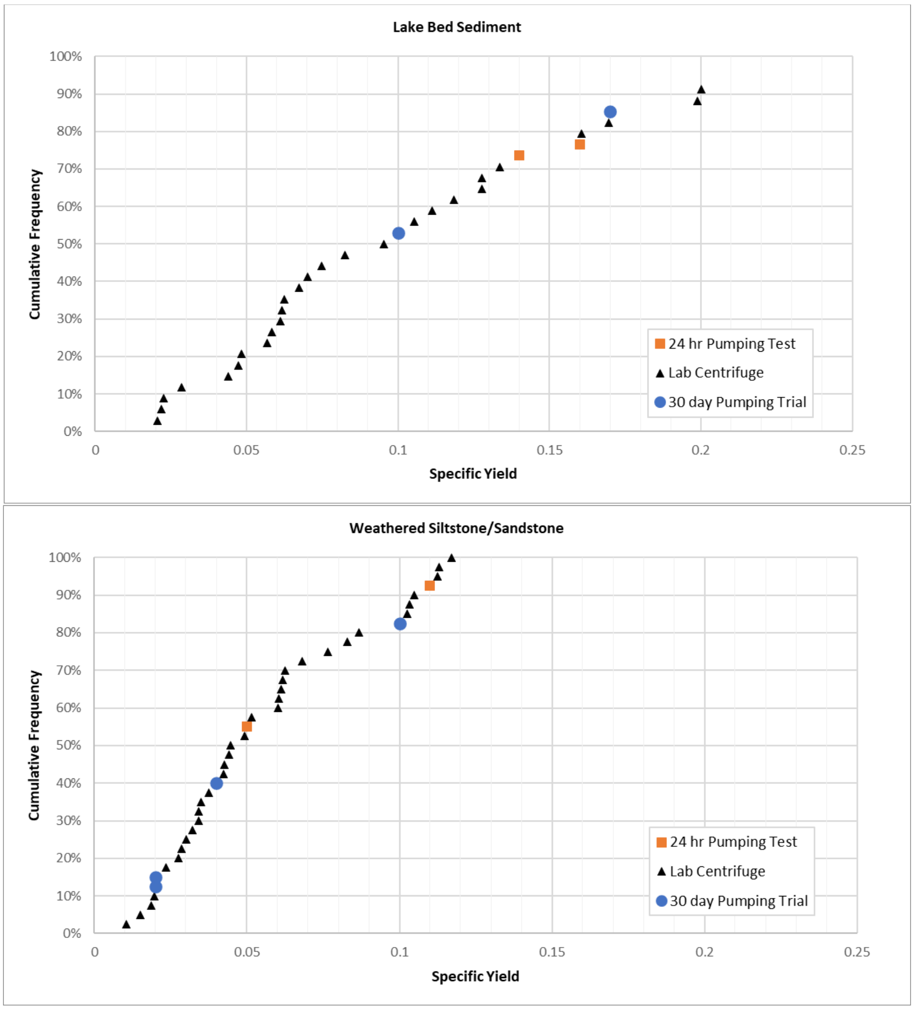


Figure 2.12: Specific yield determination cumulative frequency plots.

Total leachable Potassium content

A set of samples taken from the 2012 sonic drilling campaign were subject to laboratory determination of the total leachable potassium content of the sediment. The sampling and assay methodology is described in Section 2.3.5. Data is presented as Appendix A4

The total leachable potassium was expressed as an equivalent brine concentration (total leachable potassium / total porosity) and compared to assay of brine samples taken from the sonic core holes. The comparison is presented in Figure 2.13. The data are comparable, though noisy. The inference is that the potassium held in total porosity can be leached by contact with distilled water, which is an analogue of leaching with rainfall and run-off recharge which forms the basis of the Total Porosity Mineral Resource Estimate. The laboratory data does represent an ideal situation where all distilled water comes into contact with all of the sediment sample.

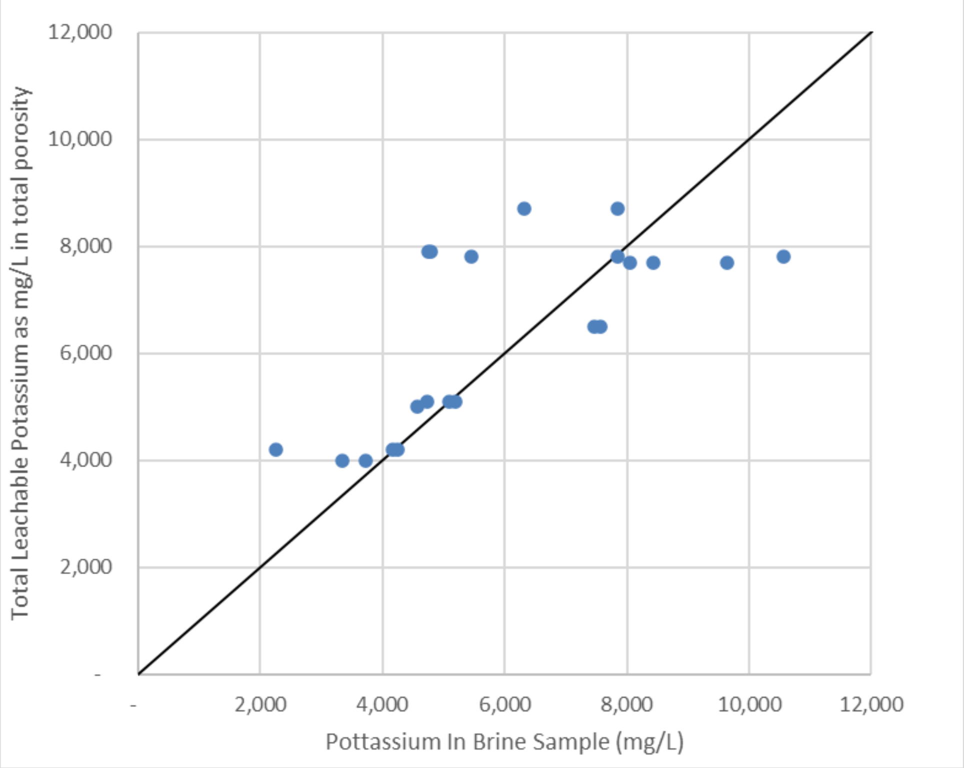


Figure 2.13: Total leachable potassium vs brine samples from Piezometers

Solute Concentration

Solute concentration was determined by assay of brine samples from the drilling and sampling campaigns described in Section 2.3. Sample treatment, Q/A QC and handling is described in Section 2.3.1. The data set is presented as Appendix A3.1.

The data was treated as follows:

- Profiles of brine concentration with depth from air-core drilling indicate that brine concentration is relatively constant with depth. Multiple brine assays from depth intervals sampled during aircore drilling were averaged to provide one average assay value per sample location. All other samples from sonic holes, bores, trenches and hand dug pits were assumed to be a single composite of the full depth of the borehole or excavation. Vertical composites are considered appropriate since the mining method is not vertically selective. All brine will drain to the trenches.

- Spatial distribution of solute concentration was interpolated in 2 dimensions using Ordinary Kriging interpolation using 1500m search radius, minimum 1 data point per sector with one search expansion. Interpolation up to 3000 m is consistent with the conceptual understanding of a relatively homogenous brine resource. The brine resource is generated in-situ by evaporation of a consistent groundwater source which is subject to sporadic mixing and dilution due to infiltration of rainwater, and subsequent re-concentration by evaporation.

Parameter interpolation was checked by querying the interpolated data sets to extract the interpolated value for each data point (drillhole) and analysing the variance.

Table 2.2: Resource Model Validation

Model Parameter	**Average variance (%)**	**Average variance absolute** Positive value is a high interpolated estimate	**Comment**
Potassium concentration	1.7%	83 mg/L	Satisfactory
Top of brine resource	<0.1%	-0.05 mAHD	Satisfactory. Brine surface is very flat and predictable
Base of Unit 1	0.5%	+0.02 mAHD	Satisfactory
Base of Unit 2	23%	4.4 mAHD	Interpolated surface is high (conservative) due to smoothing of variable drillhole depths that define the base of the resource.

Mineral Resource Estimation

The mineral resource estimate for each grid cell was calculated as the product of the brine concentration, volume (stratigraphic unit thickness x cell area) and a constant value for porosity applied to each stratigraphic unit.

The mineral tonnage was calculated using drainable porosity. This represents the static free-draining portion of the Mineral Resource prior to extraction.

The mineral tonnage was also calculated using total porosity and application of a modifying factor. The modifying factor produces the portion of the total porosity hosted mineral tonnage considered to be extractable. On the basis of the production modelling reported in Section 3, a modifying factor of 0.34 is applied to the mineralisation hosted in Total Porosity. This proportion of mineralisation is considered to meet requirements of reasonable prospects of economic recovery and is reported as the Mineral Resource Estimate.

2.4.5 Results

The drainable porosity (or specific yield) mineral tonnage at the Karinga Lake Potash Project comprises 520 kt of potassium as detailed in Table 2.3. This drainable porosity mineral tonnage represents the static free-draining portion of the total porosity mineral tonnage prior to extraction. It does not take into account the impact of any groundwater recharge or solute transport which increases the amount of extractable brine above the static free-draining component over time.

The total porosity hosted Mineral Resource Estimate at the Karinga Lake Potash Project, after application of a modifying factor contains 1,000 kt of potassium as detailed in Table 2.4. This is the portion of the total porosity mineralisation considered to exhibit reasonable prospects for economic extraction based on the transient groundwater flow affecting the deposit during extraction. Rainfall and run-off recharge is particularly relevant to the upper zones of the Mineral Resource and has been assessed as a component of the dynamic hydrogeological modelling which was used to determine the KLPP-PFS mine plan.

The reported Mineral Resource Estimate is inclusive of the drainable porosity fraction of the Mineral Resource.

2.4.6 Discussion of the relative accuracy/confidence

Brine resources are very different to solid mineral resources.

Brine production rate to a bore or trench is proportional to the hydraulic conductivity (permeability) of the host rock. This places a physical limitation on production rate that cannot be exceeded. The production rate will decline over time as the brine resource is depleted in proximity to a bore or trench. The production rate over longer time periods will be dependent on the rate of rainfall and run-of infiltration to the brine aquifer.

The brine concentration reported in the mineral resource is the starting point for production. This concentration will decline over time as the brine body is depleted and replaced by infiltrating recharge from rainfall and run-off and lateral inflow of lower concertation groundwater.

The capacity to mobilise a fraction of the potassium hosted in bound porosity is dependent on chemical equilibration of recharge from rainfall and run-off. The degree of equilibration is assumed from laboratory test work and has inherent uncertainty.

The cumulative effect of these characteristics is that the accuracy and confidence in a brine mineral resource declines with duration of mining. Over time:

- Flow rate will decline and is dependent on variable and uncertain recharge.
- Brine grade will decline and is dependent on variable and uncertain recharge.
- The final proportion of the resource that can be recovered is dependent on chemical equilibration of recharge and on the duration of mining.

The Resource is classified as an Indicated Resource on the basis that the estimate is adequate to inform mine planning (production modelling as described in Section 3).

2.4.7 Results

Table 2.3: Mineral Tonnage – Drainable Porosity

Lake			Strat 1					Strat 2					**Total**
Lake	Area (km^2)	K Average (kg/m^3)	Thickness (m)	Bulk Volume (Mm^3)	Drainable Porosity	Brine Volume (Mm^3)	Potassium Tonnage (kt)	Thickness (m)	Bulk Volume (Mm^3)	Drainable Porosity	Brine Volume (Mm^3)	Potassium Tonnage (kt)	**Potassium Tonnage (kt)**
Corkwood	2.1	4.2	5.0	10.5	0.10	1.0	4.4	10.4	21.9	0.05	1.1	4.6	**9.0**
Curtin Boundary	5.2	4.3	2.2	11.2	0.10	1.1	4.9	17.5	90.1	0.05	4.5	19.5	**24**
Curtin North	14.3	3.4	2.8	40.3	0.10	4.0	13.9	17.5	249.8	0.05	12.5	43.1	**57**
Curtin West	1.0	5.7	5.2	5.4	0.10	0.5	3.1	12.6	13.0	0.05	0.7	3.7	**6.8**
Erldunda Boundary	10.2	3.3	1.0	10.0	0.10	1.0	3.3	10.5	107.3	0.05	5.4	17.9	**21**
Highway	3.0	3.1	0.8	2.5	0.10	0.3	0.8	14.7	44.2	0.05	2.2	6.8	**7.5**
Island 2	0.6	6.5	5.1	2.9	0.10	0.3	1.9	13.3	7.6	0.05	0.4	2.5	**4.4**
Island 4	1.4	5.2	4.3	6.2	0.10	0.6	3.2	13.9	19.9	0.05	1.0	5.2	**8.4**
Island 1	0.8	8.2	5.9	4.5	0.10	0.4	3.7	10.5	8.0	0.05	0.4	3.3	**6.9**
Island 5	0.7	5.3	5.2	3.6	0.10	0.4	1.9	14.1	9.7	0.05	0.5	2.6	**4.5**
Jetts	1.7	2.4	4.5	7.7	0.10	0.8	1.8	10.5	18.0	0.05	0.9	2.1	**4.0**
Lyndavale West	18.6	3.2	8.8	162.9	0.10	16.3	52.8	9.0	168.0	0.05	8.4	27.3	**80**
Main North Road	3.9	4.7	5.3	21.0	0.10	2.1	9.8	8.0	31.7	0.05	1.6	7.4	**17**
Mallee Well East	4.1	6.1	2.6	10.7	0.10	1.1	6.5	9.6	39.3	0.05	2.0	12.0	**18**
Miningere	7.8	7.7	3.0	23.9	0.10	2.4	18.4	16.1	126.2	0.05	6.3	48.7	**67**
Miningere West	3.0	5.6	2.3	6.9	0.10	0.7	3.9	21.6	64.4	0.05	3.2	18.0	**22**
Murphys	2.7	3.8	10.7	29.0	0.10	2.9	11.1	0.3	0.8	0.05	0.0	0.1	**11**
Mygoora South	1.2	4.8	1.2	1.5	0.10	0.1	0.7	10.6	12.7	0.05	0.6	3.0	**3.7**
Mygoora North	10.1	2.9	2.3	23.6	0.10	2.4	6.8	7.9	79.8	0.05	4.0	11.5	**18**
Pulcurra	5.8	3.9	4.7	27.3	0.10	2.7	10.8	10.9	63.1	0.05	3.2	12.4	**23**
Skinny	4.1	4.1	2.1	8.5	0.10	0.9	3.5	18.3	74.8	0.05	3.7	15.2	**19**
Swansons	8.8	4.3	7.1	62.8	0.10	6.3	27.1	10.1	89.0	0.05	4.5	19.2	**46**
Swansons North	9.0	3.3	2.2	19.6	0.10	2.0	6.5	16.1	145.0	0.05	7.3	24.0	**31**
Minskin	4.4	3.4	2.9	12.8	0.10	1.3	4.3	13.6	59.5	0.05	3.0	10.0	**14**
Total	125												**520**

Notes: 1) This drainable porosity hosted mineral tonnage represents the static free-draining portion of the total porosity hosted mineral tonnage prior to extraction. It does not take into account the impact of any groundwater recharge or solute transport which increases the amount of extractable brine above the static free-draining component over time.

Table 2.4: Mineral Resource Estimate – Total Porosity

Lake			Strat 1					Strat 2					Total		
Lake	Area (km^2)	K Average (kg/m^3)	Thickness (m)	Bulk Volume (Mm^3)	Total Porosity	Brine Volume (Mm^3)	Potassium Tonnage (kt)	Thickness (m)	Bulk Volume (Mm^3)	Total Porosity	Brine Volume (Mm^3)	Potassium Tonnage (kt)	Potassium Tonnage[1] (kt)	Reasonable Prospects Modifier[2]	**Mineral Resource Estimate[3]** (kt)
Corkwood	2.1	4.2	5.0	10.5	0.33	3.4	15	10.4	22	0.36	7.9	33	48	0.34	16
Curtin Boundary	5.2	4.3	2.2	11.2	0.33	3.7	16	17.5	90	0.36	32.4	140	160	0.34	54
Curtin North	14.3	3.4	2.8	40.3	0.33	13.3	46	17.5	250	0.36	89.9	310	360	0.34	122
Curtin West	1.0	5.7	5.2	5.4	0.33	1.8	10	12.6	13	0.36	4.7	27	37	0.34	13
Erldunda Boundary	10.2	3.3	1.0	10.0	0.33	3.3	11	10.5	107	0.36	38.6	129	140	0.34	48
Highway	3.0	3.1	0.8	2.5	0.33	0.8	3	14.7	44	0.36	15.9	49	51	0.34	17
Island 2	0.6	6.5	5.1	2.9	0.33	1.0	6	13.3	8	0.36	2.7	18	24	0.34	8.2
Island 4	1.4	5.2	4.3	6.2	0.33	2.0	11	13.9	20	0.36	7.2	37	48	0.34	16
Island 1	0.8	8.2	5.9	4.5	0.33	1.5	12	10.5	8	0.36	2.9	23	36	0.34	12
Island 5	0.7	5.3	5.2	3.6	0.33	1.2	6	14.1	10	0.36	3.5	19	25	0.34	8.5
Jetts	1.7	2.4	4.5	7.7	0.33	2.6	6	10.5	18	0.36	6.5	15	21	0.34	7.1
Lyndavale West	18.6	3.2	8.8	162.9	0.33	53.7	174	9.0	168	0.36	60.5	196	370	0.34	126
Main North Road	3.9	4.7	5.3	21.0	0.33	6.9	32	8.0	32	0.36	11.4	53	85	0.34	29
Mallee Well East	4.1	6.1	2.6	10.7	0.33	3.5	22	9.6	39	0.36	14.1	86	110	0.34	37
Miningere	7.8	7.7	3.0	23.9	0.33	7.9	61	16.1	126	0.36	45.4	351	410	0.34	139
Miningere West	3.0	5.6	2.3	6.9	0.33	2.3	13	21.6	64	0.36	23.2	130	140	0.34	48
Murphys	2.7	3.8	10.7	29.0	0.33	9.6	37	0.3	1	0.36	0.3	1	38	0.34	13
Mygoora South	1.2	4.8	1.2	1.5	0.33	0.5	2	10.6	13	0.36	4.6	22	24	0.34	8.2
Mygoora North	10.1	2.9	2.3	23.6	0.33	7.8	22	7.9	80	0.36	28.7	82	100	0.34	34
Pulcurra	5.8	3.9	4.7	27.3	0.33	9.0	36	10.9	63	0.36	22.7	89	120	0.34	41
Skinny	4.1	4.1	2.1	8.5	0.33	2.8	11	18.3	75	0.36	26.9	110	120	0.34	41
Swansons	8.8	4.3	7.1	62.8	0.33	20.7	89	10.1	89	0.36	32.1	138	230	0.34	78
Swansons North	9.0	3.3	2.2	19.6	0.33	6.5	21	16.1	145	0.36	52.2	173	190	0.34	65
Minskin	4.4	3.4	2.9	12.8	0.33	4.2	14	13.6	60	0.36	21.4	72	86	0.34	29
Total	125														**1000**

Notes: 1) The total porosity tonnage is not presented as a mineral resource estimate. Only a proportion of the mineralisation might be recovered by mining.

2) The reasonable prospects modifier is that proportion of the total porosity resource for which there are reasonable prospects for economic recovery. This proportion is based on simulation of a 15 year production duration and incorporates recharge and dilution of brine by rainfall and run-off recharge.

3) The Mineral Resource Estimate is that proportion of the total mineralisation for which there are reasonable prospects for economic recovery. It is not reported as an Ore Reserve since a mine plan and schedule has not been developed to incorporate all Lakes.

2.4.8 Mining factors or assumptions

Mining factors and assumptions are described in Section 3. Mining is assumed to occur by gravity drainage to trenches excavated into the lake surface and oriented axial to each lake.

2.4.9 Metallurgical factors or assumptions

No metallurgical factors or assumptions have been applied.

The brine is characterised by elevated concentration of potassium, magnesium and sulphate elements while distinctly deficient in calcium ions. Such a chemical makeup is considered highly favourable for efficient recovery of Schoenite containing potassium enriched mixed salts from the lake brines (the main feedstock for SOP production), using conventional evaporation methods.

2.4.10 Environmental factors or assumptions

Environmental impacts are expected to be: localized reduction in saline groundwater level, surface disturbance associated with trench, bore, and pond construction and accumulation of salt tails. The project is in a remote area and these impacts are not expected to prevent project development.

2.4.11 Further Work

Further work should address the uncertainties of brine production over time detailed in Section 2.4.6 . A detailed discussion of further work is presented in Section 3.4.7.

3 Production Planning

3.1 Overview

Production planning and simulation has been undertaken to provide an estimated yield from production trenches to inform the production design. The production plan comprises the trench layout and production schedule.

The production plan does not comprise a Ore Reserve.

3.2 Trench Layout and Design

3.2.1 Trench Layout

The Trench Layout comprises a single trench axial to each lake orientation (Figure 3.13). The rationale for this layout is the relationship between aquifer transmissivity and estimated recharge. The trench spacing is designed to provide sufficient hydraulic gradient to the trench to convey all recharge to the trench (Figure 3.1).

Trenches are planned with a nominal water level at 6 m depth.

Optimal trench spacing (L) can be calculated as a function of:

- aquifer transmissivity (T),
- recharge infiltration rate (I) and
- trench depth (D)

where:

L = Sqrt (T x D /I)

Spacing between trenches will be 2 x L, while spacing from the lake edge will be L.

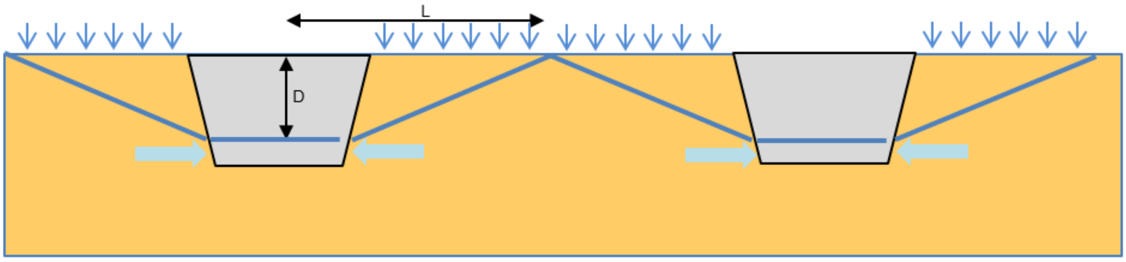


Figure 3.1: Trench Spacing

Estimated available recharge approximates 146 mm/year (0.0004 m/day) and total aquifer Transmissivity averages 140 m^2/day. The concomitant value of L is 1450 m. All lakes are less than 3000 m wide. This means that a single trench axial to the lake will meet the optimum spacing requirement.

3.2.2 Trench Design

A nominal trench design is presented as Figure 3.3. This design is taken from equivalent studies at other lakes and is not based on site specific geotechnical design. Total trench depth will range from 6 to 8 m. The designed brine level in the trench is 6 m below surface, minimum brine depth at the base of the trench is 0.65 m and the trenches will require up to 1.3 m fall from one end of the lake to another (0.1 m per km).

The likely process to excavate to 6-8 m based on experience at other lakes involves the removal of the friable upper 2 m of lakebed sediments using a 20-tonne amphibious excavator. Once a stable platform is achieved then the trench is excavated to 8 m depth using a 36-tonne standard excavator. Boards are used for stabilisation (see Figure 3.2 below).

Figure 3.2: Trench Excavation (T Swiericzuk, Feb 2020)

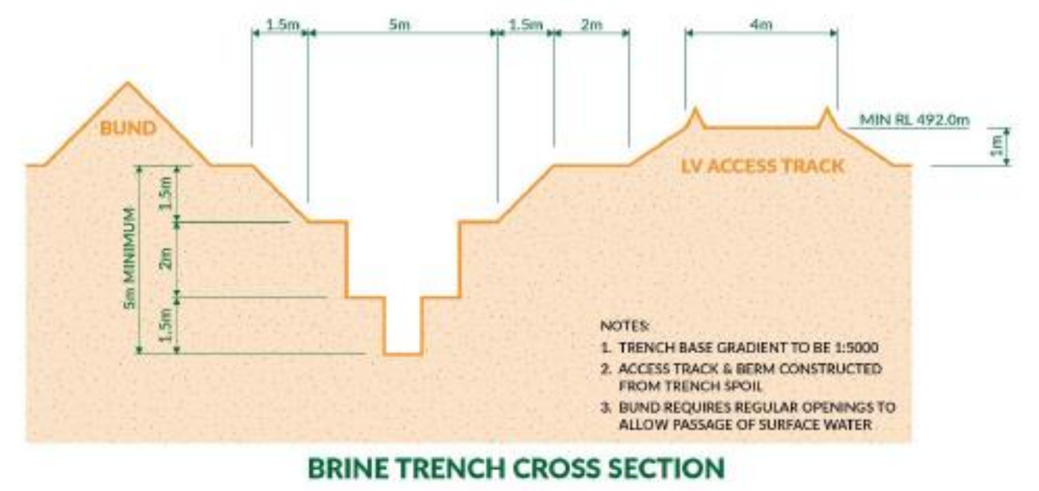


Figure 3.3: Nominal Trench Design (SO4 ASX 13/6/2019)

3.2.3 Trench Hydraulic Gradient

The hydraulic gradient required to maintain brine flow has been calculated using the Manning equation as follows:

- The maximum design flow rate is 750 m^3/hour (0.2 m^3/sec)
- A conservative target velocity is 0.15 m/s to minimise friction

- Roughness coefficient is 0.03 (unitless) consistent with a channel excavated into earth with moderate irregularity (moderately eroded or sloughed channel side slopes)
- The channel is a maximum 2 m wide at base and minimum brine depth is 0.65 m.

The required gradient is 0.1 m per km.

3.3 Production Model

3.3.1 Model Objectives

Brine production from each playa lake has been simulated. The model objective is to provide an estimate of the brine flow rate over time and the brine concentration over time for each lake.

3.3.2 Hydrogeological Conceptualisation

Overview

The hydrogeological conceptual model of the lakes comprises a 2-layer system. The upper layer is the Lake Bed Sediment (LBS), characterised as a high hydraulic conductivity aquifer with high specific yield and moderate total porosity. Underlying the LBS is the weathered Horseshoe Bend Shale formation (Described in the data tables as “Strat 2”). The depth of this unit is defined as the limit of drilling. The rational is that the low intensity drilling method (small rig aircore and vibracore) is constrained by the depth of weathering. Unit thicknesses are taken from the resource model.

Removal of water by evapotranspiration occurs at a rate of 0.004 m/day and is based on the observed rates of water removal in the data sets presented in Section 3.3.3. The ET extinction depth is 0.6 m below surface based on the observed depth to water table logged after extended dry periods.

Recharge is applied at a constant rate of 0.0004 m/day (146 mm/yr) and is based on the annual average available recharge calculated from the rainfall data presented in Section 3.3.3.

The trench removes brine from the system by gravity drainage. Some proportion of the removed water is replaced by recharge. Recharge adds water to the system but not solute. Over time the rate of drainage from the trench reaches a steady state equilibrium with the rate of recharge. However, the solute concentration continues to decline over time as brine is replaced by recharge.

Hydraulic Conductivity and Transmissivity

Hydraulic conductivity is the capacity of a porous material to conduct water in response to a pressure gradient. Transmissivity is the production of the hydraulic conductivity of a material and its thickness. Most in-situ tests (pumping tests) return a value of transmissivity. This is then divided by the bed thickness to derive hydraulic conductivity of the material. These parameters have been determined for the Karinga Lakes Project by bore and trench pumping trials. The results are presented as Table 3.1.

Transmissivity of the Lake Bed Sediment (LBS) aquifer measured through pumping tests ranges from 96 to 431 m^2/day with a geometric mean of 133 m^2/day. The concomitant range of hydraulic conductivity is 1 to 81 m/day with a geometric mean of 25 m/day.

Transmissivity of the underlying siltstone (Strat 2) aquifer measured through pumping tests ranges from 1.5 to 240 m^2/day with a geometric mean of 39 m^2/day. The concomitant range of hydraulic conductivity is 0.2 to 80 m/day with a geometric mean of 3 m/day.

The measured hydraulic conductivity generally exceeds the values expected for the observed lithology which comprises mainly fine-grained material: silty and clayey sands with evaporite minerals including gypsum overlying highly weathered siltstone. The high measured hydraulic conductivity is attributed to void spaces created by formation of evaporite minerals through in-situ precipitation and displacement of sediments and shrinkage fissures. The hypothesis is supported by observations during trench pumping of preferential flow through layers of gypsum crystals in lakebed sediment and also through weathering structures in the underlying siltstone unit.

Table 3.1: Hydraulic Conductivity and Transmissivity

Test Site	Depth From (m)	Depth to (m)	Lake	Geological Unit	K (m/day)	T m^2/day
KLAC048	0	14.5	Island 5	LBS	25	368
KLAC051	0	12.7	Island 4	LBS	13	165
KLAC029	0	2.5	Murphy's	LBS	35	88
KLAC089	0	5.3	Mallee Well East	LBS	81	431
KLAC060	0	8.5	Island 1	LBS	4	37
Pulcura_Trench	0	4	Pulcura	LBS	23	92
KLAC048 30 day trial	0	1.5	Island 5	LBS	80	96
Stat 1 Geomean					**25**	**133**
KLAC063	0	13.5	Curtin Boundary	SltS	12	163
KLAC068	0	11.5	Skinny	SltS	6	72
KLAC088	0	24	Curtin North	SltS	1	27
KLAC033	0	14.5	Miningere	SltS	8	119
KLAC082	0	17.5	Miningere West	SndS	4	71
Curtin Boundary_Trench	0	3	Curtin Boundary	SltS	0.5	1.5
Curtin Boundary_Trench_Structure	0	3	Curtin Boundary	SltS	80	240
Curtin Boundary_Trench_Structure	3	20	Curtin Boundary	SltS	5	85
Curtin Boundary_Trench	3	20	Curtin Boundary	SltS	0.2	3.4
Miningere_Trench zone1	0	20	Miningere	SltS	0.4	8
Miningere_Trench zone 2	0	20	Miningere	SltS	11	220
Pulcura_Trench	2	20	Pulcura	SltS	0.25	4
KLAC048 30 day trial	1.5	15	Island 5	SltS	18	210
Strat 2 Geomean					**3**	**39**

Total Porosity

A total porosity implemented in the production model for Strat 1 and Strat 2 is 33 % and 36 % by volume respectively.

Specific Yield

Lake bed sediment (Strat 1) is modelled with a value of **0.10** whilst weathered siltstone/sandstone (Strat 2) is modelled with a value of **0.05**.

3.3.3 Rainfall Recharge

Overview

Recharge of the brine resource by rainfall infiltration is a significant component of the production plan. The rainfall does not add K to the resource, but adds water, which mobilises a proportion of the K that is bound in retained porosity.

An estimate of recharge under natural conditions has been developed based on the relationship between rainfall and water table fluctuation in the LBS aquifer.

Data Capture

A data set has been collected from 29/4/2015 to 14/9/2016 that reports

- water table fluctuation in the LBS aquifer, measured by data logging pressure transducers installed into piezometers (Data was corrected for barometric pressure and brine density), and

- Site specific rainfall measured by data logging tipping bucket rain gauges.

Figure 3.4: Rainfall Recharge Logging Site

Five sites were established, of these 3 were used for analysis. Details are provided below in the table below.

Table 3.2: Rainfall recharge logging sites

Lake	Discussion
Miningere	Data suited for use
Lyndavale West	Data suited for use
Curtin Boundary	Data suited for use
Miningere West	Rain Gauge failed. Data not available
Skinny	Rain Gauge failed. Data not available
Swanson’s	Piezometer leaking from surface indicated by excessive water level peaks and rapid temperature changes in response to rainfall. Data not suitable for analysis.

Cumulative rainfall data is presented in Figure 3.5. The data shows that rainfall between the sites is comparable. The accumulated rainfall over the period of record ranges from 300 mm at Lyndavale West to 356 mm at Miningere. Each site records roughly comparable weather events but the size of each event varies between sites. Curtin Springs BOM station also reports roughly comparable rainfall, with similar site-specific event variability.

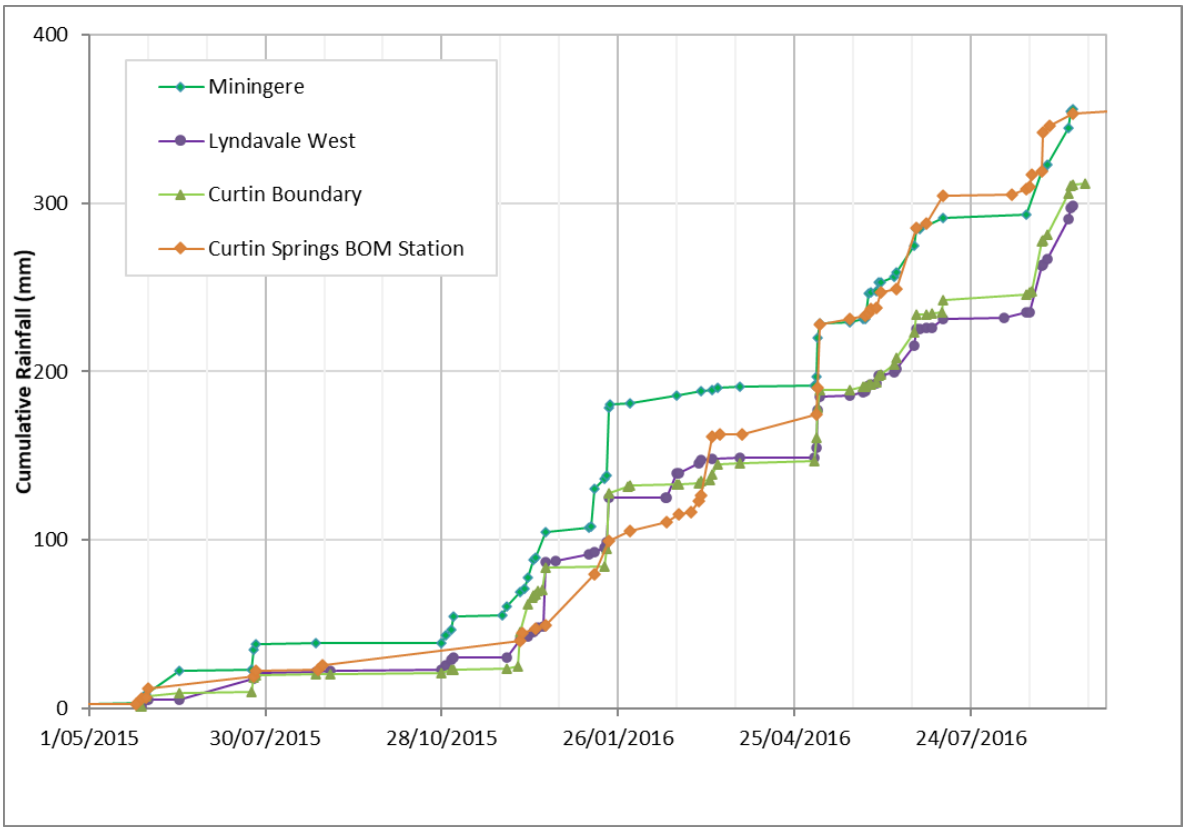


Figure 3.5: Accumulated Rainfall Data

Hydrographs of rainfall, brine level below playa surface and brine temperature in the piezometer are presented in Figure 3.6, Figure 3.7 and Figure 3.8. The dynamics illustrated by the data set are annotated on Figure 3.9 and described as follows:

- Brine levels slowly decline due to removal of water due to capillary rise and evaporation from surface and near surface. The rate is reasonably consistent at 0.00016 m/day calculated as the product of the rate of decline and specific yield of 0.10.
- Rainfall events typically larger that 1 mm per day infiltrate to the water table and cause marked water table rise.
- Large rainfall events cause significant recharge and water table rises above the playa surface. Ponded water is now present on the playa.
- Ponded water evaporates at a fixed rate until the surface of the playa is reached. The summer rate is approximately 0.009 m/day and the winter rate is approximately 0.004 m/day.
- The measured rate of decline increases below the surface since the fraction of water removed (specific yield) is only 0.1 of the total volume.
- The rate of decline then slows as the brine level deepens and the rate of capillary rise and evaporation slows.

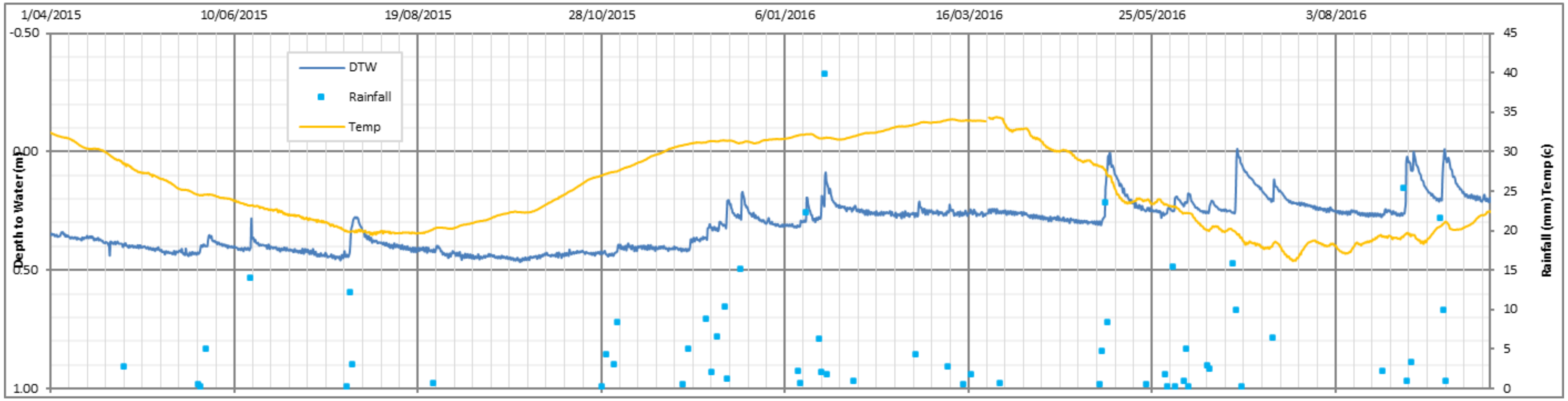


Figure 3.6: Miningere Rainfall and Brine Level Hydrograph

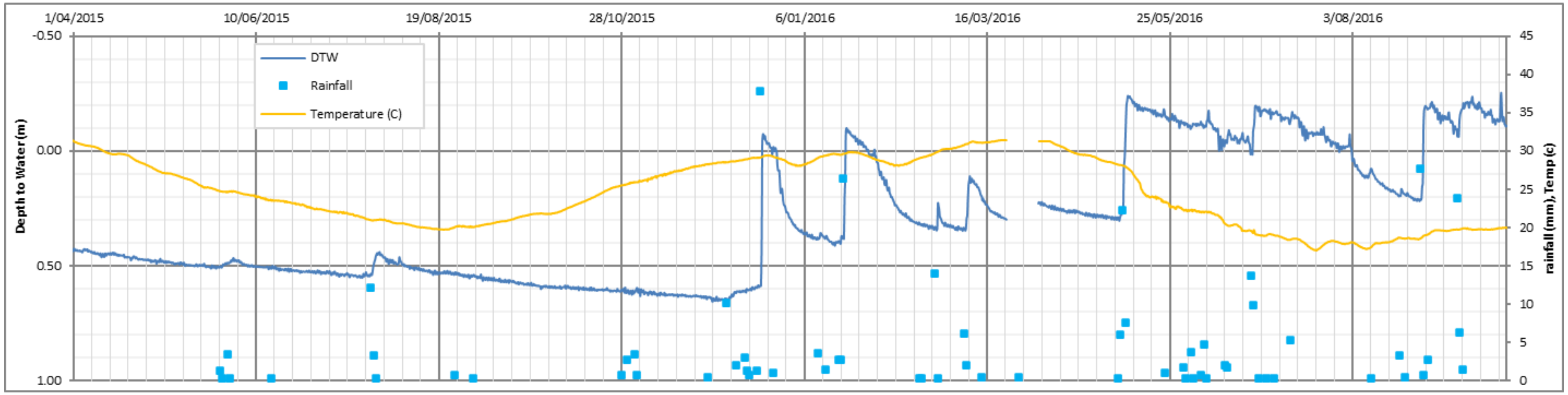


Figure 3.7: Lyndavale West Rainfall and Brine Level Hydrograph

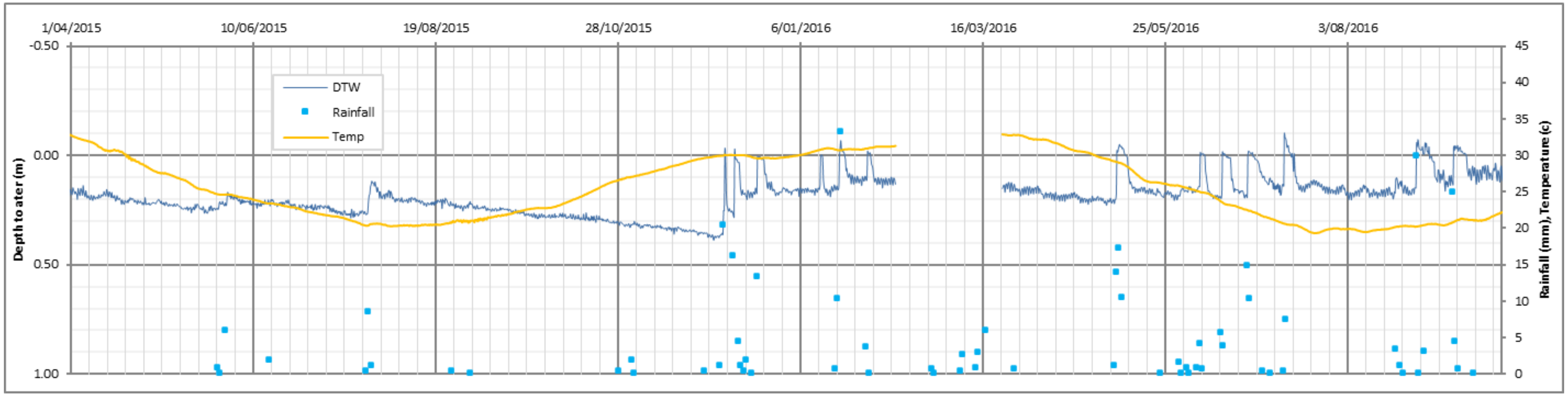
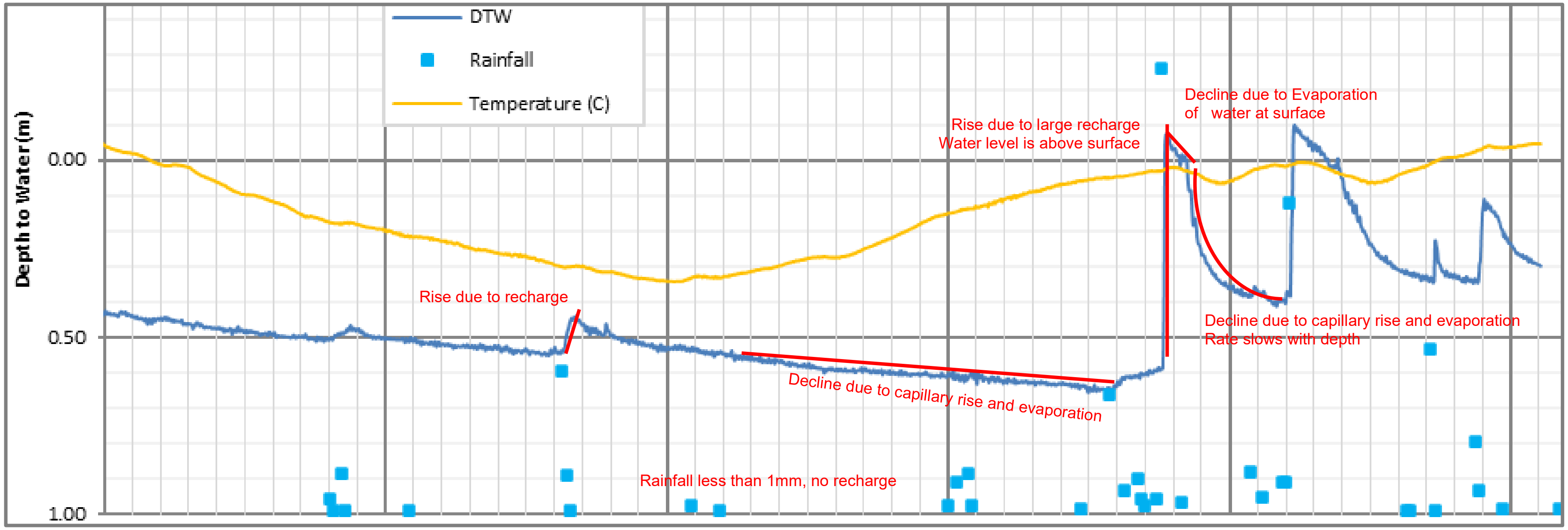


Figure 3.8 Curtin Boundary Rainfall and Brine Level Hydrograph



Rise due to large recharge
Water level is above surface

Decline due to Evaporation
of water at surface

Rise due to recharge

Decline due to capillary rise and evaporation
Rate slows with depth

Decline due to capillary rise and evaporation

Rainfall less than 1mm, no recharge

Figure 3.9: Lyndavale West Rainfall and Brine Level Hydrograph - Annotated to show dynamics

Recharge Model Development

Recharge was analysed by determining the water table rise for each rainfall event. Consecutive days of rainfall were treated as a single rainfall event. Recharge for each event was calculated as the product of the water table rise, and the specific yield of the Lakebed Sediment. The specific yield applied in the calculation is 0.10.

A model was then developed to relate rainfall event to recharge in the form of:

Available Recharge = (Rainfall - Wetting threshold) x Infiltration Coefficient

The data is presented as **Figure 3.10** and Table 3.3. The parameters that best fit the data are:

- Wetting threshold of 1 mm per rainfall event.
- Infiltration coefficient of 0.85.

Instances where the water level is above the lake surface are not amenable to the method and are not included in the method. There is an anomalous series of rainfall events around the 28/10/2015 that produced no recharge at two lakes and do not fit the model. A possible explanation is an unusually warm, windy series of days with high evaporation, and low rainfall intensity such that rainfall was removed from the surface by evaporation whilst still being recorded by the rain gauge.

The model fits the data quite well (**Figure 3.10**, Table 3.3). The 1 mm threshold is quite consistent. The model slightly underestimates recharge from small events less than 8 mm and overestimates larger events. The totals for the period of record match very well at the Lyndavale West and Miningere sites. At the Curtin Boundary site, the generally model underpredicts recharge, this site is characterised by frequent flooding which reduces the number of events suited for analysis.

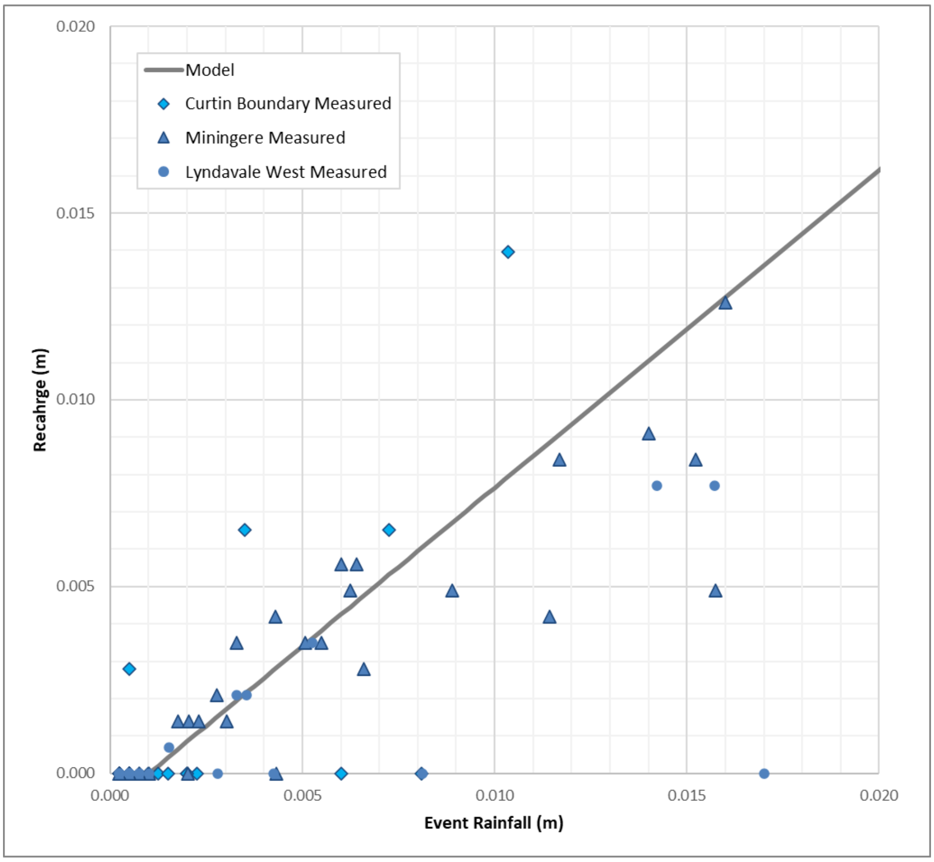


Figure 3.10: Measured Recharge vs event rainfall

Table 3.3: Rainfall Event size and calculated recharge

Lyndavale West				Miningere				Curtin Boundary			
Event Date	Rainfall	Measured Recharge	Model Recharge	Event Date	Rainfall	Measured Recharge	Model Recharge	Event Date	Rainfall	Measured	Model
31/05/2015	0.005	0.004	0.003	30/05/2015	0.006	0.006	0.003	30/05/2015	0.007	0.00651	0.005
16/06/2015	0.0003	0.000	0.000	16/06/2015	0.014	0.009	0.008	16/06/2015	0.002	0	0.001
26/07/2015	0.016	0.008	0.010	25/07/2015	0.016	0.013	0.010	25/07/2015	0.010	0.01395	0.008
25/08/2015	0.001	0.000	0.000	28/10/2015	0.0003	0.000	0.000	25/08/2015	0.001	0.00279	0
1/09/2015	0.0003	0.000	0.000	30/10/2015	0.004	0.000	0.002	1/09/2015	0.0003	0	0
28/10/2015	0.001	0.000	0.000	3/11/2015	0.011	0.004	0.007	28/10/2015	0.001	0	0
30/10/2015	0.003	0.000	0.001	28/11/2015	0.001	0.000	0.000	3/11/2015	0.002	0	0.001
3/11/2015	0.004	0.000	0.002	30/11/2015	0.005	0.004	0.003	30/11/2015	0.001	0	0
30/11/2015	0.001	0.000	0.000	7/12/2015	0.009	0.005	0.005	7/12/2015	0.022	Flooded	
16/12/2015	0.017	Lake Flooded		9/12/2015	0.002	0.000	0.001	16/12/2015	0.025		
20/12/2015	0.039	Lake Flooded		11/12/2015	0.007	0.003	0.004	18/12/2015	0.0003		
25/12/2015	0.001	0.000	0.000	15/12/2015	0.012	0.008	0.007	20/12/2015	0.014		
11/01/2016	0.004	0.002	0.002	20/12/2015	0.015	0.008	0.009	21/01/2016	0.044		
14/01/2016	0.002	0.001	0.000	12/01/2016	0.003	0.001	0.001	1/02/2016	0.004		
21/01/2016	0.032	Lake Flooded		14/01/2016	0.022	0.007	0.014	26/02/2016	0.001	No Water Level Data	
20/02/2016	0.001	0.000	0.000	22/01/2016	0.050	Lake Flooded		8/03/2016	0.003	Flooded	
26/02/2016	0.014	0.008	0.009	1/02/2016	0.001	0.000	0.000	14/03/2016	0.004		
8/03/2016	0.008	Lake Flooded		25/02/2016	0.004	0.004	0.002	17/03/2016	0.006		
14/03/2016	0.001	0.000	0.000	8/03/2016	0.003	0.002	0.001	28/03/2016	0.001	0	0
28/03/2016	0.001	0.000	0.000	14/03/2016	0.001	0.000	0.000	8/05/2016	0.043	Flooded	
8/05/2016	0.036	Lake Flooded		17/03/2016	0.002	0.001	0.001	23/05/2016	0.0003	0	0
23/05/2016	0.001			28/03/2016	0.001	0.000	0.000	31/05/2016	0.002	0	0.001
31/05/2016	0.002			8/05/2016	0.037	0.021	0.024	3/06/2016	0.001	0	0.000
3/06/2016	0.004			23/05/2016	0.001	0.000	0.000	8/06/2016	0.006	Flooded	
8/06/2016	0.006			31/05/2016	0.002	0.001	0.001	16/06/2016	0.010		
16/06/2016	0.004			3/06/2016	0.016	0.005	0.010	26/06/2016	0.025		
26/06/2016	0.024			8/06/2016	0.006	0.005	0.003	1/07/2016	0.001	0	0
28/06/2016	0.0003			16/06/2016	0.006	0.004	0.003	4/07/2016	0.0003	0	0
1/07/2016	0.0003			26/06/2016	0.026	0.019	0.016	10/07/2016	0.008	Flooded	
4/07/2016	0.0003			28/06/2016	0.0003	0.000	0.000	21/08/2016	0.004	0.00651	0.002
10/07/2016	0.005			10/07/2016	0.006	0.006	0.004	24/08/2016	0.002	Flooded	
10/08/2016	0.0003	0.000	0.000	21/08/2016	0.002	0.001	0.001	1/09/2016	0.034	Flooded	
21/08/2016	0.003	0.002	0.001	30/08/2016	0.026	0.018	0.017	14/09/2016	0.030	Flooded	
23/08/2016	0.001	0.000	0.000	1/09/2016	0.003	0.004	0.001	20/09/2016	0.0003	0	0
30/08/2016	0.028	Lake Flooded		14/09/2016	0.033	0.014	0.020	**Total**		**0.030**	**0.018**
1/09/2016	0.003			**Total**		**0.172**	**0.177**				
14/09/2016	0.032										
Total		**0.024**	**0.028**								

Long-term available recharge estimate

The available recharge (AR) equation defined above has been used to calculate the long-term available recharge. The daily rainfall record from Curtin Spring BOM station was used from 1953 to 2019. The wetting threshold and infiltration coefficient were 1 mm and 0.85 mm respectively. Consecutive days of rainfall were accumulated as a single event.

The total AR for each year was collated and is presented as Figure 3.11 . A cumulative frequency plot is presented as Figure 3.12. AR ranges from zero in 1954 to 660 mm in 1974 when 813 mm rainfall was recorded in one year. The annual average AR is 180 mm however this value is skewed by rare large events. The median AR is 154 mm/year. 72 percent of years exhibit AR of greater than 100 mm/year.

Figure 3.11: Rainfall and Potential Recharge – Curtin Springs 1954 – 2019.

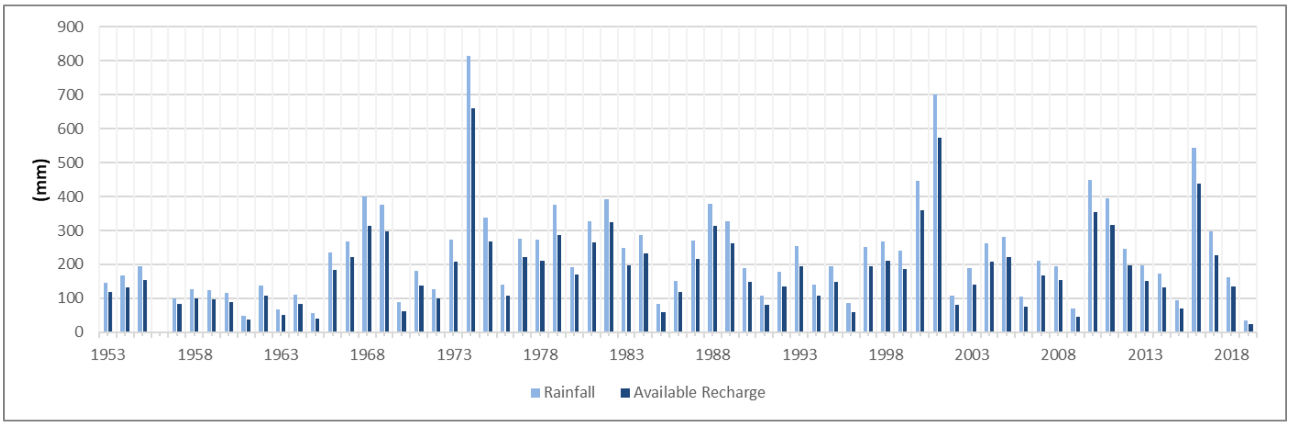
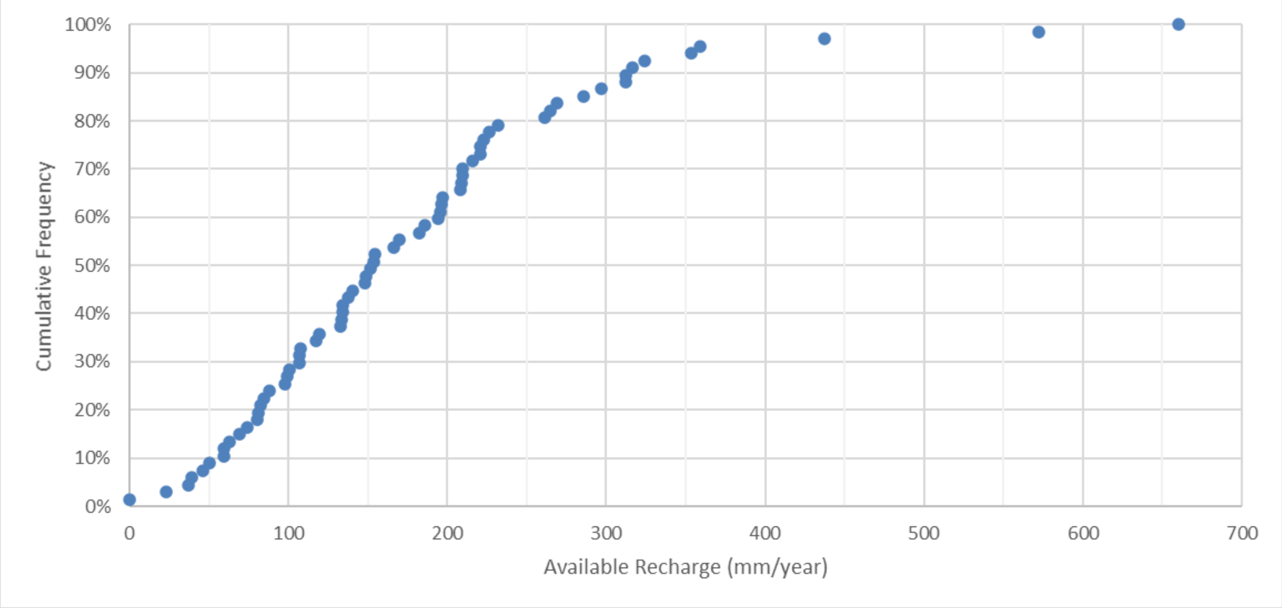


Figure 3.12: Potential Recharge, Cumulative Frequency



3.3.4 Model code, design and construction

Overview

Modelling was undertaken using the Groundwater Vistas interface and the MODFLOW 1996 Code for brine flow and MT3D code for solute transport.

Model Grid

Flow simulation was executed as two-dimensional flow to a single side of a trench. This was implemented with a model grid comprising one row, 1 m wide, and column spacing was 5 m and the number of columns was varied for each lake model to yield the required width. Layer spacing was 1 m for the top layer, and 0.5 m for subsequent layers. The number of layers was varied to achieve the required model thickness for each Lake.

Boundaries

The trench was simulated as a drain boundary with drain elevation at 6 m depth. The boundary cell was applied in Layer 14 from 7.5 to 8 m depth.

Recharge was applied to the uppermost active layer at a constant rate of 0.0004 m/day (146 mm/year).

Evapotranspiration was applied to the top layer only with a rate of 0.004 m/day and an extinction depth of 0.6 m.

The model boundary opposite the trench (lake edge) was simulated as a no-flow boundary. This was implemented as conservative approach that assumes the aquifer adjacent the lake exhibits low transmissivity and contributes negligible water or solute to the brine production simulation.

Properties

Aquifer parameters applied in the model are presented in Table 3.4.

Table 3.4: Modelled Aquifer Parameters

Aquifer Unit	Hydraulic conductivity (m/day)	Specific Yield (v/v	Total Porosity (v/v)
Lake Bed Sediment	25 (Horizontal) 2.5 (Vertical)	0.10	0.33
Strat 2	3 (Horizontal) 3 (Vertical)	0.05	0.36

Model Run Settings

Solute Transport

Solute was simulated with an initial concentration of 100. Recharge was applied with a solute concentration of zero. Actual brine concentrations were then calculated from the model output in a spreadsheet as a production of the modelled solute (as a percentage) and the brine concentration from that lake from the Mineral resource Estimate.

Solute is removed from the model by the drain cell that simulates trench production. No additional solute is added to the model and the solute concertation decreases over time as the solute is diluted by recharge.

3.3.5 Predictive modelling

Setup

Simulations were run for eight lakes summarised in Table 3.5. The trench networks are typically designed as a single trench located along the long axis of the lake. Trench layouts are presented as

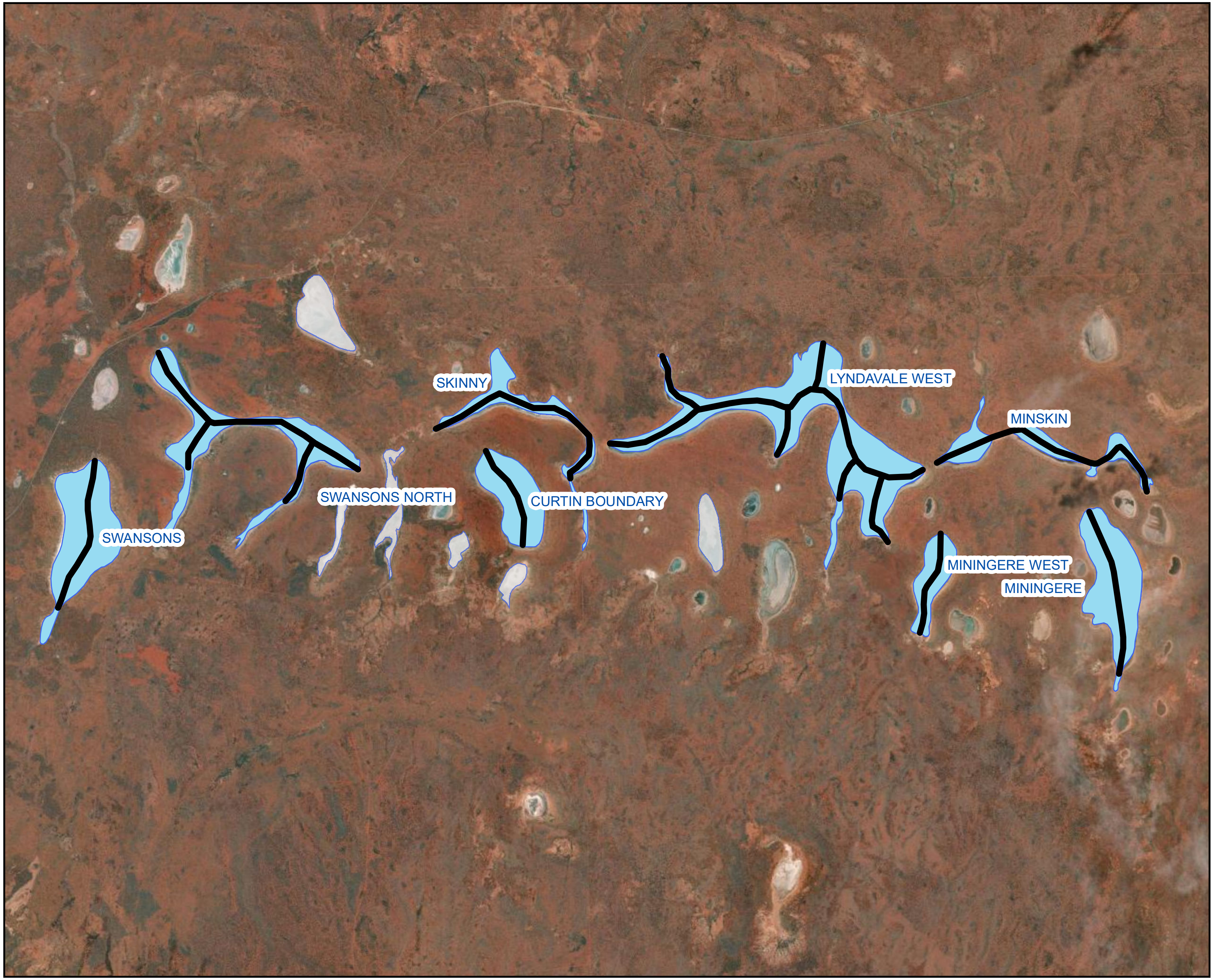
Figure 3.13. The average fetch of each trench is the average distance from the edge of the lake to the trench, calculated as the area of the lake divided by the trench length, divided by 2.

The average fetch was implemented as the width of the model. The thickness of the model was defined by the average thickness of Stat 1 and Strat 2 in the Resource Model (Table 3.5).

Simulations were run for 10 to 15 years as a single stress period with constant boundary conditions. Four lake simulations were extended to 15 years to allow for additional production (Table 3.5).

Table 3.5: Production Simulation

Lake	Area (km^2)	Potassium Concentration (kg/m^3)	Trench Length (m)	Average Fetch / Model Width (m)	Base Stat 1 (m)	Model Base (m)	Simulated Production Duration (years)
Miningere	7.8	7.3	6,000	650	3.5	19.5	15
MinSkin	4.4	3.2	8,000	275	3.5	17.0	15
Lyndavale West	18.6	3.2	17,000	547	9.5	18.5	15
Skinny	4.1	4.1	8,000	256	6.0	24.5	10
Curtin Boundary	5.2	4.3	3,500	743	2.5	20.0	10
Miningere West	3.0	5.6	4,000	375	3.0	24.5	15
Swansons North	9.0	3.3	17,000	265	3.0	19.0	10
Swansons	8.8	4.3	6,600	667	7.5	17.5	10
Totals	**61**		**70,100**				



Legend

🟦	Lakes Included
⬜	Lakes Not Included

GROUNDWATER
SCIENCE

Job Number: PWM-20-1

Client: Parkway Minerals

Version: 1 Date: 20/10/2020

Drawn by: BJ

Coordinate System: GDA 1994 MGA Zone 53

Karinga Lakes
Trench Layout

Figure 3.12

Output

Production was exported from the model as flow rate (flux) and solute concentration at the drain cell simulating the trench. Brine production for each lake was then calculated by multiplying drain flux by the trench length and doubling to account for symmetrical flow to each side of the trench. Solute concentration was calculated as the product of model concentration (as a percentage) and the initial potassium concentration at each lake from the Mineral Resource Estimate.

Cumulative production is compared in Figure 3.14. Individual lake production profiles are presented as Figure 3.15 and the data is presented as Appendix B2.1. Miningere and Lyndavale West produce the greatest tonnage of potassium. Miningere as a function of the high brine grade, and Lyndavale west as a function of the comparatively large lake extent and long trench network and hence higher flow rate of moderate grade brine. Smaller, lower grade lakes produce proportionally less potassium.

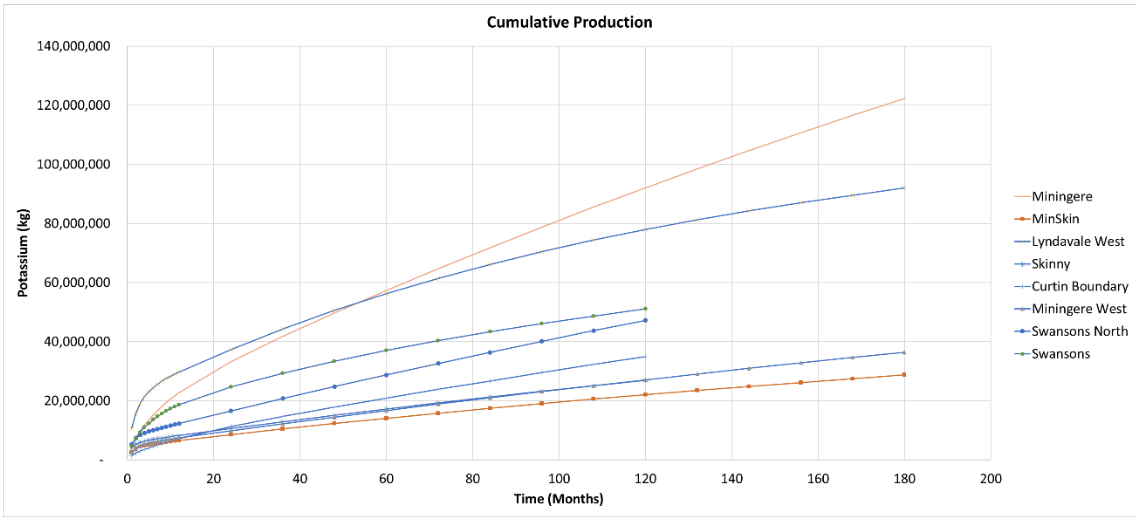


Figure 3.14: Cumulative brine production

Total production is summarised in Table 3.6. On average 22% of the Potassium contained in total porosity is recovered from each lake in 10 years of production and 26-33 % when mining is extended to 15 years.

Table 3.6: Production Summary

Lake	Area (km^2)	Potassium Concentration (kg/m^3)	Tonnage Potassium in Total Porosity[1]	10 Year Production (Tonnes Potassium)	10 year Recovery	15 Year Production (Tonnes Potassium)	15 year Recovery
Miningere	7.8	7.3	411,467	92,100	0.22	122,323	0.30
MinSkin	4.4	3.3	86,238	22,054	0.26	28,717	0.33
Lyndavale West	18.6	3.2	370,563	77,991	0.21	91,975	0.25
Skinny	4.1	4.1	121,182	26,985	0.22		
Curtin Boundary	5.2	4.3	156,458	34,941	0.22		
Miningere West	3.0	5.6	142,567	27,110	0.19	36,440	0.26
Swansons North	9.0	3.3	193,106	47,248	0.24		
Swansons	8.8	4.3	227,380	51,148	0.22		
Totals	**61**		**1,708,962**	**379,578**	**0.22**		

Notes: 1) The total porosity mineral tonnage is not presented as a mineral resource estimate. Not all the potassium can be recovered by mining. The data is presented here to calculate the percentage that is estimated to be recovered by mining.

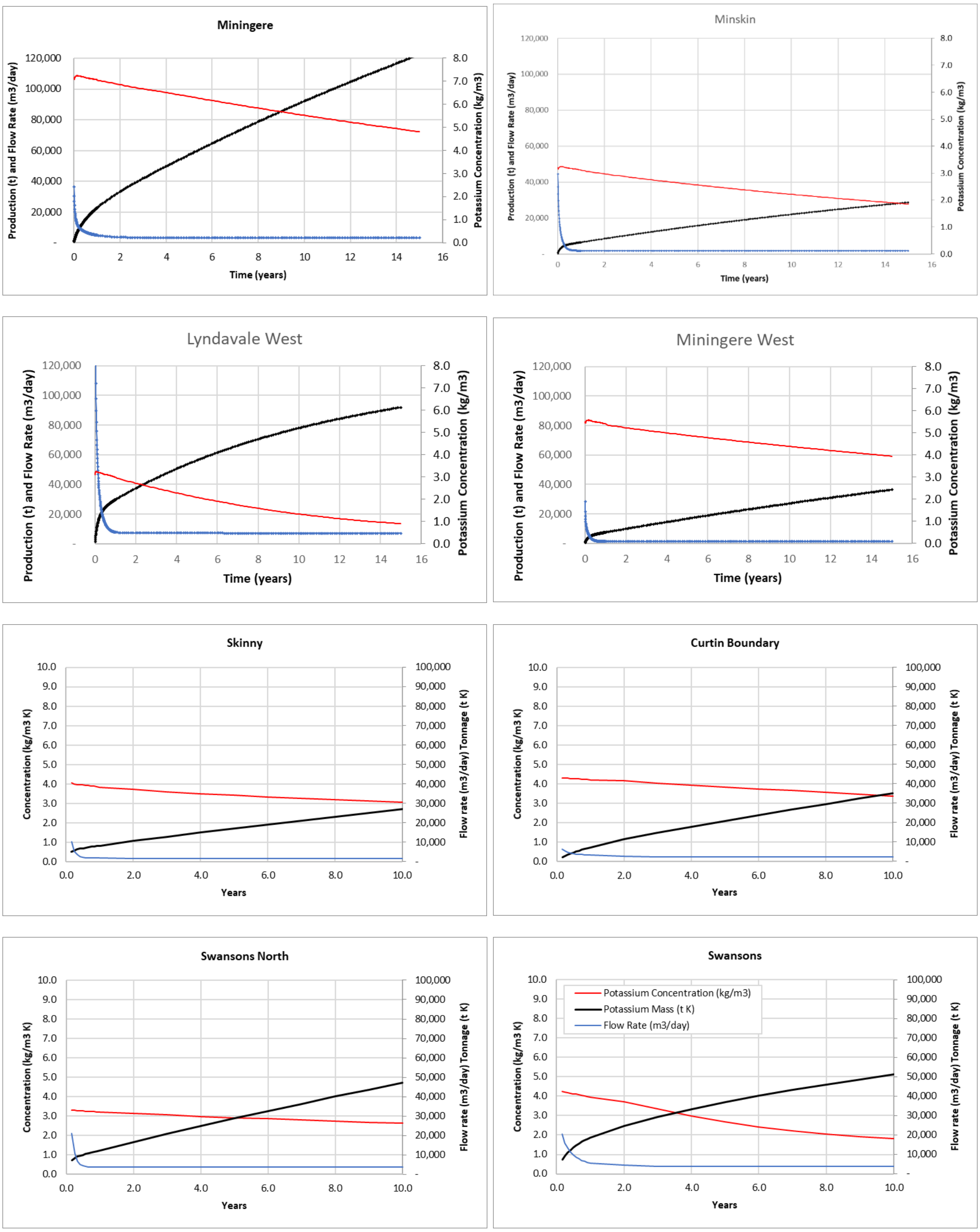


Figure 3.15: Lake Production Profiles

Cross sections showing brine level and concentration over time for the Miningere Model are presented as Figure 3.16. These illustrate that brine level reaches steady state after approximately 1-2 years. From this time onward brine production from the trench is balanced by recharge and the brine level remains constant. Brine concentration at the recharge surface continues to decline as recharge acts to dilute the brine. The depth of diluted brine increases over time, and the proportion of diluted brine delivered to the trench increases over time.

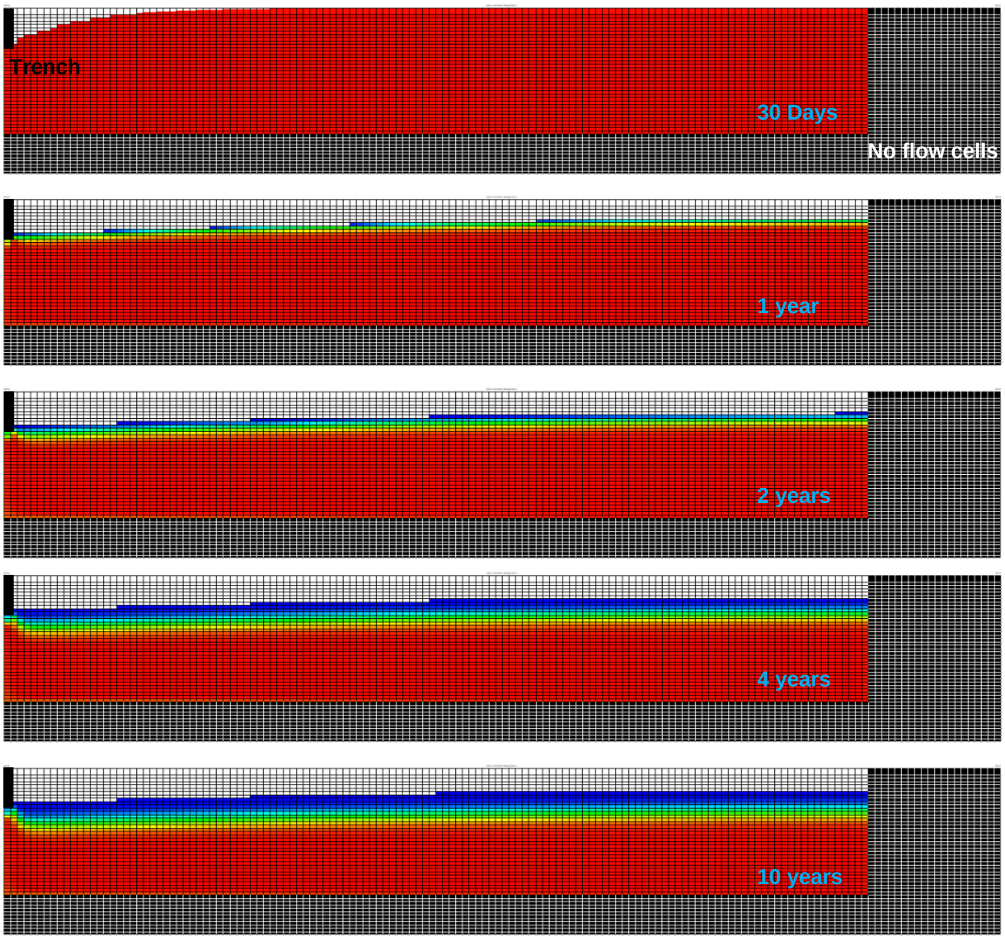


Figure 3.16: Brine Production – Cross Sections Colour shaded to show concentration

3.3.6 Uncertainty analysis

The main uncertainty in the production model is recharge. Recharge is known to be seasonally variable and episodic. The proportion of rainfall that might infiltrate to recharge a dewatered brine aquifer is not yet tested. The current recharge estimate applied in the model is based on observed rainfall infiltration to a shallow water table through a damp, partially saturated vadose zone.

The impact of seasonal variability has been assessed by running a transient simulation that implements 10 years of rainfall from 1990 to 1999 applied on a daily time step. This period was chosen because the average rainfall over the period is equal to the median value of the full data set, and because it excludes the three extreme rainfall events in 1974, 2001 and 2016 that will produce a-typical results.

The impact of increased wetting threshold has been assessed by calculating available recharge for three different wetting thresholds: 1 mm (base case), 5 mm and 10 mm (Worst Case). The uncertainty analysis was run for the Miningere model only. The model grid was modified such that the top 6 m was simulated as a single layer. This was done to reduce model instability and solute mass balance errors that occur when cells become unsaturated and re-saturated between time steps. The model runs are summarised in Table 3.7 and the production profiles are compared in Figure 3.17. The change in layer set up produces a slight change in model output. Comparison in Table 3.7 is based on models with the same layer set-up and differing recharge rates.

Table 3.7: Uncertainty Analysis Model Runs

Model Run	Description	Recharge Model Wetting Threshold (mm)	Annual Average Recharge (m)	Total Simulated Production (as a proportion of base case)
Production Model	Model used for Production Planning. Constant rate recharge.	1	0.146	-
Production Model Transient Recharge	Transient Recharge model with constant rate recharge. Used as a check of layer setup and transient simulation	1	0.146	-
Transient C1 (Base Case)	Transient Model with variable recharge 1mm wetting threshold	1	0.146	1.0
Transient C2	Transient Model with variable recharge 5mm wetting threshold	5	0.104	0.8
Transient C3	Transient Model with variable recharge 10mm wetting threshold	10	0.073	0.7

Brine production is sensitive to the applied recharge wetting threshold. Higher wetting thresholds result in reduced rates of recharge and a reduced rate of brine production. The relationship is not linear since the reduced rates of recharge result in reduced brine dilution for the same point in time.

The exercise demonstrates the uncertainty of the brine production estimate. Applying a higher wetting threshold results in a 30% reduction in potassium production during the 10 year simulation.

Contingency to maintain brine production for this project is important and discussed in Section 3.4.6. Work to de-risk the production estimate is described in Section 3.4.7.

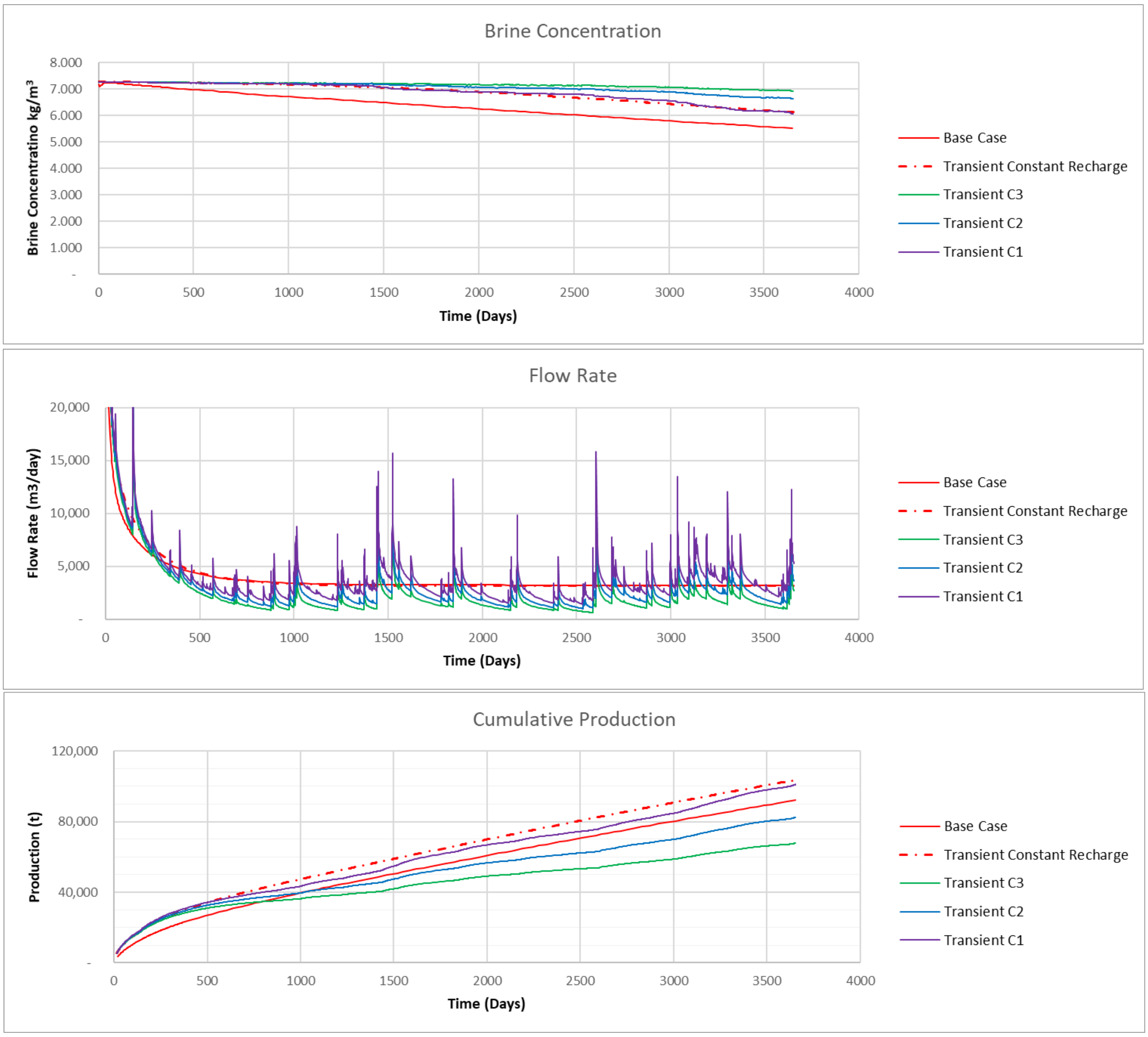


Figure 3.17: Uncertainty Analysis Production Profiles

3.3.7 Model capabilities and limitations

The model is designed to allow planning and scheduling of brine production from the playas comprising the Karinga Project to a Pre-Feasibility Standard.

The model is un-calibrated. This is of necessity at this stage of project development since there is no medium-term pumping data available for calibration. The model is set up with carefully specified parameters based on extensive test work. However, any multiparameter groundwater flow model exhibits considerable uncertainty, and the uncertainty increases with time.

The model also represents all lakes as a homogenous aquifer with consistent aquifer properties for each stratigraphic unit, and consistent unit thicknesses for each lake. This is a necessary simplification of the real system. It is likely that specific lake performance will vary from that predicted by the model, but that the model provides a reasonable prediction of the average performance of all lakes over time.

The model assumes that all bound solutes (solutes hosted in specific retention, or undrainable porosity) will equilibrate with infiltrating recharge and will mobilise to the trenches over time.

3.3.8 Use of the model

The model is intended to inform a Pre-feasibility Study. Work to progress to a Definitive Feasibility Study should include a trial mining exercise where a portion of a lake is trenched and the trench is pumped for a duration that encompasses significant primary drainage of the lake sediments, and takes in a recharge season so that the medium term brine yield is demonstrated, and so that the interaction between infiltrating recharge, and the in-situ brine can be demonstrated.

3.4 Production Plan and Schedule

The estimated production profiles from each lake have been incorporated in a production schedule. The basis for the schedule is the production of 40,000,000 kg Sulphate of potash per year from a brine feed of 42,000,000 kg SOP. The brine feed specified for this production is 18,843,000 kg Potassium.

The production Schedule is presented as Table 3.9 and Figure 3.18. It can be noted that production peaks due to commissioning of new lakes result in production that exceeds the target rate. This is an artefact of the trench production profiles which assume that each lake is pumped at full capacity for the duration of operation. In operation, production can be moderated by two mechanisms: reduced brine pumping rates, and progressive trench excavation. The scheduled production over the life of mine exceeds the planned production rate by 14%. This provides some contingency production.

A trenching schedule is provided as Table 3.8.

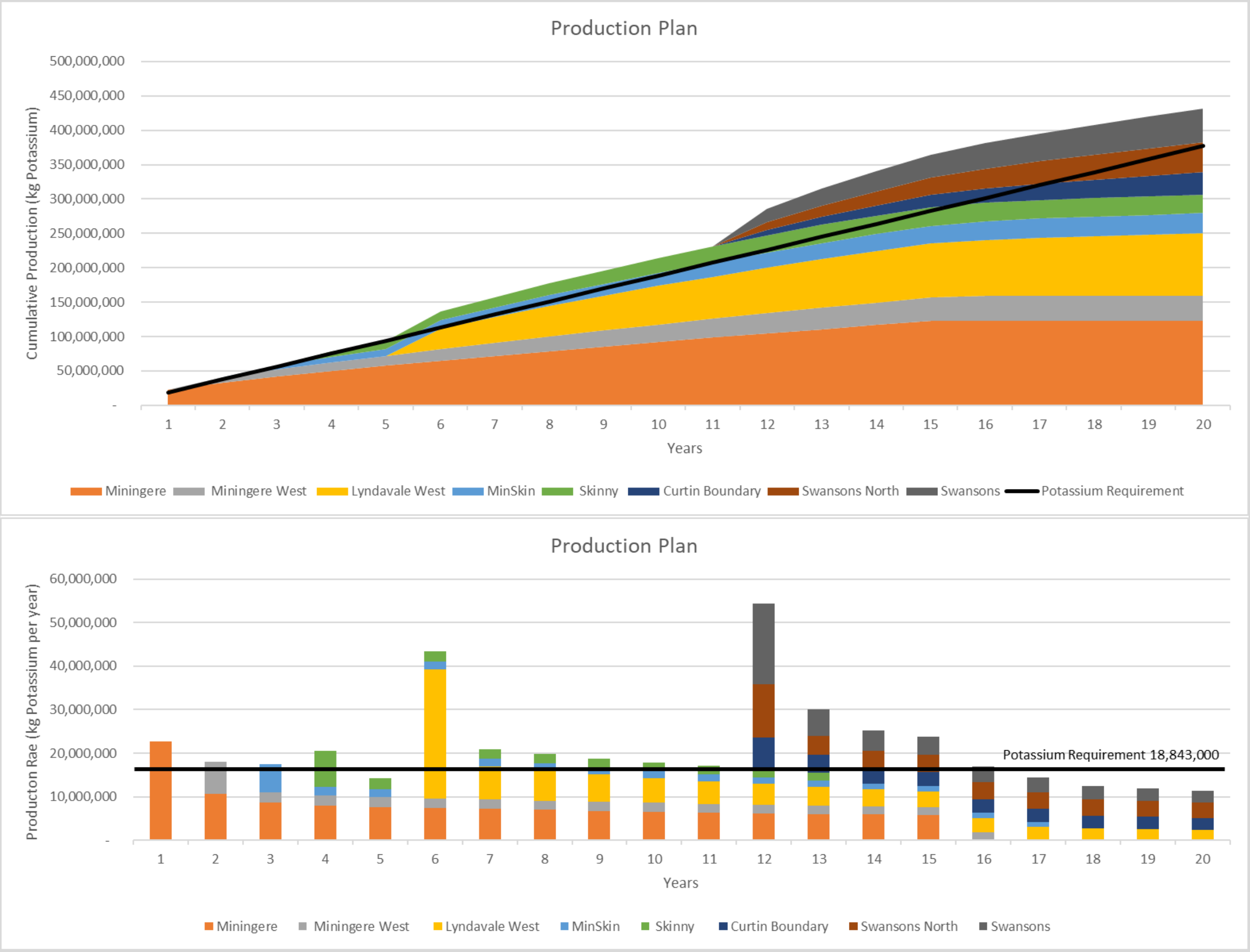


Figure 3.18: Production Schedule – Potassium Production

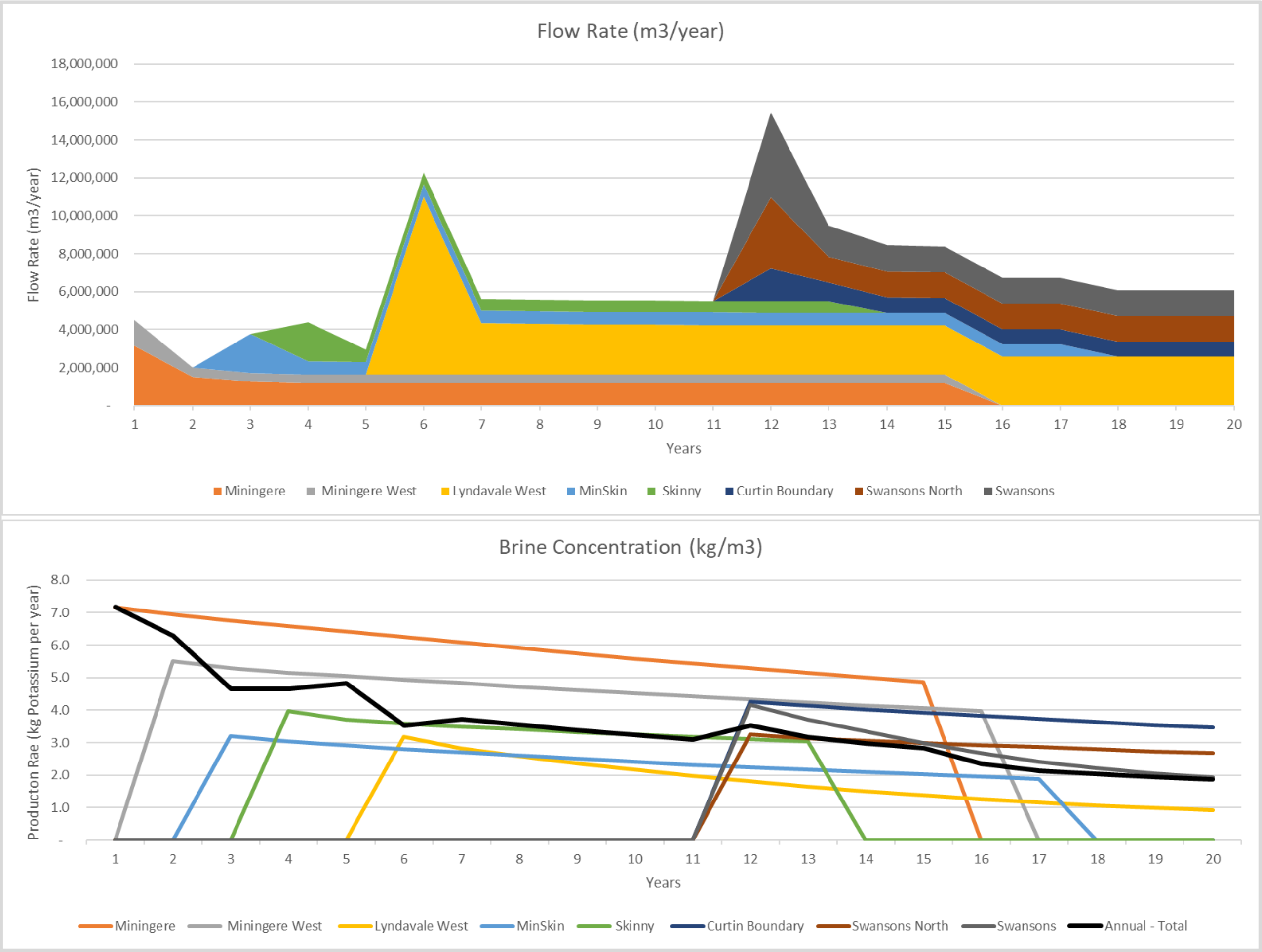


Figure 3.19: Production Schedule – Flow rate and brine concentration

Table 3.8: Trenching Schedule

Year	Lakes	km trench
1	Miningere	6
2	Miningere West	4
3	Minskin	8
6	Lyndavale West	17
12	Curtin Boundary Swanson's North Swanson's	3.5 17 6.6

Table 3.9: Production Schedule Potassium Tonnage (Units are kg Potassium)

Year	Miningere	Miningere West	Lyndavale West	MinSkin	Skinny	Curtin Boundary	Swanson’s North	Swanson’s	Annual Total	Cumulative Total
1	22,664,662								22,664,662	22,664,662
2	10,582,467	7,412,587							17,995,055	40,659,717
3	8,583,977	2,457,724		6,509,420					17,551,121	58,210,837
4	7,892,641	2,337,116		2,030,905	8,274,539				20,535,202	78,746,039
5	7,573,663	2,277,663		1,921,718	2,396,085				14,169,130	92,915,169
6	7,361,830	2,224,056	29,697,350	1,846,830	2,247,534				43,377,601	136,292,771
7	7,155,427	2,173,741	7,685,794	1,777,719	2,173,919				20,966,600	157,259,370
8	6,954,572	2,125,169	6,888,167	1,711,941	2,110,390				19,790,238	177,049,608
9	6,759,644	2,078,901	6,274,701	1,649,943	2,053,965				18,817,153	195,866,761
10	6,570,856	2,033,743	5,709,627	1,590,781	2,002,082				17,907,089	213,773,850
11	6,388,147	1,989,739	5,198,087	1,534,467	1,953,914				17,064,355	230,838,205
12	6,211,084	1,947,081	4,734,033	1,480,544	1,908,029	7,255,935	12,276,671	18,631,513	54,444,891	285,283,095
13	6,039,232	1,905,481	4,305,584	1,428,689	1,864,589	4,082,461	4,327,021	6,078,583	30,031,640	315,314,736
14	5,872,862	1,864,920	3,919,591	1,378,624		3,366,738	4,152,548	4,616,537	25,171,820	340,486,556
15	5,711,798	1,825,369	3,578,059	1,330,753		3,143,863	4,047,127	4,067,123	23,704,093	364,190,649
16		1,786,671	3,274,364	1,284,504		3,040,203	3,952,935	3,634,215	16,972,892	381,163,541
17			3,004,232	1,239,916		2,960,951	3,862,130	3,283,003	14,350,232	395,513,773
18			2,765,543			2,883,493	3,776,785	3,003,683	12,429,504	407,943,276
19			2,558,386			2,808,288	3,694,558	2,780,273	11,841,505	419,784,781
20			2,381,910			2,735,117	3,616,264	2,600,188	11,333,480	431,118,260
Total	**122,322,863**	**36,439,963**	**91,975,427**	**28,716,755**	**26,985,046**	**32,277,048**	**43,706,040**	**48,695,119**	**431,118,260**	

Table 3.10: Production Schedule Flow (Units are m^3 brine)

Year	Miningere	Miningere West	Lyndavale West	MinSkin	Skinny	Curtin Boundary	Swanson's North	Swanson's	Annual Total	Cumulative Total
1	3,161,133								3,161,133	3,161,133
2	1,521,965	1,343,347							2,865,311	6,026,445
3	1,271,913	464,271		2,035,543					3,771,726	9,798,171
4	1,198,430	452,783		670,390	2,076,078				4,397,682	14,195,853
5	1,180,463	451,432		660,734	643,975				2,936,603	17,132,456
6	1,178,730	450,668	9,360,656	659,978	623,766				12,273,798	29,406,254
7	1,177,684	450,184	2,715,400	659,199	620,131				5,622,598	35,028,853
8	1,176,641	449,733	2,657,117	658,588	617,428				5,559,506	40,588,359
9	1,175,711	449,733	2,640,956	658,588	615,343				5,540,332	46,128,691
10	1,174,808	449,487	2,627,708	658,588	614,035				5,524,627	51,653,318
11	1,174,010	449,038	2,616,268	658,588	612,743				5,510,647	57,163,965
12	1,173,283	449,038	2,606,558	658,588	612,639	1,702,348	3,758,952	4,464,324	15,425,731	72,589,696
13	1,172,719	449,038	2,597,465	658,705	611,579	984,802	1,379,955	1,632,530	9,486,792	82,076,488
14	1,172,033	449,038	2,590,447	658,589		836,241	1,358,056	1,381,443	8,445,847	90,522,335
15	1,171,676	449,038	2,584,308	658,588		798,738	1,354,075	1,361,518	8,377,941	98,900,276
16		449,038	2,578,395	658,588		791,692	1,352,155	1,358,292	7,188,161	106,088,436
17			2,574,196	658,588		791,083	1,350,215	1,355,335	6,729,418	112,817,854
18			2,569,816			790,539	1,349,203	1,352,942	6,062,500	118,880,354
19			2,566,556			790,080	1,349,203	1,350,552	6,056,391	124,936,745
20			2,563,596			789,563	1,349,203	1,348,345	6,050,707	130,987,452
Total	**20,081,200**	**7,655,863**	**45,849,442**	**11,271,845**	**7,647,718**	**8,275,086**	**14,601,018**	**15,605,280**	**130,987,452**	

Table 3.11: Production Schedule Brine Concentration (Units are kg Potassium per m^3 brine)

Year	Miningere	Miningere West	Lyndavale West	MinSkin	Skinny	Curtin Boundary	Swanson’s North	Swanson’s	Annual Total	Life of mine average
1	7.2								7.2	7.2
2	7.0	5.5							6.3	6.7
3	6.7	5.3		3.2					4.7	5.9
4	6.6	5.2		3.0	4.0				4.7	5.5
5	6.4	5.0		2.9	3.7				4.8	5.4
6	6.2	4.9	3.2	2.8	3.6				3.5	4.6
7	6.1	4.8	2.8	2.7	3.5				3.7	4.5
8	5.9	4.7	2.6	2.6	3.4				3.6	4.4
9	5.7	4.6	2.4	2.5	3.3				3.4	4.2
10	5.6	4.5	2.2	2.4	3.3				3.2	4.1
11	5.4	4.4	2.0	2.3	3.2				3.1	4.0
12	5.3	4.3	1.8	2.2	3.1	4.3	3.3	4.2	3.5	3.9
13	5.1	4.2	1.7	2.2	3.0	4.1	3.1	3.7	3.2	3.8
14	5.0	4.2	1.5	2.1		4.0	3.1	3.3	3.0	3.8
15	4.9	4.1	1.4	2.0		3.9	3.0	3.0	2.8	3.7
16		4.0	1.3	2.0		3.8	2.9	2.7	2.4	3.6
17			1.2	1.9		3.7	2.9	2.4	2.1	3.5
18			1.1			3.6	2.8	2.2	2.1	3.4
19			1.0			3.6	2.7	2.1	2.0	3.4
20			0.9			3.5	2.7	1.9	1.9	3.3
Average	**6.1**	**4.8**	**2.0**	**2.5**	**3.5**	**3.9**	**3.0**	**3.1**	**3.3**	

3.4.1 Production Summary

The Indicated Mineral Resource described in Section 1 is the basis of the production schedule reported here. Potassium production is reported at the point of delivery to the first evaporation pond.

In total the planned production comprises approximately 430 kt Potassium dissolved in approximately 130 Mm^3 brine at an average life of mine grade of approximately 3.3 kg/m^3. Potassium production is summarized in Table 3.12.

Table 3.12: Production Summary

	Tonnage Potassium (kt)	Brine Volume (Mm^3)	Brine Grade (kg potassium / m^3)
Miningere	120	20,	6.1
Miningere West	36	7.7	4.8
Lyndavale West	92	46	2.0
MinSkin	29	11	2.5
Skinny	27	7.6	3.5
Curtin Boundary	32	8.3	3.9
Swansons North	44	15	3.0
Swansons	49	16	3.1
Total	**430**	**130**	**3.3**

3.4.2 Study status

The current level of study is a Pre-Feasibility Study. The intention of the study is to allow different study options to be evaluated and to enable selection of an optimal study option (if any) to progress to Definitive Feasibility Study.

3.4.3 Cut-off parameters

No cut-off grades or quality parameters are applied in the production estimate. Brine grade depletion over time is estimated through hydrogeological modeling and is applied in the production schedule that underpins the mine plan.

3.4.4 Mining factors or assumptions

Mining will occur through pumping of brine from trenches constructed into 8 playa salt lakes. This is an appropriate method for mining of shallow brine deposits and is implemented in most shallow brine projects worldwide.

Trench design and Layout is described in Section 3.2. The total trench length is 70 km. Trenches are axial to each lake.

The estimation of brine flow rate and brine concentration to be obtained from trenches is detailed in Section 3.3 The mine schedule is described in Section 3.4. Flow rate from trenches averages 740 m^3/hour over the life of the project, brine grade averages 3.3 kg/m3 over the life of the project. Brine grade is initially high at 6.7 kgK/m^3 when the high-grade lake Miningere is commissioned. Brine grade declines over time as lower concentration lakes are brought into production and as brine grade is diluted over time by rainfall infiltration and recharge. The final brine grade in year 20 is 1.9 kgK/m^3.

Not all the in-situ brine can be recovered. The production modelling detailed in Section 3.3 provides an estimate of overall recovery. This overall recovery factor has been used to calculate the Mineral Resource. The Mine plan then schedules production of a lesser fraction as detailed in Table 3.13.

No minimum mining widths are applied.

No Inferred Resources are included in the production plan.

Infrastructure requirements of the mining method are trenches as detailed in Section 3.2. Other infrastructure including evaporation ponds, water supply, energy supply and a process plant are being managed by the Verdant Minerals and Parkway Minerals, with the support of Worley as PFS study manager.

3.4.5 Resource Utilization.

Resource Utilization is detailed in Table 3.13. For the eight lakes included in the mine plan, the Mineral Resource estimate is approximately 580 kt. Of this the production schedule over the 20 year mine plan incorporates mining approximately 430 kt.

Table 3.13: Resource Utilisation.

Lake	Mineralisation Contained in Drainable Porosity	Indicated Mineral Resource contained in Total Porosity that meets reasonable prospects of economic extraction	Ore Reserve
	Potassium Tonnage	Potassium Tonnage	Potassium Tonnage
	(kt)	(kt)	(kt)
Lakes included in the mine plan			
Miningere	67	139	120
Miningere West	22	48	36
Minskin	14	29	29
Skinny	19	41	27
Lyndavale West	80	126	92
Curtin Boundary	24	54	36
Swansons	46	78	49
Swansons North	31	65	44
Sub Total	**300**	**580**	**430**
Remaining Lakes			
Corkwood	9.0	16	
Curtin North	57	122	
Curtin West	6.8	13	
Erldunda Boundary	21	48	
Highway	7.5	17	
Island 2	4.4	8.2	
Island 4	8.4	16	
Island 1	6.9	12	
Island 5	4.5	8.5	
Jetts	4.0	7.1	
Main North Road	17	29	
Mallee Well East	18	37	
Murphys	11	13	
Mygoora South	3.7	8.2	
Mygoora1	18	34	
Pulcurra	23	41	
Sub total	**220**	**430**	
Totals	**520**	**1000**	**430**

Note: Totals are rounded to 2 significant figures

3.4.6 Discussion of relative accuracy/ confidence

Brine resources are very different to solid mineral resources and the accuracy / confidence in the production plan is lower.

- The production rate is naturally constrained and will vary over time with uncertainty increasing over time and is subject to uncertain rainfall recharge.
- The brine grade will decline over time at a rate that is subject to uncertainty. The uncertainty increases with mining duration and is subject to uncertain rainfall recharge.
- The overall recovery of the Resource (i.e. the Reserve) is dependent on the mining duration, and also on the mobilisation of brine by recharge which is subject to uncertainty.

Production in the first few years of production is quite predictable, however the production over longer periods becomes more uncertain due to all the factors above. The uncertainty increases with duration of mining.

In conventional resources that uncertainty does not exist. An open pit or underground mine plan will remove a defined volume of rock at an estimated grade from the resource model and that can be planned out indefinitely as long as resource remains.

Contingency options for this project to maintain brine production in later years are extremely important for managing the higher risk associated with a brine resource. Contingency options if required include:

- Additional lakes to maintain production. There are a further 16 lakes in the Karinga Lakes chain with a total additional Mineral Resource of approximately 430 kt Potassium. Some of these can be developed if required.
- Deepening of trenches. Trenches can be deepened to extract the brine more efficiently at depth.

3.4.7 Further Work

The project is currently at a Pre-Feasibility level of study. The study aims to evaluate development options for the project.

Feasibility Studies for the project should be designed to mitigate the production risks described above. The recommended approach is trial mining of a single lake (or portion of a single Lake). The trial mining duration should be long enough to:

- Achieve significant dewatering of the drainable porosity hosted fraction of the resource
- Maintain production through a recharge cycle (summer rainfall and recharge season)

The trial mining should be set up to measure, flow rate, brine grade and water level in the production trench, and an array of piezometers to measure the brine resource throughout the lake.

Trial mining also provides the opportunity to test evaporation pond performance, and to stockpile potassium within the ponds.

4 References

Groundwater Science (2012) *Karinga Creek Potash Project- Hydrogeological Testing Program*. Consultants Report to Rum Jungle Resources. Report Number RJR-12-1-R003

Groundwater Science (2014) *Karinga Creek Potash Project – Hydrogeological Investigation – Trench Pumping Tests.* Consultants Report to Rum Jungle Resources. Report Number RJR-13-3-R001

5 Competent Persons Statement

The information in this announcement that relates to Exploration Results and Mineral Resources for the Karinga Lakes Potash Project is based on, and fairly represents, information compiled by Mr Ben Jeuken, who is a member of the Australian Institute of Mining and Metallurgy and a member of the International Association of Hydrogeologists. Mr Jeuken is employed by Groundwater Science Pty Ltd, an independent consulting company. Mr Jeuken has sufficient experience, which is relevant to the style of mineralisation and type of deposit under consideration and to the activity, which they are undertaking to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Jeuken consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

Appendix A Mineral Resource Estimate Appendices

A1. Collars

Note: Not all Drillholes are located on Lakes that were included in the Resource Estimate. Drillholes not on lakes were excluded from evaluation of the resource.

A1.1. Hand Dug Pits

HoleID	Lake	x	y	Zone_	Elevation (mAHD)	End of Hole (m)	Date
HDP_11	Corkwood	256535.2	7193993	53	445	0.5	5/05/2010
HDP_12	Corkwood	255975.3	7193763	53	445	0.5	5/05/2010
HDP_13	Corkwood	255848.4	7194660	53	445	0.5	5/05/2010
HDP_14	Mygoora South	263886.1	7191484	53	437	0.5	5/05/2010
HDP_15	Mygoora South	263376.2	7191740	53	437	0.5	5/05/2010
HDP_16	Mygoora South	263656.5	7192140	53	437	0.5	5/05/2010
HDP_17	Mygoora South	264199.8	7191995	53	437	0.5	5/05/2010
HDP_18	Mygoora	267962.6	7197246	53	433	0.5	6/05/2010
HDP_19	Mygoora	268529.2	7197994	53	433	0.5	6/05/2010
HDP_2	Pulcura	261353.9	7191589	53	439	0.5	26/03/2010
HDP_20	Mygoora	269616.4	7198413	53	433	0.5	6/05/2010
HDP_21	Erldunda Boundary	275983.6	7196878	53	427	0.5	6/05/2010
HDP_22	Erldunda Boundary	275831.6	7198625	53	427	0.5	6/05/2010
HDP_23	Erldunda Boundary	275358.6	7199249	53	427	0.5	6/05/2010
HDP_24	Erldunda Boundary	274532.7	7198360	53	427	0.5	6/05/2010
HDP_25	Erldunda Boundary	274869.3	7197348	53	427	0.5	6/05/2010
HDP_26	Erldunda Boundary	274363.6	7197351	53	427	0.5	6/05/2010
HDP_27	Miningere	233530	7197617	53	464	0.5	7/05/2010
HDP_28	Miningere	233211.2	7198266	53	464	0.5	7/05/2010
HDP_29	Miningere	232602	7198900	53	464	0.5	7/05/2010
HDP_3	Pulcura	261025.8	7192413	53	439	0.5	26/03/2010
HDP_30	Miningere	233012.3	7196196	53	464	0.5	7/05/2010
HDP_31	Curtin Boundary	212352.3	7200066	53	463	0.5	7/05/2010
HDP_32	Curtin Boundary	211572	7200595	53	458	0.5	7/05/2010
HDP_33	Curtin Boundary	211970.7	7197772	53	467	0.5	7/05/2010
HDP_34	Curtin Boundary	212757.9	7199291	53	466	0.5	7/05/2010
HDP_35	Skinny	209665.3	7202282	53	465	0.5	8/05/2010
HDP_36	Skinny	210833.4	7203048	53	465	0.5	8/05/2010
HDP_37	Skinny	211173.3	7203847	53	465	0.5	8/05/2010
HDP_38	Skinny	212271.4	7202707	53	465	0.5	8/05/2010
HDP_39	Lyndavale West	225953.7	7200082	53	466	0.5	8/05/2010
HDP_4	Pulcura	260315.5	7193130	53	439	0.5	26/03/2010
HDP_40	Lyndavale West	224573.6	7199132	53	466	0.5	8/05/2010
HDP_41	Lyndavale West	223650.2	7202025	53	466	0.5	8/05/2010
HDP_42	Lyndavale West	221442.3	7201236	53	466	0.5	8/05/2010
HDP_43	Lyndavale West	220086.6	7202755	53	466	0.5	8/05/2010
HDP_44	Lyndavale West	218319.6	7201995	53	466	0.5	8/05/2010
HDP_45	Lyndavale West	215802.6	7201141	53	466	0.5	8/05/2010
HDP_46	Skinny	213677.7	7202554	53	465	0.5	8/05/2010
HDP_47	Island 1	211636.7	7196276	53	467	0.5	8/05/2010
HDP_48	Island 1	212064.4	7196478	53	465	0.5	8/05/2010
HDP_49	Island 1	212128.3	7196943	53	469	0.5	8/05/2010
HDP_5	Mygoora	267374.1	7197232	53	433	0.5	26/03/2010
HDP_50	Highway	205385.8	7206009	53	464	0.5	8/05/2010
HDP_51	Highway	205645.3	7205186	53	464	0.5	8/05/2010
HDP_52	Highway	204865.6	7205305	53	464	0.5	8/05/2010
HDP_53	Highway	204251.1	7206247	53	464	0.5	8/05/2010
HDP_54	Swansons	195520.9	7196744	53	467	0.5	8/05/2010
HDP_54	Swansons	195520.9	7196744	53	467	0.5	8/05/2010
HDP_55	Swansons	195636.4	7197214	53	467	0.5	8/05/2010
HDP_55	Swansons	195636.4	7197214	53	467	0.5	8/05/2010
HDP_60	Curtin North	185447.5	7205097	53	480	0.5	9/05/2010
HDP_60	Curtin North	185447.5	7205097	53	480	0.5	9/05/2010
HDP_61	Curtin North	184260.1	7204667	53	477	0.5	9/05/2010
HDP_61	Curtin North	184260.1	7204667	53	477	0.5	9/05/2010
HDP_62	Curtin North	182638.6	7204050	53	470	0.5	9/05/2010
HDP_62	Curtin North	182638.6	7204050	53	470	0.5	9/05/2010

HDP_63	Curtin West	172165.7	7207880	53	485	0.5	9/12/2010
HDP_63	Curtin West	172165.7	7207880	53	485	0.5	9/12/2010
HDP_64	Curtin West	172165.7	7207880	53	485	0.5	9/12/2010
HDP_64	Curtin West	172165.7	7207880	53	485	0.5	9/12/2010
HDP_69	Mygoora South	263375	7192349	53	437	0.5	7/12/2010
HDP_7	Pulcura	259751.9	7194144	53	439	0.5	4/05/2010
HDP_70	Mygoora South	263375	7192349	53	437	0.5	7/12/2010
HDP_71	Mygoora South	263375	7192349	53	437	0.5	7/12/2010
HDP_73	Swansons	195506.9	7195712	53	472	0.5	10/12/2010
HDP_73	Swansons	195506.9	7195712	53	472	0.5	10/12/2010
HDP_74	Swansons	195506.9	7195712	53	472	0.5	10/12/2010
HDP_74	Swansons	195506.9	7195712	53	472	0.5	10/12/2010
HDP_8	Pulcura	259800.7	7195286	53	439	0.5	4/05/2010
HDP_9	Corkwood North	256140	7197994	53	436	0.5	4/05/2010
K26	Miningere	232850	7197292	53	464	0.6	8/09/2011
K31	MinSkin	228428	7201281	53	464	0.5	8/09/2011
K36	Lyndavale West	224001	7201600	53	466	0.8	8/09/2011
K55	Swansons North	200017	7203333	53	466	0.4	11/09/2011
K63	Curtin North	789027	7205600	52	474	0.5	7/09/2011
K64	Curtin North	790037	7205620	52	472	0.5	7/09/2011
KPWS1	Swansons North	201629	7202110	53	466	0.7	11/09/2011
KPWS11	Miningere	232778	7198915	53	464	0.7	13/09/2011
KPWS12	Miningere	234084	7195204	53	464	0.5	13/09/2011
KPWS13	Pulcura	260949	7190981	53	440	0.8	14/09/2011
KPWS14	Pulcura	261448	7191691	53	439	0.6	14/09/2011
KPWS2	Swansons North	205423	7200687	53	466	0.5	11/09/2011
KPWS3	Swansons North	203518	7201914	53	466	0.7	11/09/2011
KPWS4	Swansons North	200267	7200512	53	466	0.6	11/09/2011
KPWS5	Swansons North	199770	7198756	53	466	0.7	11/09/2011
KPWS55	Swansons North	200017	7203333	53	466	0.5	11/09/2011
KPWS6	Island 4	207355	7197264	53	469	0.7	12/09/2011
KPWS7	Island 5	204896	7196670	53	468	0.7	12/09/2011
KPWS8	Island 4	207552	7199478	53	466	0.4	12/09/2011
KPWS9	Island 2	209699	7196898	53	470	0.5	12/09/2011

A1.2. Sampling Trenches

HoleID	Lake	x	y	Zone_	Elevation (mAHD)	End of Hole (m)	Date_
Curtain West Trench	Curtin West	776774	7209020	52	485	2.4	1/01/2010
Mallee Well Trench	Mallee Well	784430	7203963	52	477	2.1	1/01/2010
Mygoora South Trench	Mygoora South	263375	7192349	53	437	1.9	1/01/2010
Swansons Trench	Swansons	195506.9	7195712	53	472	3.3	1/01/2010

A1.3. Vibracore Drilling

HoleID	Lake	x	y	Zone_	Elevation (mAHD)	End of Hole (m)	Date
KPVC036	Lyndavale West	224001	7201600	53	466	3.53	8/01/2011
KPVC052	Curtin West	777098	7209636	52	485	1.51	1/01/2011
KPVC057	Swansons	800600	7198200	52	467	0.71	2/01/2011
KPVC059	Mallee Well East	789400	7202300	52	474	1.04	3/01/2011
KPVC060	Mallee Well East	789991	7201482	52	471	1.2	4/01/2011
KPVC061	Mallee Well East	790089	7200451	52	476	1	5/01/2011
KPVC063	Curtin North	789027	7205600	52	474	1.02	6/01/2011
KPVC064	Curtin North	790037	7205620	52	472	1.21	7/01/2011

A1.4. Sonic Core

HoleID	Lake	x	y	Zone_	Elevation (mAHD)	End of Hole (m)	Date	SWL (m)
KPSC001	Erldunda Boundary	275353	7199246	53	427	0.9	29/09/2011	0.5
KPSC003	Erldunda Boundary	275505	7197502	53	427	3.5	29/09/2011	0.8
KPSC004	Erldunda Boundary	275505	7196500	53	427	3.4	30/09/2011	0.65
KPSC005	Erldunda Boundary	276497	7195998	53	427	3	30/09/2011	0.7
KPSC006	Mygoora	264533	7192248	53	435	2.9	14/10/2011	0.25
KPSC007	Mygoora	267106	7195895	53	433	0.9	14/10/2011	nd
KPSC009	Mygoora	269812	7198342	53	433	2.3	14/10/2011	0.5
KPSC010	Corkwood North	256194	7199196	53	444	4.8	12/10/2011	0.6
KPSC011	Corkwood North	255551	7198511	53	445	3.4	12/10/2011	0.7
KPSC012	Corkwood	256199	7195299	53	445	3.9	13/10/2011	0.5
KPSC013	Corkwood	256411	7194732	53	445	4.3	13/10/2011	0.4
KPSC014	Corkwood	256533	7193650	53	445	4.4	13/10/2011	0.4
KPSC015	Pulcura	259744	7195995	53	439	3.05	12/10/2011	0.3
KPSC016	Pulcura	259919	7194956	53	439	2	12/10/2011	0.3
KPSC017	Pulcura	258995	7193685	53	439	2.15	11/10/2011	0.07
KPSC018	Pulcura	260359	7192677	53	439	2.8	11/10/2011	0.3
KPSC019	Mygoora South	263446	7192108	53	437	2.8	14/10/2011	0.25
KPSC020	Mygoora South	263923	7191264	53	437	2.8	14/10/2011	0.45
KPSC021	Murphys	247366	7191942	53	446	1.9	15/10/2011	0.2
KPSC022	Murphys	248129	7192321	53	446	3.2	15/10/2011	0.23
KPSC023	Murphys	248849	7193343	53	446	2.7	15/10/2011	0.2
KPSC024	Murphys	248721	7194503	53	446	2.8	15/10/2011	0.2
KPSC025	Miningere	232384	7198801	53	464	3	16/10/2011	0.3
KPSC026	Miningere	232850	7197292	53	464	4	16/10/2011	0.4
KPSC027	Miningere	234097	7196244	53	464	1.9	16/10/2011	nd
KPSC028	Miningere	233658	7194721	53	464	3.5	16/10/2011	0.25
KPSC029	Miningere West	227296	7197704	53	466	3.2	3/10/2011	0.5
KPSC030	Miningere West	226422	7196403	53	466	4	4/10/2011	0.1
KPSC031	Minskin	228428	7201281	53	464	3.5	3/10/2011	0.2
KPSC032	Minskin	230310	7201698	53	461	3.5	2/10/2011	0.15
KPSC033	Minskin	231602	7200910	53	461	3.4	2/10/2011	0.01
KPSC034	Minskin	233603	7201161	53	461	3.9	2/10/2011	0.15
KPSC035	Lyndavale West	224964	7199663	53	466	3.2	3/10/2011	0.35
KPSC037	Lyndavale West	223001	7203206	53	466	4.1	7/10/2011	0.05
KPSC038	Lyndavale West	222002	7202315	53	466	4.2	7/10/2011	0.05
KPSC039	Lyndavale West	218787	7202560	53	466	4.3	7/10/2011	0.08
KPSC040	Lyndavale West	216814	7201462	53	466	4.4	8/10/2011	0.1
KPSC041	Skinny	213808	7202531	53	465	3	18/10/2011	0.1
KPSC042	Skinny	212277	7202812	53	465	3.7	18/10/2011	0.15
KPSC043	Skinny	210218	7202767	53	466	4	18/10/2011	0.2
KPSC044	Curtin Boundary	211201	7200704	53	469	3.4	17/10/2011	0.3
KPSC045	Curtin Boundary	212809	7199436	53	466	3.1	17/10/2011	0.35
KPSC046	Curtin Boundary	211938	7197708	53	467	2.7	17/10/2011	0.15
KPSC047	Island 1	211944	7196584	53	471	4	8/10/2011	0.01
KPSC048	Island 2	209837	7197204	53	468	3	19/10/2011	0.1
KPSC050	Island 4	207561	7199981	53	466	4.8	19/10/2011	0.07
KPSC051	Island 4	207674	7198490	53	469	4.2	19/10/2011	0.25
KPSC053	Swansons North	204877	7201336	53	466	3	8/10/2011	0.13
KPSC054	Swansons North	199966	7201387	53	466	1.5	9/10/2011	0.07
KPSC055	Swansons North	199925	7203259	53	466	1.9	9/10/2011	0.17
KPSC056	Swansons	800024	7196953	52	467	3.1	20/10/2011	0.3
KPSC057	Swansons	800605	7198200	52	467	1.7	20/10/2011	0.05
KPSC062	Curtin North	787698	7205357	52	478	1.85	10/10/2011	0.3

HoleID	Lake	x	y	Zone_	Elevation (mAHD)	End of Hole (m)	Date	SWL (m)
KPSC065	Curtin North	789430	7207714	52	473	2.8	10/10/2011	0.17
KLS01	CURTIN WEST	777001	7209933	52	482	20	28/09/2013	nd
KLS02	CURTIN NORTH	787322	7204493	52	467	20.1	18/10/2013	nd
KLS03	MALLEE WELL EAST	789709	7202771	52	475	12	20/10/2013	nd
KLS05	SWANSONS	800582	7200481	52	467	20	21/10/2013	nd
KLS06	SWANSONS NORTH	206079	7200882	53	466	15	23/10/2013	nd
KLS07	ISLAND 5	205798	7199144	53	466	15	24/10/2013	nd
KLS08	ISLAND 4	207422	7200546	53	470	15	28/10/2013	nd
KLS09	Skinny	210072	7202256	53	466	15	29/10/2013	nd
KLS10	CURTIN BOUNDARY	211944	7197703	53	467	14	1/11/2013	nd
KLS11	ISLAND 2	210157	7197586	53	474	13	31/10/2013	nd
KLS12	ISLAND 1	212296	7196746	53	467	12	1/11/2013	nd
KLS13	MININGERE WEST	227298	7196244	53	466	20	3/10/2013	nd
KLS14	MININGERE WEST	226806	7195229	53	466	20	5/10/2013	nd
KLS15	Miningere	233228	7198416	53	464	20	6/11/2013	nd
KLS16	MURPHYS	247540	7192398	53	446	3	8/11/2013	nd
KLS17	MURPHYS	250182	7194214	53	446	5	9/11/2013	nd
KLS18	PULCURA	261494	7191554	53	439	20	7/11/2013	nd

A1.5. Sonic Core Holes Cased as Piezometers

HoleID	Lake	x	y	Zone_	Elevation (mAHD)	End of Hole (m)	Date	SWL (m)
KPSC006_P	Mygoora	264533	7192248	53	435	1.5	2011	0.1
KPSC015_P	Pulcura	259744	7195995	53	439	3	2011	0.25
KPSC016_P	Pulcura	259919	7194956	53	439	1.5	2011	0.22
KPSC019_P	Mygoora South	263446	7192108	53	437	1.5	2011	0.1
KPSC020_P	Mygoora South	263923	7191264	53	437	1.5	2011	0.2
KPSC021_P	Murphys	247366	7191942	53	446	1.3	2011	0.1
KPSC024_P	Murphys	248721	7194503	53	446	2.8	2011	0.2
KPSC026_P	Miningere	232850	7197292	53	464	4	2011	0.23
KPSC028_P	Miningere	233658	7194721	53	464	1.1	2011	0.15
KPSC046_P	Curtin Boundary	211938	7197708	53	467	2.7	2011	nd
KPSC048_P	Island 2	209837	7197204	53	468	1.3	2011	0.13
KPSC057_P	Swansons	800605	7198200	52	467	1.1	2011	nd

A1.7. Aircore Drillholes

HoleID	Lake	x	y	Zone_	elevation (mAHD)	End of Hole (m)	Date_	SWL (m)
KLAC001	Erldunda Boundary	275419	7196264	53	427	19.5	3/05/2012	nd
KLAC002	Erldunda Boundary	275190	7197222	53	427	11.5	3/05/2012	nd
KLAC003	Erldunda Boundary	274841	7198387	53	427	9	3/05/2012	0.31
KLAC004	Erldunda Boundary	275744	7198918	53	427	11.5	4/05/2012	0.3
KLAC005	Erldunda Boundary	276184	7198170	53	427	8.5	4/05/2012	nd
KLAC006	Mygoora South	263420	7191446	53	437	14.5	5/05/2012	nd
KLAC007	Mygoora South	263885	7192172	53	437	13.5	5/05/2012	nd
KLAC008	Mygoora	264900	7192493	53	433	6	5/05/2012	0.2
KLAC009	Mygoora	265410	7192870	53	433	8.5	6/05/2012	nd
KLAC010	Pulcura	261456	7191535	53	439	6	6/05/2012	0.1
KLAC011	Pulcura	260792	7192659	53	439	11.5	7/05/2012	0.25
KLAC012	Pulcura	260326	7193321	53	439	11.5	7/05/2012	0.3
KLAC013	Pulcura	259924	7194381	53	439	11.5	8/05/2012	0.3
KLAC014	Pulcura	259977	7194941	53	439	14.5	8/05/2012	0.3
KLAC015	Corkwood North	256193	7199201	53	444	17.5	9/05/2012	nd
KLAC016	Corkwood North	256452	7198072	53	442	14.5	9/05/2012	nd
KLAC017	Corkwood North	255866	7197732	53	438	17.5	9/05/2012	nd
KLAC018	Corkwood	256485	7195271	53	445	14.5	9/05/2012	0.3
KLAC019	Corkwood	256639	7194428	53	445	17.5	10/05/2012	nd
KLAC020	Corkwood	256152	7193447	53	445	12	10/05/2012	nd
KLAC021	Lyndavale North	250277	7198053	53	444	20	11/05/2012	nd
KLAC022	Lyndavale North	250635	7199467	53	440	20	11/05/2012	nd
KLAC023	Lyndavale North	251176	7200127	53	447	20	11/05/2012	nd
KLAC024	Murphys	250178	7194218	53	446	18	19/05/2012	0.5
KLAC025	Murphys	249089	7194341	53	446	11.5	19/05/2012	0.15
KLAC026	Murphys	248111	7195050	53	451	17	20/05/2012	1.3
KLAC027	Murphys	248856	7193511	53	446	8.5	20/05/2012	0.1
KLAC028	Murphys	248256	7192971	53	446	8.5	20/05/2012	0.1
KLAC029	Murphys	247544	7192398	53	446	11.5	21/05/2012	0.1
KLAC030	Murphys	246985	7192406	53	449	12	21/05/2012	0.5
KLAC031	Miningere	234036	7194254	53	464	17.5	23/05/2012	nd
KLAC032	Miningere	234138	7195188	53	464	14	23/05/2012	nd
KLAC033	Miningere	233115	7198556	53	464	17.5	23/05/2012	0.3
KLAC034	Miningere	233345	7198230	53	464	21	24/05/2012	0.45
KLAC035	Miningere	233227	7198419	53	464	24	25/05/2012	0.4
KLAC036	Minskin	233742	7201589	53	461	15	25/05/2012	0.3
KLAC037	Minskin	232057	7200712	53	461	8.5	25/05/2012	0.4
KLAC038	Swansons	800778	7197184	52	467	7	28/05/2012	nd
KLAC039	Swansons	801805	7197873	52	467	9	28/05/2012	0.35
KLAC040	Swansons	800069	7200416	52	467	6	29/05/2012	0.3
KLAC042	Swansons North	199416	7200947	53	467	12	29/05/2012	0.3
KLAC043	Swansons North	199745	7200767	53	466	15	29/05/2012	0.2
KLAC044	Swansons North	200044	7200424	53	466	18	29/05/2012	0.3
KLAC046	Island 5	205797	7199139	53	466	24	8/06/2012	1.19
KLAC047	Island 5	205629	7198196	53	466	16	9/06/2012	0.62
KLAC048	Island 5	205797	7199139	53	466	15	10/06/2012	0.75
KLAC049	Swansons North	206081	7200875	53	466	13.2	11/06/2012	nd
KLAC050	Swansons North	205407	7201540	53	467	15	11/06/2012	nd
KLAC051	Island 4	207419	7200549	53	470	15	11/06/2012	0.71
KLAC052	Island 4	207700	7199413	53	468	15	12/06/2012	nd
KLAC053	Island 4	207571	7199455	53	466	14.5	12/06/2012	nd
KLAC054	Island 4	207495	7198303	53	476	15	13/06/2012	nd
KLAC055	Island 4	207455	7197505	53	470	12	13/06/2012	0.85
KLAC056	Island 2	209596	7197647	53	473	15	13/06/2012	0.85
KLAC057	Island 2	209580	7197205	53	463	22	14/06/2012	nd
KLAC058(1)	Island 1	211962	7197049	53	472	21	14/06/2012	3.17
KLAC058(2)	Island 1	211962	7197049	53	472	6	15/06/2012	nd
KLAC059	Island 1	211526	7196441	53	466	24	15/06/2012	nd
KLAC060	Island 1	212289	7196745	53	467	21	16/06/2012	0.955
KLAC061	Curtin boundary	211525	7198420	53	479	26	17/06/2012	nd
KLAC062	Curtin boundary	211804	7197743	53	461	41	17/06/2012	1
KLAC063	Curtin boundary	211944	7197707	53	467	18	18/06/2012	0.55
KLAC064	Curtin boundary	212224	7197657	53	461	18	20/06/2012	1.03
KLAC065	Curtin boundary	212837	7199033	53	458	18	20/06/2012	0.81
KLAC066	Curtin boundary	212077	7200557	53	472	21	20/06/2012	nd

HoleID	Lake	x	y	Zone_	elevation (mAHD)	End of Hole (m)	Date_	SWL (m)
KLAC067	Curtin boundary	211165	7200850	53	473	18	21/06/2012	nd
KLAC068	Skinny	210070	7202262	53	466	21	22/06/2012	0.7
KLAC069	Skinny	211110	7202769	53	465	18	23/06/2012	1.1
KLAC070	Skinny	211663	7202791	53	465	27	23/06/2012	0.7
KLAC071	Skinny	212102	7202632	53	465	38.5	24/06/2012	nd
KLAC072	Skinny	213301	7202390	53	465	18	25/04/2012	nd
KLAC073	Lyndavale west	216358	7201488	53	466	15	25/04/2012	0.4
KLAC074	Lyndavale west	218066	7202567	53	466	12	25/04/2012	0.5
KLAC075	Lyndavale west	219683	7202966	53	466	20	26/06/2012	0.3
KLAC076	Lyndavale west	221913	7203931	53	466	16	26/06/2012	0.5
KLAC077	Lyndavale west	223554	7204271	53	466	27	27/06/2012	0.4
KLAC078	Lyndavale west	224073	7201991	53	466	21	27/06/2012	nd
KLAC079	Lyndavale West	226097	7200700	53	466	30	10/07/2012	nd
KLAC080	Lyndavale West	226352	7200070	53	466	15	10/07/2012	0.6
KLAC081	Lyndavale west	225413	7199204	53	466	15	11/07/2012	nd
KLAC082	Miningere West	226334	7196527	53	466	19.5	11/07/2012	0.3
KLAC083	Miningere West	226259	7195947	53	466	24	11/07/2012	0.4
KLAC084	Lyndavale west	223579	7199524	53	466	15	12/07/2012	nd
KLAC085	MinSkin	227687	7201235	53	464	17	12/07/2012	nd
KLAC086	Highway	205178	7207067	53	464	14.5	13/07/2012	nd
KLAC087	Highway	205617	7205775	53	464	12	13/07/2012	0.4
KLAC088	Curtin North	787323	7204499	52	467	30.5	14/07/2012	0.2
KLAC089	Mallee Well East	789691	7202766	52	478	30	16/07/2012	0.4
KLAC090	Mallee Well East	788778	7202153	52	476	6.5	17/07/2012	0.4
KLAC091	Mallee Well East	790171	7201019	52	478	8	17/07/2012	0.4
KLAC092	Curtin North	789828	7205229	52	474	12	18/07/2012	0.5
KLAC093	Curtin North	790862	7206621	52	469	24	18/07/2012	0.5
KLAC094	Curtin North	789745	7208319	52	475	30	18/07/2012	0.5
KLAC095	Curtin North	788907	7209082	52	472	12	19/07/2012	nd
KLAC096	Curtin North	788868	7207171	52	468	24	19/07/2012	0.4
KLAC097	Curtin North	787030	7205688	52	473	18	19/07/2012	0.5
KLAC098	Curtin North	786808	7204758	52	469	11.5	19/07/2012	nd
KLAC099	Curtin North	788623	7205126	52	472	9	20/07/2012	nd
KPAC001	Mulga Bank	306869	7198998	53	406	21	27/09/2010	nd
KPAC002	Mulga Bank	306025	7198464	53	407	16	27/09/2010	nd
KPAC003	Mulga Bank	305228	7197791	53	407	18	27/09/2010	11
KPAC004	Mulga Bank	303574	7197254	53	409	18	27/09/2010	12
KPAC005	Erldunda Boundary	273519	7199882	53	435	34	28/09/2010	nd
KPAC006	Erldunda Boundary	273593	7197687	53	443	24	28/09/2010	nd
KPAC007	Erldunda Boundary	273751	7195595	53	443	20	28/09/2010	nd
KPAC008	Erldunda Boundary	273871	7193098	53	434	27	28/09/2010	7
KPAC009	Pulcura	261544	7190903	53	448	36	28/09/2010	18
KPAC010	Pulcura	261493	7191846	53	445	14	28/09/2010	nd
KPAC011	Pulcura	261109	7192645	53	444	7	29/09/2010	nd
KPAC012	Murphys	251634	7194040	53	449	29	29/09/2010	nd
KPAC013	Murphys	251224	7194654	53	449	18	1/10/2010	6
KPAC014	Murphys	251809	7195639	53	452	36	1/10/2010	18
KPAC015	Swansons	798389	7200664	52	477	39	10/12/2010	7
KPAC016	Swansons	798977	7199094	52	489	42	10/12/2010	13
KPAC017	Swansons	798644	7198142	52	482	39	10/12/2010	12
KPAC018	Swansons	798489	7197107	52	482	33	10/12/2010	12
KPAC019	Swansons	798084	7196163	52	481	45	10/12/2010	12
KPAC020	Swansons	798576	7195914	52	483	45	10/12/2010	16
KPAC021	Swansons	798980	7195594	52	477	78	10/12/2010	nd
KPAC022	Swansons	799453	7195694	52	475	30	10/12/2010	2
KPAC023	Skinny	214763	7201523	53	466	9	10/12/2010	nd
KPAC024	Skinny	214811	7201428	53	468	9	10/12/2010	2
KPAC025	Skinny	214851	7201358	53	467	9	10/12/2010	4
KPAC026	Skinny	214914	7201247	53	469	15	10/12/2010	nd
KPAC027	Skinny	214252	7199933	53	472	34	10/12/2010	nd
KPAC028	Skinny	214496	7199021	53	469	51	10/12/2010	nd
KPAC029	Skinny	214302	7197087	53	473	37	10/12/2010	nd
KPAC030	Island 1	211416	7197052	53	479	57	10/12/2010	nd
KPAC031	Mallee Well	782442	7202676	52	490	51	10/12/2010	6
KPAC032	Mallee Well	783322	7203446	52	481	39	10/12/2010	1
KPAC033	Mallee Well	783650	7203547	52	483	60	10/12/2010	nd
KPAC043	Murphys	243565	7191945	53	465	72	10/12/2010	15

HoleID	Lake	x	y	Zone_	elevation (mAHD)	End of Hole (m)	Date_	SWL (m)
KPAC044	Murphys	244182	7193847	53	460	39	10/12/2010	nd
KPAC045	Murphys	244643	7195234	53	454	84	10/12/2010	6
KPAC046	Murphys	245593	7197080	53	468	60	10/12/2010	nd
KPAC047	Murphys	252651	7189861	53	462	55	10/12/2010	nd
KPAC048	Murphys	251525	7194825	53	451	52	10/12/2010	nd
KPAC049	Murphys	251718	7195952	53	451	71	10/12/2010	nd
KPAC050	Lyndavale North	250480	7196917	53	451	84	10/12/2010	nd
KPAC051	Lyndavale North	249735	7197155	53	462	59	10/12/2010	nd
KLAC101	Main North Road	773486	7210075	52	483	4.5	13/06/2013	1
KLAC102	Main North Road	773127	7210637	52	482	15	13/06/2013	nd
KLAC103	Main North Road	772648	7210739	52	481	15	14/06/2013	nd
KLAC104	Main North Road	771967	7210339	52	483	21	14/06/2013	nd
KLAC105	Main North Road	774386	7209795	52	485	21	14/06/2013	nd
KLAC106	Main North Road	774663	7209412	52	481	20	15/06/2013	nd
KLAC107	Main North Road	775286	7209318	52	482	6	15/06/2013	nd
KLAC108	Main North Road	775789	7208803	52	483	11	15/06/2013	nd
KLAC109	Curtin West	776832	7209143	52	486	27	16/06/2013	0.5
KLAC110	Curtin West	777000	7209933	52	482	24	17/06/2013	0.3
KLAC111	Curtin West	777372	7210541	52	485	8	17/06/2013	0.5
KLAC112	Curtin North	787975	7204921	52	478	21	20/06/2013	0.4
KLAC113	Curtin North	789344	7205041	52	474	30	20/06/2013	0.5
KLAC114	Curtin North	788511	7206339	52	468	15	24/06/2013	0.5
KLAC115	Curtin North	788008	7207483	52	471	18	24/06/2013	0.5
KLAC116	Curtin North	786857	7207093	52	472	27	18/06/2013	nd
KLAC117	Curtin North	787434	7208117	52	474	12	18/06/2013	nd
KLAC118	Mallee Well East	789284	7202624	52	485	8	21/06/2013	0.5
KLAC119	Mallee Well East	790242	7202450	52	475	12	22/06/2013	0.4
KLAC120	Mallee Well East	790458	7202450	52	480	21	22/06/2013	0.5
KLAC121	Mallee Well East	790474	7200493	52	473	10	23/06/2013	0.5
KLAC122	Swansons	799458	7196258	52	467	6	25/06/2013	0.3
KLAC123	Swansons	799516	7197162	52	467	6	26/06/2013	0.5
KLAC124	Swansons	799835	7198384	52	468	17	26/06/2013	0.8
KLAC125	Swansons	799865	7199349	52	467	24	27/06/2013	1
KLAC126	Swansons	799660	7200224	52	467	21	27/06/2013	1
KLAC127	Swansons	800582	7200481	52	467	25	28/06/2013	1
KLAC128	Swansons North	200044	7201630	53	467	2	29/06/2013	1
KLAC129	Swansons North	200373	7202237	53	467	15	29/06/2013	1
KLAC130	Swansons North	199534	7203203	53	468	8	29/06/2013	0.5
KLAC131	Swansons North	199187	7204726	53	466	15	10/07/2013	1
KLAC132	Swansons North	203217	7202266	53	466	30	11/07/2013	0.4
KLAC133	Swansons North	204434	7202038	53	466	30	11/07/2013	0.3
KLAC134	Island 5	205803	7199138	53	466	21	12/07/2013	0.2
KLAC135	Island 5	205884	7199112	53	470	18	12/07/2013	nd
KLAC136	Island 5	205968	7199083	53	470	18	13/07/2013	nd
KLAC137	Island 5	205516	7198658	53	469	18	13/07/2013	0.2
KLAC138	Island 5	205388	7197615	53	466	27	14/07/2013	0.3
KLAC139	Island 4	207156	7200980	53	466	24	15/07/2013	0.8
KLAC140	Island 4	207281	7199789	53	466	18	15/07/2013	0.8
KLAC141	Island 4	207255	7198849	53	483	15	15/07/2013	nd
KLAC142	Island 2	210154	7197583	53	474	13	16/07/2013	0.4
KLAC143	Island 1	212115	7197023	53	472	12	16/07/2013	0.3
KLAC144	Island 1	212173	7196368	53	472	12	19/07/2013	1
KLAC145	Island 1	211797	7196034	53	472	10	19/07/2013	1
KLAC146	Curtin Boundary	211356	7199198	53	465	21	20/07/2013	0.4
KLAC147	Curtin Boundary	210678	7199845	53	456	29	20/07/2013	0.4
KLAC148	Skinny	210959	7203205	53	465	30	21/07/2013	0.4
KLAC149	Skinny	211262	7204725	53	465	20	22/07/2013	0.4
KLAC150	Skinny	212010	7203049	53	465	21	22/07/2013	1
KLAC151	Skinny	213515	7202823	53	465	16	23/07/2013	nd
KLAC152	Lyndavale West	215908	7201059	53	466	15	23/07/2013	1
KLAC153	Lyndavale West	217875	7201636	53	466	15	24/07/2013	0.2
KLAC154	Lyndavale West	219459	7201636	53	480	15	24/07/2013	1
KLAC155	Lyndavale West	220659	7202499	53	466	11	25/07/2013	nd
KLAC156	Lyndavale West	221638	7201169	53	466	12	25/07/2013	0.4
KLAC157	Lyndavale West	222272	7202360	53	466	21	26/07/2013	0.3
KLAC158	Lyndavale West	223510	7202569	53	466	18	26/07/2013	1
KLAC159	Lyndavale West	223225	7200422	53	466	21	26/07/2013	0.3

HoleID	Lake	x	y	Zone_	elevation (mAHD)	End of Hole (m)	Date_	SWL (m)
KLAC160	Rod's	221639	7195760	53	467	15	27/07/2013	0.4
KLAC161	Rod's	221860	7197106	53	467	15	28/07/2013	0.4
KLAC162	Milly's	220427	7199646	53	470	14	10/08/2013	1
KLAC163	Jetts	219089	7199012	53	465	11	10/08/2013	0.6
KLAC164	Jetts	219314	7197918	53	470	16	11/08/2013	0.6
KLAC165	Jac's	218375	7196018	53	468	15	11/08/2013	0.3
KLAC166	BJ's	217842	7196908	53	467	23	12/08/2013	0.3
KLAC167	LJ's	216977	7196717	53	475	15	12/08/2013	0.3
KLAC168	Mini-Me	227761	7194766	53	470	14	13/08/2013	0.6
KLAC169	Miningere West	226804	7195226	53	466	30	13/08/2013	1
KLAC170	Miningere West	227297	7196242	53	466	30	14/08/2013	1
KLAC171	Miningere West	227704	7197545	53	466	30	15/08/2013	1
KLAC172	Miningere	233255	7198455	53	466	30	16/08/2013	nd
KLAC173	Miningere	233297	7198481	53	466	28	16/08/2013	nd
KLAC174	Miningere	233370	7198563	53	469	25	16/08/2013	nd
KLAC175	Miningere	232496	7198980	53	464	21	17/08/2013	0.2
KLAC176	Miningere	232226	7197986	53	464	19	17/08/2013	1
KLAC177	Miningere	232680	7196957	53	464	20	17/08/2013	nd
KLAC178	Miningere	232743	7196971	53	464	18	17/08/2013	nd
KLAC179	Miningere	232387	7195227	53	465	24	18/08/2013	0.4
KLAC180	Lyndavale North	252559	7200167	53	450	19	20/08/2013	nd
KLAC181	Lyndavale North	253449	7201222	53	450	9	20/08/2013	nd
KLAC182	Lyndavale North	253246	7201105	53	435	10	20/08/2013	nd
KLAC183	Pulcura	261456	7191548	53	439	21	21/08/2013	0.3
KLAC184	Pulcura	261167	7191082	53	440	12	21/08/2013	1
KLAC185	Pulcura	261130	7191905	53	440	18	21/08/2013	1
KLAC186	Pulcura	260049	7192286	53	439	15	22/08/2013	nd
KLAC187	Pulcura	259345	7192979	53	441	21	22/08/2013	1
KLAC188	Corkwood	255849	7195274	53	445	18	23/08/2013	0.4
KLAC189	Corkwood	255659	7194150	53	445	19	23/08/2013	1
KLAC190	Erldunda Boundary	276666	7195448	53	427	15	24/08/2013	1
KLAC191	Erldunda Boundary	276558	7197311	53	427	10	24/08/2013	nd
KLAC192	Susi Q	277665	7197218	53	426	10	25/08/2013	nd
KLAC193	Susi Q	277512	7196173	53	430	8	25/08/2013	nd
KLAC194	Lake Suzi	281133	7195157	53	423	15	25/08/2013	0.8
KLAC195	Lake Suzi	281010	7196117	53	422	24	26/08/2013	0.4
KLAC196	Swansons North	206258	7200890	53	468	36	20/10/2013	nd
KLAC197	Swansons North	204414	7202186	53	469	39	20/10/2013	nd
KLAC198	Island 2	210161	7197580	53	474	21	20/10/2013	0.4
KLAC199	Island 2	210145	7198050	53	471	33	20/10/2013	0.4
KLAC200	Miningere West	226836	7195218	53	466	36	21/10/2013	0.6
KLAC201	Miningere West	227544	7196524	53	466	30	21/10/2013	0.6
KLAC202	Miningere West	227170	7198160	53	467	27	21/10/2103	0.6

A1.8. Test Trenches and Piezometer Arrays

HoleID	Lake	x	y	Zone	Elevation (mAHD)	End of Hole (m)	Date	Sample Type	SWL (m)
Pulcurra Trench	Pulcura	261485	7191530	53	439	1.5	16/07/2013	Trench	0.35
PTP01	Pulcura	261485	7191550	53	439	1.95	16/07/2013	TP	0.36
PTP02	Pulcura	261480	7191579	53	439	1.77	16/07/2013	TP	0.29
PTP03	Pulcura	261473	7191630	53	439	2	16/07/2013	TP	0.27
PTP04	Pulcura	261420	7191769	53	439	1.82	16/07/2013	TP	0.23
PTP05	Pulcura	261492	7191508	53	439	1.92	16/07/2013	TP	0.35
PTP06	Pulcura	261494	7191479	53	439	1.9	16/07/2013	TP	0.27
PTP07	Pulcura	261500	7191430	53	439	1.84	16/07/2013	TP	0.09
PTP08	Pulcura	261458	7191287	53	439	1.88	16/07/2013	TP	0.27
PTP09	Pulcura	261383	7191523	53	439	1.85	16/07/2013	TP	0.21
PTP10	Pulcura	261544	7191533	53	439	2.46	16/07/2013	TP	0.9
Curtin Boundary Trench	Curtin Boundary	211935	7197727	53	467	2	22/08/2013	Trench	0.26
PTC01	Curtin Boundary	211955	7197717	53	467	2.2	24/08/2013	TP	0.24
PTC02	Curtin Boundary	211981	7197705	53	467	2.2	24/08/2013	TP	0.21
PTC03	Curtin Boundary	212026	7197680	53	469	2.19	25/08/2013	TP	0.215
PTC04	Curtin Boundary	212174	7197675	53	467	2.18	25/08/2013	TP	0.22
PTC05	Curtin Boundary	211917	7197735	53	468	2.465	22/08/2013	TP	0.28
PTC06	Curtin Boundary	211891	7197748	53	468	2.44	22/08/2013	TP	0.295
PTC07	Curtin Boundary	211845	7197772	53	468	2.25	22/08/2013	TP	0.325
PTC08	Curtin Boundary	211711	7197839	53	470	3.015	22/08/2013	TP	0.375
PTC09	Curtin Boundary	211982	7197808	53	474	1.87	25/08/2013	TP	0.28
PTC10	Curtin Boundary	211903	7197666	53	467	2.47	25/08/2013	TP	0.805
Miningere Trench	Miningere	233195	7198425	53	464	2.5	10/09/2013	Trench	0.34
PTM01	Miningere	233185	7198445	53	464	2.91	10/09/2013	TP	0.335
PTM02	Miningere	233175	7198470	53	464	2.94	10/09/2013	TP	0.34
PTM03	Miningere	233156	7198521	53	464	3.27	12/09/2013	TP	0.345
PTM04	Miningere	233069	7198643	53	464	2.99	12/09/2013	TP	0.495
PTM05	Miningere	233202	7198404	53	464	3.33	13/09/2013	TP	0.34
PTM06	Miningere	233210	7198382	53	464	3.215	14/09/2013	TP	0.355
PTM07	Miningere	233227	7198335	53	464	3	14/09/2013	TP	0.36
PTM08	Miningere	233279	7198195	53	464	2.63	14/09/2013	TP	0.25
PTM09	Miningere	233110	7198385	53	464	3	13/09/2013	TP	0.225
PTM10	Miningere	233248	7198462	53	466	3.77	14/09/2013	TP	1.19
PTI5S01	Island 5	205729	7198899	53	466	1.25	19/09/2013	TP	0.03
PTI5S02	Island 5	205766	7199043	53	466	1.27	19/09/2013	TP	0.03
PTI5S03	Island 5	205782	7199094	53	466	1.58	19/09/2013	TP	
PTI5S04	Island 5	205888	7199119	53	470	1.95	19/09/2013	TP	0.68
PTI5S05	Island 5	205848	7199124	53	470	1.84	21/09/2013	TP	0.53
PTI5S06	Island 5	205802	7199192	53	466	1.47	21/09/2013	TP	0.19
PTI5S07	Island 5	205808	7199240	53	466	1.22	21/09/2013	TP	0.09
PTI5S08	Island 5	205743	7199155	53	466	1.26	22/09/2013	TP	0.03
PTI5S09	Island 5	205696	7199163	53	466	1.17	22/09/2013	TP	0.01
PTI5D01	Island 5	205731	7198899	53	466	3.71	21/08/2013	TP	0.15
PTI5D02	Island 5	205768	7199043	53	466	3.8	22/08/2013	TP	0.115
PTI5D03	Island 5	205783	7199094	53	466	5.96	26/10/2013	TP	0.12
PTI5D04	Island 5	205888	7199118	53	470	6.59	26/10/2013	TP	0.74
PTI5D05	Island 5	205847	7199124	53	470	5.83	25/10/2013	TP	0.53
PTI5D06	Island 5	205804	7199192	53	466	5.84	25/10/2013	TP	0.19
PTI5D07	Island 5	205810	7199240	53	466	6.1	25/10/2013	TP	0.21
PTI5D08	Island 5	205743	7199153	53	466	5.88	27/10/2013	TP	0.05
PTI5D09	Island 5	205697	7199163	53	466	5.74	27/10/2013	TP	0.07

A1.9. Pumping Test Bores

HoleID	Lake	x	y	Zone_	Elevation (mAHD)	End of Hole (m)
KLAC 29	Murphys	247544	7192398	53	446	3
KLAC33	Miningere	233115	7198556	53	464	15
KLAC48	Island 5	205797	7199139	53	466	15
KLAC51	Island 4	207419	7200549	53	470	13.2
KLAC60	Island 1	212289	7196745	53	467	9
KLAC63	Curtin boundary	211944	7197707	53	467	14
KLAC68	Skinny	210070	7202262	53	466	12
KLAC82	Miningere West	226334	7196527	53	466	18
KLAC88	Curtin North	787323	7204499	52	467	27
KLAC89	Mallee Well East	789691	7202766	52	478	5.5

A2. Porosity Data

A2.1. British Geological Survey Laboratory

Hole	Lake	From (m)	To (m)	Lithology	Sample No	Strat Code	Total Porosity (% v/v)	Drainable Porosity (Fraction v/v)
KLS11	Island 2	0	0.15	fine brown sand lake sed	BGS4	1	41.2	0.02
KLS11	Island 2	5.6	5.75	moist silty caly	BGS5	1	41.8	0.08
KLS17	Murphys	0.35	0.5	fine brown wet clayey sand lake sed	BGS8	1	42.2	0.02
KLS17	Murphys	1.6	1.75	coarse brown clayey gyspum sand	BGS9	1	25.3	0.07
KLS17	Murphys	2.7	2.85	coarse brown clayey gyspum sand	BGS10	1	35.5	0.13
KLS17	Murphys	3	3.15	brown grey coarse sandstone	BGS11	1	35.2	0.11
KLS16	Murphys	0.35	0.5	coarse gypsum sand	BGS12	1	26.6	0.07
KLS16	Murphys	0.7	0.85	coarse gypsum sand	BGS13	1	21.7	0.07
KLS16	Murphys	1.5	0.65	fine brown clayey sand	BGS14	1	27.2	0.05
KLS08	Island 4	0.2	0.35	f-m brown clayey gypsum sand	BGS15	1	23.0	0.06
KLS08	Island 4	1	1.15	f-m brown clayey gypsum sand	BGS16	1	33.8	0.06
KLS08	Island 4	4	4.15	brown clayey silt	BGS17	1	33.6	0.05
KLS18	Pulcura	0.3	0.45	brown clayey sand lake sed	BGS38	1	31.9	0.06
KLS18	Pulcura	0.8	0.95	grey clayey gypsum sand lake sed	BGS39	1	40.5	0.10
KLS18	Pulcura	2.7	2.85	fine brown sand	BGS40	1	37.5	0.13
KLS18	Pulcura	3.7	3.85	fine brown sand	BGS41	1	32.9	0.16
KLS18	Pulcura	4.2	4.35	fine tan sand	BGS42	1	34.5	0.20
KLS05	Swansons	0.2	0.35	grey brown fine sand lake sed	BGS45	1	28.7	0.12
KLS03	Mallee Well East	0.5	0.65	orange brown sand	BGS50	1	29.4	0.17
KLS03	Mallee Well East	3.1	3.25	grey coarse sand	BGS51	1	27.8	0.13
KLS03	Mallee Well East	5.2	5.35	tan fine sand	BGS52	1	30.2	0.11
KLS03	Mallee Well East	7.3	7.45	tan fine sand	BGS53	1	24.0	0.02
KLS07	Island 5	0.45	0.6	fine brown clayey sand	BGS54	1	28.5	0.04
KLS06	Swansons North	0.4	0.55	fine brown sand lake sed	BGS58	1	32.4	0.20
KLS01	Curtin West	0.3	0.45	very coarse gypsum sand lake sed	BGS65	1	23.6	0.06
KLS09	Skinny	0.6	0.75	fine brown sand lake sed	BGS67	1	31.6	0.06
KLS12	Island 1	3.1	3.25	Fractured tan siltstone with clay	BGS1	2	66.5	0.02
KLS12	Island 1	11.4	11.55	Fractured tan siltstone with clay	BGS2	2	43.7	0.03
KLS12	Island 1	5.6	5.75	Fractured tan siltstone with clay	BGS3	2	65.8	0.04
KLS11	Island 2	8.6	8.75	fractured clayey siltstone	BGS6	2	47.9	0.11
KLS11	Island 2	10.7	10.85	coarse clayey sandstone	BGS7	2	36.1	0.06
KLS08	Island 4	6.4	6.55	soft brown siltstone	BGS18	2	38.0	0.03
KLS08	Island 4	11.6	11.75	soft brown siltstone	BGS19	2	40.9	0.08
KLS08	Island 4	12.4	12.55	soft brown siltstone	BGS20	2	27.3	0.01
KLS13	Miningere West	5.4	5.55	soft tan brown sandstone	BGS21	2	39.7	0.08
KLS13	Miningere West	8	8.15	clean tan sandstone	BGS22	2	28.1	0.03
KLS13	Miningere West	9.3	9.45	clean tan sandstone	BGS23	2	33.5	0.15
KLS13	Miningere West	10.55	10.7	clean tan sandstone	BGS24	2	26.7	0.07
KLS13	Miningere West	12.65	12.8	clean tan sandstone	BGS25	2	33.8	0.15
KLS13	Miningere West	15.95	16.1	tan brown sandstone	BGS26	2	32.8	0.07
KLS13	Miningere West	17.4	17.55	silty sandstone tan brown	BGS27	2	34.6	0.03
KLS14	Miningere West	2.25	2.4	brown fractured siltstone	BGS28	2	39.4	0.10
KLS14	Miningere West	3.15	3.3	fractured brown sandy silstone	BGS29	2	45.4	0.10
KLS14	Miningere West	12.5	2.65	fractured brown sandy silstone	BGS30	2	35.9	0.11
KLS14	Miningere West	17.1	17.25	brown sandstone fine	BGS31	2	37.2	0.07
KLS14	Miningere West	18.8	18.95	brown sandstone fine	BGS32	2	32.0	0.02
KLS15	Miningere	5.3	5.45	brown grey siltstone	BGS33	2	35.5	0.03
KLS15	Miningere	8.15	8.3	brown siltstone	BGS34	2	36.3	0.03
KLS15	Miningere	11	11.15	brown sandy siltstone	BGS35	2	35.5	0.10
KLS15	Miningere	13	13.15	brown fractured siltstone	BGS36	2	37.0	0.04
KLS15	Miningere	18	18.15	brown fractured siltstone	BGS37	2	40.7	0.05
KLS18	Pulcura	8.3	8.45	fractured brown siltstone	BGS43	2	38.7	0.08
KLS18	Pulcura	12.2	12.35	fractured brown siltstone	BGS44	2	38.5	0.12
KLS05	Swansons	5.2	5.35	tan grey clayey siltstone	BGS46	2	24.6	0.06
KLS05	Swansons	7.3	7.45	tan brown clayey silstone	BGS47	2	17.4	0.02
KLS05	Swansons	10.1	10.25	brown siltstone	BGS48	2	29.6	0.02
KLS05	Swansons	19	19.15	brown siltstone	BGS49	2	30.4	0.09
KLS07	Island 5	4.7	4.85	grey clayey siltstone	BGS55	2	24.3	0.06

Hole	Lake	From (m)	To (m)	Lithology	Sample No	Strat Code	Total Porosity (% v/v)	Drainable Porosity (Fraction v/v)
KLS07	Island 5	10.6	10.75	grey clayey siltstone	BGS56	2	27.1	0.03
KLS07	Island 5	14.4	14.55	fractured grey siltstone	BGS57	2	24.1	0.02
KLS06	Swansons North	3.2	3.35	fractured brown siltstone	BGS59	2	38.8	0.05
KLS06	Swansons North	10.9	11.05	fractured brown siltstone	BGS60	2	20.0	0.04
KLS06	Swansons North	13.8	13.95	fractured brown siltstone	BGS61	2	33.7	0.03
KLS02	Curtin North	6.75	6.9	fractured brown siltstone	BGS62	2	37.3	0.06
KLS02	Curtin North	8.8	8.95	fractured brown siltstone	BGS63	2	39.9	0.06
KLS02	Curtin North	14.9	15.05	fractured brown siltstone	BGS64	2	38.5	0.04
KLS01	Curtin West	12	12.15	siltstone fracture zone	BGS66	2	29.0	0.03
KLS09	Skinny	7.4	7.55	fractured brown siltstone	BGS68	2	39.4	0.06
KLS10	Curtin Boundary	4.4	4.55	fractured brown siltstone	BGS69	2	43.5	0.07
KLS10	Curtin Boundary	11	11.15	fractured brown siltstone	BGS70	2	39.8	0.03
KLS10	Curtin Boundary	13.7	13.85	fractured brown siltstone	BGS71	2	40.8	0.04

A2.2. E Precision Laboratory – Porosity Data

Sample ID	Lab ID	HoleID	From (m)	To (m)	Strat Code	Total Porosity (% v/v))
PS1	RUM1	KLS12	3.25	3.4	2	58.2
PS10	RUM10	KLS17	2.85	3	1	33.6
PS11	RUM11	KLS17	3.15	3.3	2	34.8
PS12	RUM12	KLS16	0.2	0.35	1	48.4
PS13	RUM13	KLS16	0.85	1	1	33.9
PS14	RUM14	KLS16	1.65	1.8	1	27.0
PS15	RUM15	KLS08	0.35	0.5	1	28.5
PS16	RUM16	KLS08	1.15	1.3	1	45.0
PS17	RUM17	KLS08	4.15	4.3	2	38.4
PS18	RUM18	KLS08	6.55	6.7	2	39.3
PS19	RUM19	KLS08	11.75	11.9	2	5.4
PS2	RUM2	KLS12	11.5	11.65	2	23.3
PS20	RUM20	KLS08	12.55	12.7	2	36.1
PS21	RUM21	KLS13	5.55	5.7	2	39.8
PS22	RUM22	KLS13	8.15	8.3	2	22.8
PS23	RUM23	KLS13	9.45	9.6	2	22.1
PS24	RUM24	KLS13	10.4	10.55	2	22.1
PS25	RUM25	KLS13	12.5	12.65	2	55.4
PS26	RUM26	KLS13	15.8	15.95	2	28.2
PS27	RUM27	KLS13	17.55	17.7	2	27.1
PS28	RUM28	KLS14	2.1	2.25	2	31.4
PS29	RUM29	KLS14	3	3.15	2	38.5
PS3	RUM3	KLS12	5.75	59	2	54.0
PS30	RUM30	KLS14	12.65	12.8	2	71.0
PS31	RUM31	KLS14	17.25	17.4	2	30.3
PS32	RUM32	KLS14	19	19.15	2	26.4
PS33	RUM33	KLS15	5.45	5.6	2	34.8
PS34	RUM34	KLS15	8.3	8.45	2	30.6
PS35	RUM35	KLS15	11.1	11.25	2	10.3
PS36	RUM36	KLS15	13.15	13.3	2	37.9
PS37	RUM37	KLS15	18.15	18.3	2	36.9
PS38	RUM38	KLS18	0.45	0.6	1	16.3
PS39	RUM39	KLS18	0.95	1.1	1	38.0
PS4	RUM4	KLS11	0.15	0.3	1	32.9
PS40	RUM40	KLS18	2.85	3	2	37.9
PS41	RUM41	KLS18	3.85	4	2	39.2
PS42	RUM42	KLS18	4.35	4.5	2	32.5
PS43	RUM43	KLS18	8.45	8.6	2	41.3
PS44	RUM44	KLS18	12.35	12.5	2	38.9
PS45	RUM45	KLS05	0.35	0.5	1	29.0
PS46	RUM46	KLS05	5.35	5.5	2	35.4
PS47	RUM47	KLS05	7.45	7.6	2	24.7
PS48	RUM48	KLS05	10.25	10.4	2	21.6
PS49	RUM49	KLS05	19.15	19.3	2	25.9
PS5	RUM5	KLS11	5.6	5.75	2	32.9
PS50	RUM50	KLS03	0.65	0.8	2	26.3
PS51	RUM51	KLS03	3.25	3.4	2	25.2
PS52	RUM52	KLS03	5.35	5.5	2	47.0
PS53	RUM53	KLS03	7.45	7.6	2	27.3
PS54	RUm54	KLS07	0.45	0.6	1	33.5
PS55	RUM55	KLS07	4.85	5	2	28.2
PS56	RUM56	KLS07	10.75	10.9	2	24.8
PS57	RUM57	KLS07	14.55	14.6	2	13.7
PS58	RUM58	KLS06	0.55	0.7	1	41.5
PS59	RUM59	KLS06	3.35	3.5	2	40.3
PS6	RUM6	KLS11	8.75	8.9	2	37.7
PS60	RUM60	KLS06	11.05	11.2	2	33.4
PS61	RUM61	KLS06	13.95	14.1	2	36.4
PS62	RUM62	KLS02	6.9	7.05	2	33.7
PS63	RUM63	KLS02	8.95	9.1	2	39.5
PS64	RUM64	KLS02	15.05	15.2	2	36.7
PS65	RUM65	KLS01	0.45	0.6	1	40.4
PS66	RUM66	KLS01	12.15	2.3	2	47.2
PS67	RUM67	KLS09	0.75	0.9	1	30.2
PS68	RUM68	KLS09	7.55	7.7	2	31.0

Sample ID	Lab ID	HoleID	From (m)	To (m)	Strat Code	Total Porosity (% v/v))
PS69	RUM69	KLS10	4.55	4.7	2	36.7
PS7	RUM7	KLS11	10.85	11	2	23.4
PS70	RUM70	KLS10	11.15	11.3	2	36.2
PS71	RUM71	KLS10	13.85	14	2	41.4
PS8	RUM8	KLS17	0.2	0.35	1	36.6
PS9	RUM9	KLS17	1.75	1.9	1	38.2

A3. Brine Assay Data

A3.1. Brine Assay (units are mg/L)

HoleID	Depth (m)	Sample Type	SG	TDS	K	Mg	SO4	Ca	Na	Cl	HCO3
Curtain West Trench	2.4	T	nd	nd	7200	nd	nd	nd	nd	nd	nd
HDP_11	0.5	HDP	1.20	306959	3600	13674	39629	300	99000	150692	64
HDP_12	0.5	HDP	1.19	292926	4400	8800	37456	320	100000	141828	112
HDP_13	0.5	HDP	1.19	306586	4800	8557	36835	320	100000	156010	64
HDP_14	0.5	HDP	1.21	325276	4900	7585	32177	320	110000	170193	91
HDP_15	0.5	HDP	1.21	329813	4900	6100	28141	360	120000	170193	119
HDP_16	0.5	HDP	1.21	336455	5500	5883	27302	320	120000	177285	165
KLAC 29	3	PT	1.17	270000	4567	9333	53333	367	78000	123333	120
KLAC003	9	AC	1.17	272500	3525	2525	18000	658	100000	147500	22
KLAC004	11.5	AC	1.17	276667	2900	3367	19000	640	103333	146667	33
KLAC005	8.5	AC	1.17	260000	3000	2800	19000	680	100000	140000	29
KLAC007	13.5	AC	1.20	330000	4900	5400	41000	340	120000	160000	86
KLAC008	6	AC	1.19	315000	4950	4000	37500	405	110000	155000	160
KLAC010	6	AC	1.12	286667	4167	3933	28667	510	103333	146667	70
KLAC011	11.5	AC	1.18	290000	3800	4700	25000	480	110000	150000	67
KLAC012	11.5	AC	1.16	260000	3500	4900	18000	540	97000	140000	72
KLAC013	11.5	AC	1.17	270000	3700	4300	29000	560	100000	140000	48
KLAC014	14.5	AC	1.16	250000	3500	3400	24000	710	91000	120000	33
KLAC018	14.5	AC	1.19	310000	4320	6860	50600	432	104000	138000	33
KLAC019	17.5	AC	1.19	320000	3200	8600	65500	375	110000	135000	40
KLAC020	12	AC	1.19	335000	4125	12250	83750	388	102250	130000	48
KLAC023	20	AC	1.12	188000	1280	2420	8860	1480	69400	104000	44
KLAC024	18	AC	1.12	190000	3550	5250	29500	745	62500	86500	72
KLAC025	11.5	AC	1.15	290000	4550	8250	44500	435	97000	130000	140
KLAC026	17	AC	1.07	113333	1167	4333	9467	1567	36667	60000	57
KLAC027	8.5	AC	1.19	305000	5050	9650	57500	390	100000	135000	235
KLAC028	8.5	AC	1.20	320000	5600	11000	56500	335	105000	140000	180
KLAC029	11.5	AC	1.18	306667	5333	11333	54000	387	96667	136667	111
KLAC030	12	AC	1.07	99667	1500	3167	14667	1100	33000	47667	220
KLAC031	17.5	AC	1.18	306667	6700	6467	40333	450	110000	146667	52
KLAC033	17.5	AC	1.19	301667	8533	3450	45833	377	101000	140000	50
KLAC034	21	AC	1.19	306000	8700	3440	48400	342	99800	140000	70
KLAC035	24	AC	1.19	303333	8689	3344	44889	358	100000	143333	43
KLAC039	9	AC	1.22	330000	2600	7900	27000	250	110000	180000	12
KLAC040	6	AC	1.20	300000	3000	13000	50000	320	94000	140000	60
KLAC043	15	AC	1.19	290000	3133	11000	40667	360	91333	143333	40
KLAC044	18	AC	1.20	301667	3050	11000	43333	332	95500	150000	46
KLAC046	24	AC	1.18	275000	4467	11500	48333	378	78500	131667	84
KLAC047	16	AC	1.22	326667	5433	15667	57500	257	88167	160000	59
KLAC048	15	AC	1.19	280000	5500	11000	35600	328	80400	148000	63
KLAC049	13.2	AC	1.20	291667	3317	11000	47000	362	85500	148333	41
KLAC050	15	AC	1.19	280000	3350	10000	45000	395	80500	140000	19
KLAC051	15	AC	1.18	263333	5833	10017	55167	402	72167	116667	62
KLAC052	15	AC	1.17	283333	5300	10833	63000	418	80667	118333	74
KLAC055	12	AC	1.15	260000	4900	10000	61500	475	70000	110000	43
KLAC056	15	AC	1.17	300000	7000	6367	55167	472	95167	131667	67
KLAC058(1)	21	AC	1.20	456000	8540	10020	141800	434	136400	160000	67
KLAC059	24	AC	1.17	340000	7400	8450	77500	645	103000	140000	195
KLAC060	21	AC	1.19	293333	6267	8800	49667	340	92000	133333	57
KLAC061	26	AC	1.20	340000	6350	9100	58000	350	110000	150000	72
KLAC062	41	AC	1.17	268571	5200	7486	35357	279	86643	135714	59
KLAC063	18	AC	1.17	260000	5157	7114	32000	337	84000	131429	60
KLAC064	18	AC	1.16	263333	4417	6900	57500	405	83333	114667	69
KLAC065	18	AC	1.17	270000	3940	6520	31600	450	91200	138000	57
KLAC066	21	AC	1.19	313750	3950	7538	48000	428	95500	157500	38
KLAC068	21	AC	1.21	336667	4317	8533	71500	350	102000	148333	38
KLAC069	18	AC	1.21	332000	4280	10160	70800	340	101000	146000	48
KLAC070	27	AC	1.20	308750	4313	7150	48625	370	99500	148750	19
KLAC071	38.5	AC	1.19	301000	4600	7500	29100	363	98300	158000	43
KLAC072	18	AC	1.21	350000	4200	9700	82000	290	110000	150000	38
KLAC073	15	AC	1.21	300000	4100	7500	29000	310	100000	160000	38
KLAC074	12	AC	1.20	300000	3700	6700	37000	340	100000	150000	29
KLAC075	20	AC	1.20	310000	3400	5700	43000	340	100000	150000	38
KLAC076	16	AC	1.19	285000	3550	6050	34000	425	95000	140000	24
KLAC077	27	AC	1.20	300000	2600	7100	30000	370	110000	160000	38
KLAC079	30	AC	1.18	272222	3311	6622	26333	368	93000	143333	74
KLAC080	15	AC	1.18	280000	3550	5200	40500	380	93500	135000	67

HoleID	Depth (m)	Sample Type	SG	TDS	K	Mg	SO4	Ca	Na	Cl	HCO3
KLAC081	15	AC	1.20	300000	3500	7000	47000	320	100000	150000	48
KLAC082	19.5	AC	1.18	273333	5367	4150	33833	380	92500	135000	128
KLAC083	24	AC	1.20	312500	6225	5250	43000	318	103625	151250	48
KLAC084	15	AC	1.19	300000	2400	6600	44000	360	100000	140000	57
KLAC088	30.5	AC	1.18	267000	6250	8970	33800	388	83500	135000	49
KLAC089	30	AC	1.20	301000	5630	6620	40000	348	99100	149000	39
KLAC090	6.5	AC	1.18	270000	5600	6600	46000	410	86000	130000	48
KLAC091	8	AC	1.23	360000	8333	8133	69667	213	110000	160000	77
KLAC093	24	AC	1.16	248333	2650	6467	23833	592	83833	131667	43
KLAC094	30	AC	1.16	250000	2627	6418	21818	606	83818	129091	30
KLAC096	24	AC	1.19	300000	4175	6775	26000	423	100000	160000	19
KLAC097	18	AC	1.17	265000	3000	8700	37000	430	81500	135000	38
KLAC33	15	PT	1.19	280000	8333	3333	44000	357	92333	133333	32
KLAC48	15	PT	1.20	300000	5333	9967	65667	287	87333	136667	54
KLAC51	13.2	PT	1.17	260000	5667	9100	59333	380	71667	110000	65
KLAC60	9	PT	1.20	303333	6100	8500	66667	313	91000	126667	65
KLAC63	14	PT	1.17	260000	4967	6667	52333	357	84333	113333	58
KLAC68	12	PT	1.19	290000	4133	9200	47000	357	93333	140000	39
KLAC82	18	PT	1.19	283333	5533	4367	49333	373	98667	123333	109
KLAC88	27	PT	1.19	280000	6300	8500	54000	350	86000	130000	54
KLAC89	5.5	PT	1.19	300000	5600	6300	47000	360	98000	140000	31
KPAC003	18	AC	1.06	77353	610	1835	8729	1190	24000	40779	192
KPAC004	18	AC	1.04	41983	335	1410	5204	1180	11500	22163	188
KPAC014	36	AC	1.06	76698	740	1835	8192	1180	22000	42552	197
KPAC015	39	AC	1.10	134557	470	2188	6228	2000	42000	81558	73
KPAC016	42	AC	1.05	62675	840	2188	10606	600	18200	30141	92
KPAC017	39	AC	1.04	41517	600	1700	7641	400	13200	17730	238
KPAC019	45	AC	1.04	35319	335	1689	5349	820	9150	17730	238
KPAC022	30	AC	1.06	76204	980	3160	11804	800	22000	37233	201
KPAC024	9	AC	1.07	84073	1140	3026	12906	220	24000	42552	220
KPAC028	51	AC	1.07	94854	900	3160	17796	440	28000	44325	229
KPAC029	37	AC	1.09	123847	1500	3767	21092	400	33000	63828	256
KPAC031	51	AC	1.06	77483	325	437	2519	380	4350	69147	302
KPAC032	39	AC	1.05	63084	2200	1999	11570	620	19100	26595	320
KPAC033	60	AC	1.06	78812	2000	2820	18573	760	22000	31914	265
KPAC043	72	AC	1.02	5240	110	170	1609	240	1200	1595	293
KPAC045	84	AC	1.07	98425	2200	2431	13310	800	44000	35460	192
KPAC047	55	AC	1.03	20361	225	571	3991	720	4850	9751	242
KPAC049	71	AC	1.03	31616	180	1021	1609	1120	7900	19503	238
KPAC050	84	AC	1.02	15243	130	498	2191	740	3575	7624	325
KPSC006_P	1.5	SP	1.24	nd	8700	11000	79000	nd	nd	nd	nd
KPSC016_P	1.5	SP	1.18	nd	4200	3900	27000	nd	nd	nd	nd
KPSC019_P	1.5	SP	1.20	nd	4200	5600	38000	nd	nd	nd	nd
KPSC020_P	1.5	SP	1.17	nd	5000	4200	46000	nd	nd	nd	nd
KPSC021_P	1.3	SP	1.15	nd	4000	7800	55000	nd	nd	nd	nd
KPSC024_P	2.8	SP	1.18	nd	4200	9500	39000	nd	nd	nd	nd
KPSC026_P	4	SP	1.18	nd	7800	4400	39000	nd	nd	nd	nd
KPSC028_P	1.1	SP	1.18	nd	7700	3900	46000	nd	nd	nd	nd
KPSC046_P	2.7	SP	1.17	nd	5100	6700	50000	nd	nd	nd	nd
KPSC048_P	1.3	SP	1.20	nd	6500	11000	61000	nd	nd	nd	nd
KPSC057_P	1.1	SP	1.25	nd	7900	22000	74000	nd	nd	nd	nd
HDP_17	0.5	HDP	1.21	336733	5400	6077	27302	440	120000	177285	229
HDP_18	0.5	HDP	1.17	256971	1900	3525	4522	2200	94000	150692	52
HDP_19	0.5	HDP	1.19	266093	2100	2600	5298	1740	100000	154238	27
HDP_2	0.5	HDP	1.19	306131	4100	4619	23793	400	110000	163100	119
HDP_20	0.5	HDP	1.18	280883	2200	3014	18883	640	100000	156010	46
HDP_21	0.5	HDP	1.17	278736	3100	3300	21057	560	100000	150692	28
HDP_22	0.5	HDP	1.18	284694	3300	3330	17952	520	100000	159556	37
HDP_23	0.5	HDP	1.19	280899	6400	3452	17796	720	100000	152465	46
HDP_24	0.5	HDP	1.17	284683	3800	3500	17796	640	110000	148919	28
HDP_25	0.5	HDP	1.19	279038	3400	3646	22427	600	100000	148919	46
HDP_26	0.5	HDP	1.17	261872	3000	3063	17175	760	96000	141828	46
HDP_27	0.5	HDP	1.18	286073	6800	5093	31867	420	100000	141828	55
HDP_28	0.5	HDP	1.18	300695	8400	4630	35593	180	110000	141828	64
HDP_29	0.5	HDP	1.19	320959	11000	4302	42735	320	110000	152465	137
Mallee Well Trench	2.1	T	nd	nd	7925	nd	nd	nd	nd	nd	nd
HDP_3	0.5	HDP	1.17	269014	3500	3355	29879	480	97000	134736	64
HDP_30	0.5	HDP	1.20	326402	8600	6990	40872	300	110000	159556	64
HDP_31	0.5	HDP	1.19	308493	4600	7074	37456	360	110000	148919	64
HDP_32	0.5	HDP	1.19	315230	4500	6709	34040	360	110000	159556	55
HDP_33	0.5	HDP	1.19	322870	5200	8581	42735	280	110000	156010	64
HDP_34	0.5	HDP	1.18	289120	3600	7184	32488	380	100000	145373	55
HDP_35	0.5	HDP	1.21	331246	4800	10247	35593	340	110000	170193	73
HDP_36	0.5	HDP	1.20	326967	4900	7451	39319	340	110000	164875	82

HoleID	Depth (m)	Sample Type	SG	TDS	K	Mg	SO4	Ca	Na	Cl	HCO3
HDP_37	0.5	HDP	1.20	314004	4600	7329	42114	340	100000	159556	55
HDP_38	0.5	HDP	1.20	322828	3900	8399	33419	380	110000	166648	82
HDP_39	0.5	HDP	1.19	313827	3100	9031	35282	340	110000	156010	64
HDP_4	0.5	HDP	1.19	296612	3600	4060	25967	520	110000	152465	0
HDP_40	0.5	HDP	1.19	310037	3800	6734	33109	320	110000	156010	64
HDP_41	0.5	HDP	1.19	304741	4100	3719	34040	380	110000	152465	37
HDP_42	0.5	HDP	1.20	312001	3200	6442	28793	400	110000	163102	64
HDP_43	0.5	HDP	1.21	336585	3600	8994	29848	340	120000	173739	64
HDP_44	0.5	HDP	1.21	296703	2700	9845	29973	400	80000	173739	46
HDP_45	0.5	HDP	1.21	318733	7600	10234	27364	360	110000	163102	73
HDP_46	0.5	HDP	1.21	334341	4900	12447	32798	320	110000	173739	137
HDP_47	0.5	HDP	1.21	330682	5900	11960	33419	340	110000	168420	183
HDP_48	0.5	HDP	1.25	390023	12000	20372	57581	280	120000	179058	622
HDP_49	0.5	HDP	1.24	351115	11000	18232	47334	220	100000	173739	540
HDP_5	0.5	HDP	1.14	206869	1800	1823	6028	2000	78000	117008	210
HDP_50	0.5	HDP	1.19	301895	3100	10052	25035	560	100000	163102	46
HDP_51	0.5	HDP	1.20	305136	2800	11218	24352	100	100000	166648	18
HDP_52	0.5	HDP	1.20	304568	2800	11838	22707	520	100000	166648	55
HDP_53	0.5	HDP	1.21	306441	3300	11960	23949	520	100000	166648	64
HDP_54	0.5	HDP	1.22	351124	4000	12520	33419	200	120000	180830	155
HDP_54	0.5	HDP	1.22	351124	4000	12520	33419	200	120000	180830	155
HDP_55	0.5	HDP	1.23	359972	5400	14975	38387	160	120000	180830	220
HDP_55	0.5	HDP	1.23	359972	5400	14975	38387	160	120000	180830	220
HDP_60	0.5	HDP	1.18	269687	3500	5093	22609	620	96000	141828	37
HDP_60	0.5	HDP	1.18	269687	3500	5093	22609	620	96000	141828	37
HDP_61	0.5	HDP	1.19	302690	3300	9821	27954	240	100000	161329	46
HDP_61	0.5	HDP	1.19	302690	3300	9821	27954	240	100000	161329	46
HDP_62	0.5	HDP	1.20	315397	4000	10708	30718	360	110000	159556	55
HDP_62	0.5	HDP	1.20	315397	4000	10708	30718	360	110000	159556	55
HDP_63	0.5	HDP	1.13	179000	4410	5280	31400	611	57900	84900	30
HDP_63	0.5	HDP	1.13	179000	4410	5280	31400	611	57900	84900	30
HDP_64	0.5	HDP	1.14	192000	4950	5970	35200	584	65400	91600	35
HDP_64	0.5	HDP	1.14	192000	4950	5970	35200	584	65400	91600	35
HDP_69	0.5	HDP	1.20	295000	4190	6800	32400	361	104000	164000	54
HDP_7	0.5	HDP	1.20	331493	4700	5834	30128	400	120000	170193	238
HDP_70	0.5	HDP	1.20	288000	4190	5150	31600	355	106000	163000	81
HDP_71	0.5	HDP	1.19	280000	4460	4950	29500	312	95800	161000	48
HDP_73	0.5	HDP	1.22	323000	3250	7820	29300	329	116000	189000	54
HDP_73	0.5	HDP	1.22	323000	3250	7820	29300	329	116000	189000	54
HDP_74	0.5	HDP	1.21	302000	1720	5390	20000	430	117000	184000	46
HDP_74	0.5	HDP	1.21	302000	1720	5390	20000	430	117000	184000	46
HDP_8	0.5	HDP	1.19	327868	4500	4375	28141	440	120000	170193	219
HDP_9	0.5	HDP	1.19	303420	2600	8290	32488	360	100000	159556	46
K26	0.6	HDP	1.22	263000	8270	3360	46200	351	104000	129000	259
K31	0.5	HDP	1.23	279000	3360	5180	30700	347	115000	159000	121
K36	0.8	HDP	1.19	290000	2930	6660	35100	353	109000	150000	8
K55	0.4	HDP	1.22	333000	3680	13200	42300	295	114000	170000	16
K63	0.5	HDP	1.24	351000	3760	4300	22400	545	93500	136000	22
K64	0.5	HDP	1.21	235000	3300	4020	20200	613	84800	126000	26
KPWS1	0.7	HDP	1.18	257000	3620	6580	53500	342	97700	118000	52
KPWS11	0.65	HDP	1.20	293000	8910	3700	37500	333	112000	150000	41
KPWS12	0.5	HDP	1.19	282000	6050	5180	36100	366	99000	140000	39
KPWS13	0.8	HDP	1.10	141000	2800	2310	25800	581	52100	59800	421
KPWS14	0.6	HDP	1.15	216000	3190	2940	23900	602	87400	118000	52
KPWS2	0.5	HDP	1.21	304000	3480	13100	48700	259	98200	153000	101
KPWS3	0.7	HDP	1.22	299000	3830	12800	50200	224	102000	156000	70
KPWS4	0.6	HDP	1.11	148000	1420	6010	22900	751	50700	74200	76
HDP_72	0.5	HDP	1.10	140000	1350	3020	18000	885	51800	77500	90
KPWS5	0.7	HDP	1.21	305000	3310	15000	48000	257	95100	154000	28
KPWS55	0.5	HDP	1.22	333000	3680	13200	42300	295	114000	170000	16
KPWS6	0.7	HDP	1.11	144000	3020	5900	31600	610	48200	64300	108
KPWS7	0.7	HDP	1.13	179000	2230	7620	31200	588	52400	80600	279
HDP_75	0.5	HDP	1.06	81900	1030	3710	15000	827	23800	36900	146
HDP_75	0.5	HDP	1.06	81900	1030	3710	15000	827	23800	36900	146
HDP_76	0.5	HDP	1.06	81900	1060	3830	15500	849	24300	36600	145
HDP_76	0.5	HDP	1.06	81900	1060	3830	15500	849	24300	36600	145
HDP_77	0.5	HDP	1.06	82200	1040	3760	15100	835	24100	36300	144
HDP_77	0.5	HDP	1.06	82200	1040	3760	15100	835	24100	36300	144
KPWS8	0.4	HDP	1.21	310000	6230	12000	63300	267	95500	137000	65
KPWS9	0.5	HDP	1.21	299000	6010	8250	49500	256	107000	150000	141
Mygoora South Trench	1.9	T	nd	nd	5175	nd	nd	nd	nd	nd	nd
MYGST1	0.5	T	1.10	140000	1350	3020	18000	885	51800	77500	90
Swansons Trench	3.3	T	nd	nd	4000	nd	nd	nd	nd	nd	nd
Swansons Trench	3.3	T	nd	nd	4000	nd	nd	nd	nd	nd	nd

HoleID	Depth (m)	Sample Type	SG	TDS	K	Mg	SO4	Ca	Na	Cl	HCO3
Pulcurra Trench	1.5	T	1.17	140000	4000	3500	27000	510	88000	130000	55
Curtin Boundary Trench	2	T	1.17	120000	4600	5900	53000	340	73000	110000	55
Miningere Trench	2.5	T	1.19	nd	8500	3400	44000	370	98000	140000	36
PTP01	1.95	TP	1.17	140000	3900	3700	29000	510	92000	150000	55
PTP02	1.77	TP	1.18	140000	4000	4000	27000	520	94000	140000	37
PTP03	2	TP	1.18	140000	3900	4000	27000	460	96000	140000	55
PTP04	1.82	TP	1.16	130000	3500	3100	24000	610	88000	120000	110
PTP05	1.92	TP	1.17	140000	3700	4100	26000	540	92000	130000	91
PTP06	1.9	TP	1.17	140000	3900	4600	26000	550	95000	130000	91
PTP07	1.84	TP	1.15	130000	3400	4100	24000	660	83000	120000	55
PTP08	1.88	TP	1.18	140000	4100	5500	30000	470	100000	150000	73
PTP09	1.85	TP	1.19	140000	4100	4400	32000	460	110000	150000	73
PTP10	2.46	TP	1.09	94000	2000	2100	15000	960	46000	66000	55
PTC01	2.2	TP	1.18	130000	4900	6800	50000	340	85000	120000	2
PTC02	2.2	TP	1.17	120000	4900	6100	46000	360	76000	110000	3
PTC03	2.19	TP	1.16	120000	4300	5500	49000	340	68000	100000	2
PTC04	2.18	TP	1.17	120000	4300	6700	58000	410	72000	110000	1
PTC05	2.465	TP	1.21	130000	5200	8700	64000	280	98000	140000	1
PTC06	2.44	TP	1.20	130000	5100	7700	62000	300	92000	140000	0
PTC07	2.25	TP	1.21	130000	5000	8100	64000	270	97000	140000	0
PTC08	3.015	TP	1.20	130000	4800	8100	62000	220	89000	130000	0
PTC09	1.87	TP	1.21	130000	4500	7700	63000	270	96000	140000	1
PTC10	2.47	TP	1.12	100000	3100	4100	37000	350	52000	76000	3
PTM01	2.91	TP	1.19	nd	9100	3500	46000	390	100000	140000	54
PTM02	2.94	TP	1.19	nd	8900	3400	47000	380	99000	140000	36
PTM03	3.27	TP	1.19	nd	9100	3300	44000	390	99000	140000	36
PTM04	2.99	TP	1.18	nd	8200	3200	44000	420	90000	130000	36
PTM05	3.33	TP	1.19	nd	8900	3300	46000	400	94000	130000	36
PTM06	3.215	TP	1.19	nd	9200	3300	44000	400	98000	140000	18
PTM07	3	TP	1.19	nd	9600	3400	45000	380	100000	140000	18
PTM08	2.63	TP	1.19	nd	9000	3500	44000	380	100000	140000	36
PTM09	3	TP	1.19	nd	8800	3500	45000	370	100000	140000	36
PTM10	3.77	TP	1.16	nd	7300	2900	38000	520	83000	120000	36
PTI5S01	1.25	TP	1.23	nd	6800	16000	38000	270	100000	190000	220
PTI5S02	1.27	TP	1.23	nd	7300	19000	49000	220	95000	190000	270
PTI5S03	1.58	TP	1.23	nd	6000	15000	39000	260	98000	180000	180
PTI5S04	1.95	TP	1.10	nd	1800	5300	38000	600	43000	64000	220
PTI5S05	1.84	TP	1.19	nd	4000	9300	62000	320	84000	130000	72
PTI5S06	1.47	TP	1.21	nd	4700	11000	53000	270	98000	160000	54
PTI5S07	1.22	TP	1.22	nd	5100	11000	63000	230	96000	160000	18
PTI5S08	1.26	TP	1.23	nd	7000	18000	42000	230	88000	180000	250
PTI5S09	1.17	TP	1.23	nd	7700	20000	47000	210	92000	190000	250
PTI5D01	3.71	TP	1.22	nd	5100	12000	54000	240	97000	160000	110
PTI5D02	3.8	TP	1.21	nd	5100	13000	54000	240	90000	160000	72
PTI5D03	5.96	TP	1.20	130000	5900	12000	65000	370	110000	150000	53
PTI5D04	6.59	TP	1.17	120000	4000	8900	62000	430	80000	100000	96
PTI5D05	5.83	TP	1.19	130000	5200	10000	66000	360	97000	130000	64
PTI5D06	5.84	TP	1.20	130000	6200	12000	64000	390	110000	140000	43
PTI5D07	6.1	TP	1.20	130000	6100	11000	64000	390	110000	140000	53
PTI5D08	5.88	TP	1.20	130000	6000	12000	63000	370	110000	140000	53
PTI5D09	5.74	TP	1.20	130000	6500	12000	64000	380	110000	150000	53
KLAC101	4.5	AC	1.08	77000	2500	2600	22000	780	33000	49000	44
KLAC103	15	AC	1.14	110000	8400	4100	48000	550	62000	84000	44
KLAC104	21	AC	1.18	120000	9900	5100	60000	420	79500	110000	125
KLAC105	21	AC	1.06	68600	2020	2020	15600	918	29200	42600	116
KLAC106	20	AC	1.05	52000	1700	1675	15750	905	20750	29750	155
KLAC107	6	AC	1.09	84000	3400	3000	28000	770	38000	52000	55
KLAC108	11	AC	1.06	61667	2467	2100	22667	803	25333	34333	143
KLAC109	27	AC	1.19	130000	6500	7925	62250	330	89750	130000	58
KLAC110	24	AC	1.19	130000	6060	7660	54000	346	88000	130000	53
KLAC112	21	AC	1.19	130000	4000	9200	41000	360	93000	140000	33
KLAC113	30	AC	1.16	131111	3444	4689	25444	551	83889	120000	18
KLAC114	15	AC	1.18	140000	3000	6600	26000	470	94000	150000	22
KLAC118	8	AC	1.15	120000	3800	5200	39000	490	77000	100000	110
KLAC120	21	AC	1.19	130000	4900	10214	44857	333	89857	142857	42
KLAC121	10	AC	1.20	130000	5767	9267	45667	287	93000	136667	29
KLAC122	6	AC	1.15	110000	2500	10000	51000	450	64500	98000	83
KLAC124	17	AC	1.21	130000	4000	13500	60500	230	98500	150000	120
KLAC127	25	AC	1.22	140000	3614	12000	44857	173	104286	178571	35
KLAC128	2	AC	1.18	130000	3500	6700	40000	420	82000	130000	33
KLAC130	8	AC	1.16	110000	1000	5200	17000	250	35000	61000	110
KLAC131	15	AC	1.18	130000	4200	7100	39000	430	92000	130000	44
KLAC132	30	AC	1.18	134000	3530	9650	24830	354	86500	144000	39
KLAC133	30	AC	1.18	130000	3270	7840	40700	410	84600	127000	39

HoleID	Depth (m)	Sample Type	SG	TDS	K	Mg	SO4	Ca	Na	Cl	HCO3
KLAC134	21	AC	1.20	128333	5283	10000	64667	308	93333	138333	53
KLAC135	18	AC	1.19	120000	4500	9200	68000	330	84000	130000	77
KLAC137	18	AC	1.20	133333	6450	12833	31667	307	88500	163333	90
KLAC138	27	AC	1.17	130000	5233	12833	16700	382	74000	140000	86
KLAC139	24	AC	1.15	121111	6133	9544	16811	389	69889	124444	75
KLAC142	13	AC	1.15	132000	5740	6620	6120	404	73600	128000	62
KLAC143	12	AC	1.16	136667	6033	8233	5767	367	81333	150000	84
KLAC146	21	AC	1.15	120000	3200	6900	42000	510	74000	100000	55
KLAC147	29	AC	1.17	128571	4486	5743	39571	417	90143	122857	58
KLAC148	30	AC	1.19	130000	4240	7010	46600	339	96800	140000	37
KLAC149	20	AC	1.19	120000	3400	15000	44000	350	86000	140000	37
KLAC151	16	AC	1.19	135000	3600	9400	31500	370	96500	150000	37
KLAC153	15	AC	1.09	84000	1100	3100	18000	870	37000	60000	160
KLAC157	21	AC	1.20	140000	2600	7000	36500	338	100250	150000	42
KLAC161	15	AC	1.16	126000	1660	4020	29600	526	86400	124000	18
KLAC163	11	AC	1.18	140000	2550	4900	24500	580	105000	175000	55
KLAC164	16	AC	1.19	140000	2200	6700	38000	450	110000	180000	73
KLAC165	15	AC	1.19	130000	3175	4900	53750	368	106750	155000	115
KLAC166	23	AC	1.17	128750	2913	4350	40250	404	84500	111250	71
KLAC167	15	AC	1.18	130000	3600	5750	47500	340	92250	130000	82
KLAC169	30	AC	1.19	139000	5270	5330	42700	318	91500	137000	68
KLAC170	30	AC	1.18	130000	5130	4920	56900	329	98800	131000	163
KLAC171	30	AC	1.19	130000	5622	6600	55444	413	111111	164444	81
KLAC172	30	AC	1.19	138750	8400	3188	42125	358	93375	128750	46
KLAC173	28	AC	1.15	121250	6413	2700	34750	511	73500	100000	62
KLAC178	18	AC	1.19	136667	10200	3700	53000	400	108000	153333	73
KLAC179	24	AC	1.08	84500	4138	1675	14750	90	38375	54375	253
KLAC183	21	AC	1.17	140000	3671	3443	27857	481	82857	131429	58
KLAC186	15	AC	1.16	130000	3500	3100	29000	520	84000	120000	55
KLAC187	21	AC	1.18	138000	4220	5700	41200	398	103200	152000	41
KLAC188	18	AC	1.19	123333	4633	5100	79667	373	101333	123333	43
KLAC189	19	AC	1.17	130000	4940	6900	54200	394	102000	154000	96
KLAC190	15	AC	1.13	122500	1875	2475	20500	815	77250	115000	55
KLAC195	24	AC	1.23	130000	7317	16333	71667	175	104167	168333	70
KLAC196	36	AC	1.18	nd	2800	9280	47000	410	78400	126000	61
KLAC197	39	AC	1.18	nd	3317	7883	42833	420	82333	130000	54
KLAC198	21	AC	1.19	nd	7000	7400	57000	417	94333	130000	84
KLAC199	33	AC	1.18	nd	6100	6080	51800	416	85400	126000	72
KLAC200	36	AC	1.20	nd	6200	7550	49000	395	110000	145000	72
KLAC201	30	AC	1.20	nd	5480	5340	63200	354	96800	134000	152
KPSC001	0.9	SC	nd	nd	4275	5239	44011	nd	nd	nd	nd
KPSC003	3.5	SC	nd	nd	1609	1040	12014	nd	nd	nd	nd
KPSC004	3.4	SC	nd	nd	2004	2341	17462	nd	nd	nd	nd
KPSC005	3	SC	nd	nd	3219	4209	31754	nd	nd	nd	nd
KPSC006	2.9	SC	nd	nd	7113	5131	nd	nd	nd	nd	nd
KPSC009	2.3	SC	nd	nd	2044	1723	20038	nd	nd	nd	nd
KPSC010	4.8	SC	nd	nd	2312	3908	34616	nd	nd	nd	nd
KPSC011	3.4	SC	nd	nd	2030	2385	19602	nd	nd	nd	nd
KPSC012	3.9	SC	nd	nd	4548	4200	50874	nd	nd	nd	nd
KPSC013	4.3	SC	nd	nd	1794	5061	nd	nd	nd	nd	nd
KPSC014	4.4	SC	nd	nd	1700	4670	nd	nd	nd	nd	nd
KPSC015	3.05	SC	nd	nd	3709	2861	27865	nd	nd	nd	nd
KPSC016	2	SC	nd	nd	4173	2489	35330	nd	nd	nd	nd
KPSC017	2.15	SC	nd	nd	4437	3697	40669	nd	nd	nd	nd
KPSC018	2.8	SC	nd	nd	3362	3136	38359	nd	nd	nd	nd
KPSC019	2.8	SC	nd	nd	4253	4089	32715	nd	nd	nd	nd
KPSC020	2.8	SC	nd	nd	3477	2552	37706	nd	nd	nd	nd
KPSC021	1.9	SC	nd	nd	3536	5910	50982	nd	nd	nd	nd
KPSC022	3.2	SC	nd	nd	5305	7392	48761	nd	nd	nd	nd
KPSC023	2.7	SC	nd	nd	4577	4470	35428	nd	nd	nd	nd
KPSC024	2.8	SC	nd	nd	898	1633	11663	nd	nd	nd	nd
KPSC025	3	SC	nd	nd	6917	3459	40876	nd	nd	nd	nd
KPSC026	4	SC	nd	nd	7627	2578	41178	nd	nd	nd	nd
KPSC028	3.5	SC	nd	nd	8839	3197	52859	nd	nd	nd	nd
KPSC030	4	SC	nd	nd	4040	1949	35212	nd	nd	nd	nd
KPSC031	3.5	SC	nd	nd	4197	3563	nd	nd	nd	nd	nd
KPSC032	3.5	SC	nd	nd	1873	3769	24824	nd	nd	nd	nd
KPSC033	3.4	SC	nd	nd	3820	7107	48862	nd	nd	nd	nd
KPSC034	3.9	SC	nd	nd	4171	3065	34756	nd	nd	nd	nd
KPSC035	3.2	SC	nd	nd	3991	7237	71532	nd	nd	nd	nd
KPSC037	4.1	SC	nd	nd	2899	4033	32093	nd	nd	nd	nd
KPSC038	4.2	SC	nd	nd	3702	6547	49094	nd	nd	nd	nd
KPSC039	4.3	SC	nd	nd	2454	4107	24021	nd	nd	nd	nd
KPSC040	4.4	SC	nd	nd	2690	3920	23371	nd	nd	nd	nd

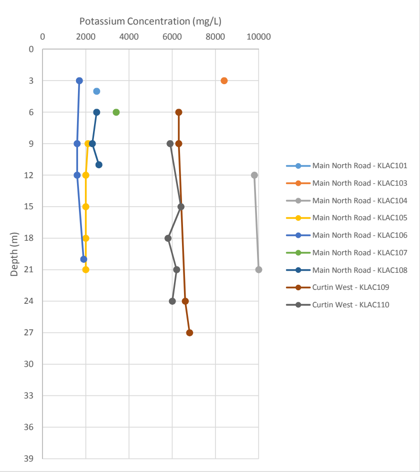
HoleID	Depth (m)	Sample Type	SG	TDS	K	Mg	SO4	Ca	Na	Cl	HCO3
KPSC041	3	SC	nd	nd	2768	5262	22880	nd	nd	nd	nd
KPSC043	4	SC	nd	nd	3802	5831	44759	nd	nd	nd	nd
KPSC044	3.4	SC	nd	nd	1729	2844	20267	nd	nd	nd	nd
KPSC045	3.1	SC	nd	nd	1822	3163	33214	nd	nd	nd	nd
KPSC046	2.7	SC	nd	nd	4977	5572	55615	nd	nd	nd	nd
KPSC047	4	SC	nd	nd	6427	8053	46710	nd	nd	nd	nd
KPSC048	3	SC	nd	nd	7516	9897	103866	nd	nd	nd	nd
KPSC050	4.8	SC	nd	nd	3513	5042	32489	nd	nd	nd	nd
KPSC051	4.2	SC	nd	nd	4636	8812	47548	nd	nd	nd	nd
KPSC053	3	SC	nd	nd	2127	4942	30622	nd	nd	nd	nd
KPSC054	1.5	SC	nd	nd	2811	3460	21622	nd	nd	nd	nd
KPSC055	1.9	SC	nd	nd	2925	8004	40906	nd	nd	nd	nd
KPSC056	3.1	SC	nd	nd	4424	10681	nd	nd	nd	nd	nd
KPSC057	1.7	SC	nd	nd	4780	11233	nd	nd	nd	nd	nd
KPSC062	1.85	SC	nd	nd	2706	6049	30278	nd	nd	nd	nd
KPSC065	2.8	SC	nd	nd	2614	7048	37215	nd	nd	nd	nd

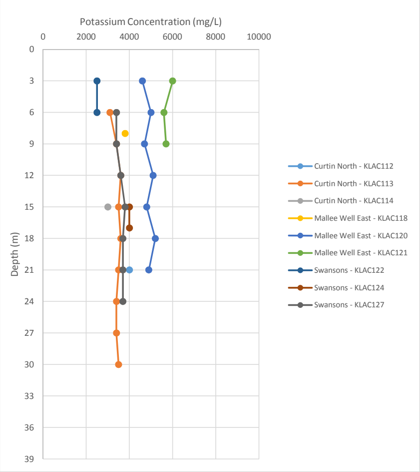
Notes: AC Sample type – Data are length weighted averages of multiple down hole brine samples from aircore drilling
SC Sample Type – Data are length weighted averages of multiple down hole sediment samples from sonic drilling. Assay was by whole core leaching and back calculation of equivalent solute concentration in total porosity

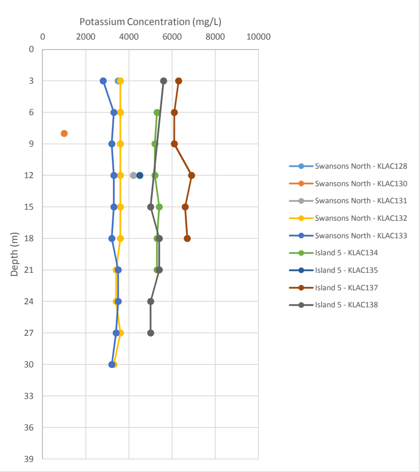
Key to Sample Type

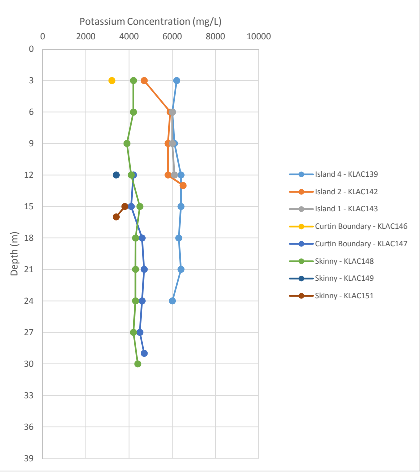
HDP	Hand Dug Pit
T	Trench
VC	Vibracore Drillhole
SC	Sonic Core Drillhole
SP	Sonic Peizo - Piezometer installed into sonic core hole
PT	Pumping Test Sample from cased bore
TP	Trench Peizo - Piezometers installed in an array around a trench pumping trial
AC	Air Core Drillhole

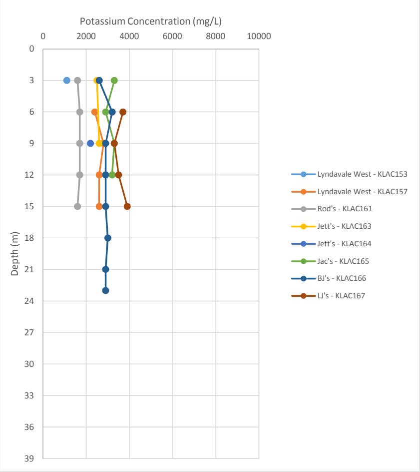
A3.2. Potassium Depth Profiles

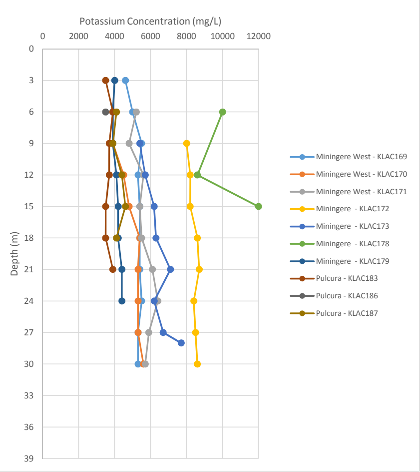

Potassium Concentration (mg/L)
0
2000
4000
6000
8000
10000
Depth (m)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
Main North Road - KLAC101
Main North Road - KLAC103
Main North Road - KLAC104
Main North Road - KLAC105
Main North Road - KLAC106
Main North Road - KLAC107
Main North Road - KLAC108
Curtin West - KLAC109
Curtin West - KLAC110

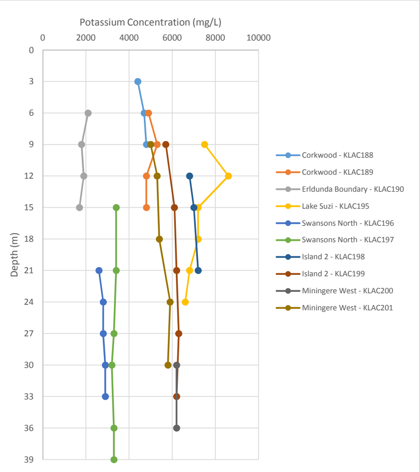

Potassium Concentration (mg/L)
0
2000
4000
6000
8000
10000
Depth (m)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
Curtin North - KLAC112
Curtin North - KLAC113
Curtin North - KLAC114
Mallee Well East - KLAC118
Mallee Well East - KLAC120
Mallee Well East - KLAC121
Swansons - KLAC122
Swansons - KLAC124
Swansons - KLAC127


Potassium Concentration (mg/L)
0
2000
4000
6000
8000
10000
Depth (m)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
Swansons North - KLAC128
Swansons North - KLAC130
Swansons North - KLAC131
Swansons North - KLAC132
Swansons North - KLAC133
Island 5 - KLAC134
Island 5 - KLAC135
Island 5 - KLAC137
Island 5 - KLAC138


Potassium Concentration (mg/L)
0
2000
4000
6000
8000
10000
Depth (m)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
Island 4 - KLAC139
Island 2 - KLAC142
Island 1 - KLAC143
Curtin Boundary - KLAC146
Curtin Boundary - KLAC147
Skinny - KLAC148
Skinny - KLAC149
Skinny - KLAC151

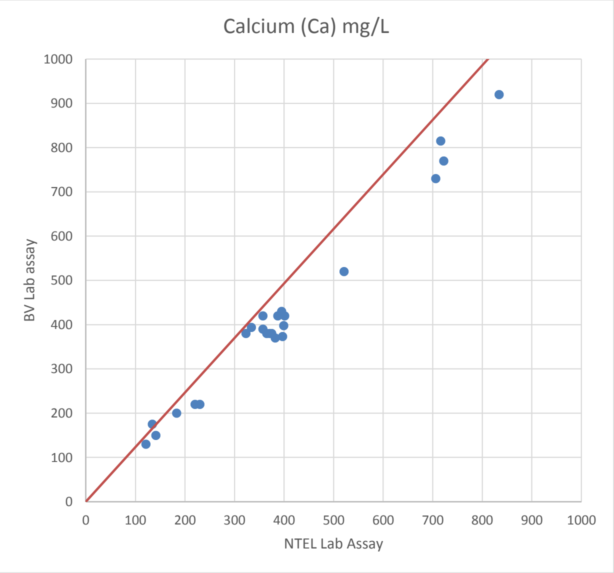

Potassium Concentration (mg/L)
0
2000
4000
6000
8000
10000
Depth (m)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
Lyndavale West - KLAC153
Lyndavale West - KLAC157
Rod's - KLAC161
Jett's - KLAC163
Jett's - KLAC164
Jac's - KLAC165
BJ's - KLAC166
LJ's - KLAC167

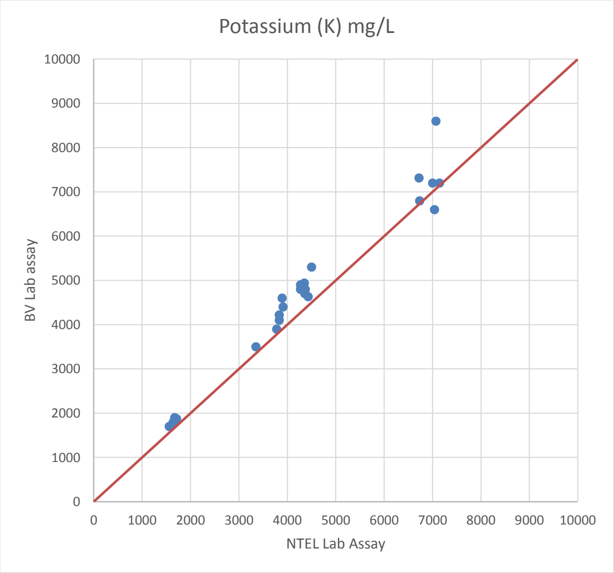

Potassium Concentration (mg/L)
0
2000
4000
6000
8000
10000
12000
Depth (m)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
Miningere West - KLAC169
Miningere West - KLAC170
Miningere West - KLAC171
Miningere - KLAC172
Miningere - KLAC173
Miningere - KLAC178
Miningere - KLAC179
Pulcura - KLAC183
Pulcura - KLAC186
Pulcura - KLAC187

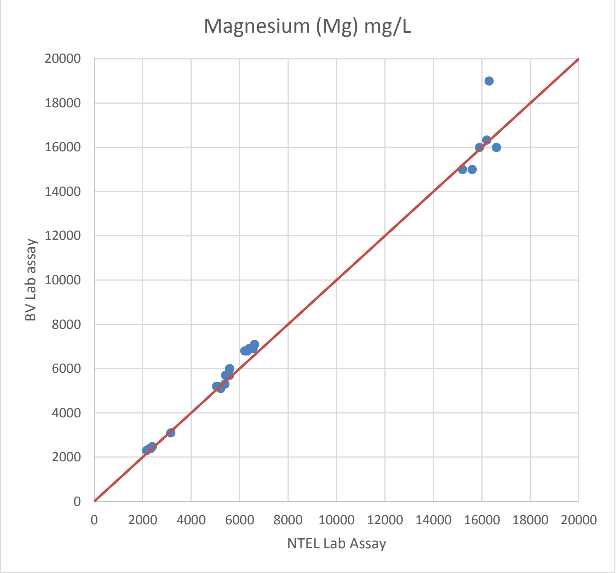

Potassium Concentration (mg/L)
0
2000
4000
6000
8000
10000
Depth (m)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
Corkwood - KLAC188
Corkwood - KLAC189
Erldunda Boundary - KLAC190
Lake Suzi - KLAC195
Swansons North - KLAC196
Swansons North - KLAC197
Island 2 - KLAC198
Island 2 - KLAC199
Miningere West - KLAC200
Miningere West - KLAC201

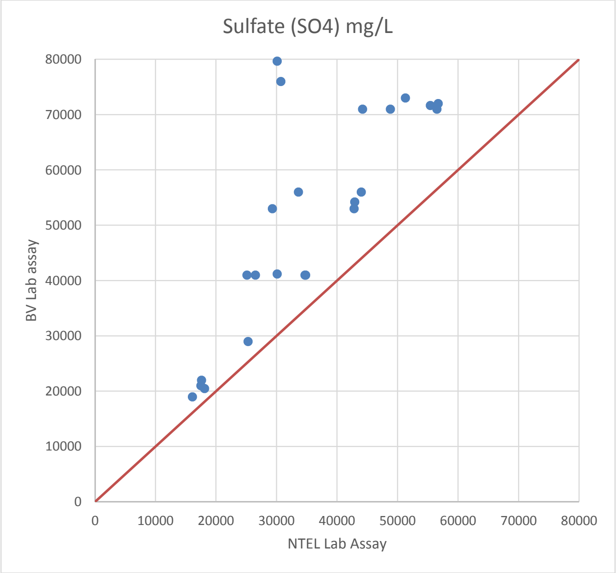
A3.3. Duplicate Brine Assay

	NTEL Assay				Bureau Veritas Assay			
	Ca	K	Mg	SO4	Ca	K	Mg	SO4
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
186-01A	521	3,350	3,160	25,300	520	3,500	3,100	29,000
187-01A	399	3,830	5,420	30,100	398	4,220	5,700	41,200
187-02A	375	3,780	5,390	34,700	380	3,900	5,300	41,000
187-03A	395	3,910	5,590	25,100	430	4,400	6,000	41,000
187-04A	387	3,890	5,590	26,500	420	4,600	6,000	41,000
187-05A	371	3,830	5,580	34,800	380	4,100	5,700	41,000
188-01A	397	4,430	5,220	30,100	373	4,633	5,100	79,667
188-02A	365	4,360	5,100	28,700	380	4,700	5,200	84,000
188-03A	357	4,310	5,050	30,700	390	4,800	5,200	76,000
MT2 13A	350	8,730	3,290	35,700	350	8,600	3,300	44,000
MT2 14A	376	8,550	3,200	35,300	350	8,500	3,200	44,000
MT2 15A	357	8,570	3,240	35,200	350	8,300	3,300	44,000
MT2 16A	365	8,500	3,220	35,300	350	8,300	3,200	44,000
MT2 17A	377	8,800	3,300	36,300	340	8,200	3,200	44,000
MT2 18A	371	8,580	3,240	35,300	350	8,400	3,200	44,000
MT2 19A	365	8,650	3,290	35,700	350	8,400	3,200	44,000
MT2 20A	367	8,500	3,250	35,400	360	8,400	3,300	45,000
189-01A	334	4,350	6,550	42,900	394	4,940	6,900	54,200
189-02A	323	4,270	6,320	44,000	380	4,900	6,800	56,000
189-03A	382	4,500	6,610	33,600	370	5,300	7,100	56,000
189-04A	401	4,370	6,380	29,300	420	4,800	6,900	53,000
189-05A	357	4,270	6,210	42,800	420	4,800	6,800	53,000
190-01A	716	1,710	2,390	18,100	815	1,875	2,475	20,500
190-02A	706	1,640	2,290	17,500	730	1,800	2,400	21,000
190-03A	722	1,670	2,340	17,600	770	1,900	2,400	22,000
190-04A	834	1,560	2,160	16,100	920	1,700	2,300	19,000
195-01A	134	6,720	16,200	55,400	175	7,317	16,333	71,667
195-02A	121	7,070	16,300	56,500	130	8,600	19,000	71,000
195-03A	141	7,140	16,600	56,700	150	7,200	16,000	72,000
195-04A	183	7,000	15,900	51,300	200	7,200	16,000	73,000
195-05A	220	6,730	15,200	44,200	220	6,800	15,000	71,000
195-06A	230	7,040	15,600	48,800	220	6,600	15,000	71,000









A4. Total Leachable Potassium Data

HoleID	SampleID	Core from	Core to	Moisture content by volume	Total Soluble Potassium	Calculated equivalent concentration dissolved in Total Porosity	Concentration of Brine sample taken from Piezometer installed into open hole.
		m	m	(v/v)	kg Potassium per m^3 core	mg/L Potassium	mg/L Potassium
KPSC001	KPSC001-01	0	0.6	0.13	0.568	4,275	
KPSC003	KPSC003-01	0	1	0.38	1.035	2,718	
KPSC003	KPSC003-02	2.3	3.5	0.76	1.847	2,429	
KPSC004	KPSC004-01	0	0.75	0.75	1.708	2,282	
KPSC004	KPSC004-02	1.15	2.15	0.70	1.741	2,475	
KPSC004	KPSC004-03	2.15	3.4	0.60	1.268	2,102	
KPSC005	KPSC005-01	0	0.5	0.13	0.845	6,417	
KPSC005	KPSC005-02	1.4	3	0.75	3.026	4,030	
KPSC006	KPSC006-01	0	1.5	0.40	3.153	7,849	8700
KPSC006	KPSC006-02	1.5	2.9	0.57	3.611	6,324	8700
KPSC009	KPSC009-01	0	1	0.55	1.119	2,044	
KPSC010	KPSC010-01	0	1	0.33	0.858	2,606	
KPSC010	KPSC010-02	1	2	0.56	1.064	1,896	
KPSC010	KPSC010-03	2	3	0.64	1.445	2,266	
KPSC010	KPSC010-04	3	4	0.64	1.660	2,603	
KPSC010	KPSC010-05	4	4.8	0.63	1.367	2,161	
KPSC011	KPSC011-01	0	2.4	0.20	0.409	2,090	
KPSC011	KPSC011-02	2.4	3.4	0.59	1.105	1,884	
KPSC012	KPSC012-01	0	1.2	0.39	1.716	4,345	
KPSC012	KPSC012-02	1.2	2.4	0.56	2.519	4,516	
KPSC012	KPSC012-03	2.4	3.9	0.39	1.852	4,734	
KPSC013	KPSC013-01	0	1	0.49	1.130	2,287	
KPSC013	KPSC013-02	2.5	3.5	0.35	1.119	3,199	
KPSC013	KPSC013-03	3.5	4.3	0.62	1.738	2,787	
KPSC014	KPSC014-01	0	1	0.34	1.190	3,508	
KPSC014	KPSC014-02	2.5	3.5	nd	2.668	nd	
KPSC014	KPSC014-03	3.5	4.4	0.72	1.454	2,008	
KPSC015	KPSC015-01	0	1.2	0.41	1.708	4,184	
KPSC015	KPSC015-02	1.2	2	0.49	1.469	2,995	
KPSC016	KPSC016-01	0	1.35	0.29	1.223	4,173	4200
KPSC017	KPSC017-01	0	1.2	0.41	1.839	4,437	
KPSC018	KPSC018-01	0	1	0.35	1.035	2,994	
KPSC018	KPSC018-02	1	2	0.75	2.810	3,729	
KPSC019	KPSC019-01	0	1.3	0.47	2.004	4,253	4200
KPSC020	KPSC020-01	0	1.2	0.46	2.329	5,061	
KPSC020	KPSC020-02	2	2.8	0.75	3.423	4,576	5000
KPSC021	KPSC021-01	0	1	0.51	1.911	3,721	4000
KPSC021	KPSC021-02	1	1.9	0.64	2.127	3,330	4000
KPSC022	KPSC022-01	0	1.2	0.48	1.775	3,715	
KPSC022	KPSC022-02	1.2	2.5	0.51	3.445	6,773	
KPSC023	KPSC023-01	0	1.5	0.46	2.051	4,463	
KPSC023	KPSC023-02	1.5	2.7	0.52	2.451	4,720	
KPSC024	KPSC024-01	0	1	0.47	1.061	2,245	4200
KPSC025	KPSC025-01	0	1	0.59	4.099	6,917	
KPSC026	KPSC026-01	0	1	0.33	3.517	10,565	7800
KPSC026	KPSC026-02	1	2.5	0.42	3.280	7,850	7800
KPSC026	KPSC026-03	2.5	4	0.63	3.447	5,444	7800
KPSC028	KPSC028-01	0	1	0.47	3.926	8,434	7700
KPSC028	KPSC028-02	1	2.5	0.40	3.829	9,637	7700
KPSC028	KPSC028-03	2.5	3.5	0.72	5.823	8,047	7700
KPSC030	KPSC030-01	0	1	0.47	1.513	3,239	
KPSC030	KPSC030-02	1	2.5	0.48	2.183	4,542	
KPSC030	KPSC030-03	2.5	4	0.49	1.992	4,071	
KPSC031	KPSC031-01	0	1.4	0.25	1.043	4,197	
KPSC032	KPSC032-01	0	1	0.48	1.478	3,110	
KPSC032	KPSC032-02	2.4	3.3	0.79	2.683	3,411	
KPSC033	KPSC033-01	0	1	0.50	1.892	3,820	
KPSC034	KPSC034-01	0	1.2	0.41	1.700	4,171	
KPSC035	KPSC035-01	0	1	0.11	0.585	5,217	
KPSC035	KPSC035-02	1	2	0.42	1.363	3,210	

KPSC035	KPSC035-03	2	3	0.49	1.749	3,547	
KPSC037	KPSC037-01	0	1.5	0.61	0.954	1,557	
KPSC037	KPSC037-02	1.5	3	0.47	1.763	3,749	
KPSC037	KPSC037-03	3	4.1	0.35	1.257	3,569	
KPSC038	KPSC038-01	0	1	0.47	1.596	3,409	
KPSC038	KPSC038-02	1	2	0.43	0.991	2,295	
KPSC038	KPSC038-03	2	3.2	0.35	1.779	5,118	
KPSC039	KPSC039-01	0	1.1	0.81	1.151	1,428	
KPSC039	KPSC039-02	1.1	2.5	0.53	1.792	3,406	
KPSC039	KPSC039-03	2.5	3.4	0.60	1.330	2,226	
KPSC040	KPSC040-01	0	1.4	0.47	1.172	2,500	
KPSC040	KPSC040-02	1.4	2.9	0.47	1.170	2,464	
KPSC040	KPSC040-03	2.9	3.7	0.80	2.747	3,449	
KPSC041	KPSC041-01	0	1.1	0.46	1.285	2,768	
KPSC043	KPSC043-01	0	1.2	0.31	1.785	5,758	
KPSC043	KPSC043-02	2	3	0.54	2.382	4,419	
KPSC043	KPSC043-03	3	4	0.81	3.144	3,881	
KPSC044	KPSC044-01	0	0.5	0.49	1.742	3,585	
KPSC044	KPSC044-02	2.4	3.4	0.86	3.501	4,086	
KPSC045	KPSC045-01	0	1	0.36	1.146	3,149	
KPSC045	KPSC045-02	2.1	3.1	0.72	1.801	2,498	
KPSC046	KPSC046-01	0	1	0.42	2.147	5,084	5100
KPSC046	KPSC046-02	1	2	0.48	2.246	4,721	5100
KPSC046	KPSC046-03	2	2.7	0.79	4.120	5,190	5100
KPSC047	KPSC047-01	0	1.5	0.46	4.405	9,534	
KPSC047	KPSC047-02	2	2.8	0.69	3.423	4,985	
KPSC047	KPSC047-03	2.8	3.5	nd	6.282	nd	
KPSC048	KPSC048-01	0	1	0.36	2.714	7,465	6500
KPSC048	KPSC048-02	1	2	0.63	4.769	7,567	6500
KPSC050	KPSC050-01	0	1	0.38	1.718	4,500	
KPSC050	KPSC050-02	1	2.5	0.44	nd	nd	
KPSC050	KPSC050-03	2.5	3.8	0.74	3.830	5,167	
KPSC050	KPSC050-04	3.8	4.8	0.63	3.581	5,647	
KPSC051	KPSC051-01	0	1.2	0.44	2.306	5,269	
KPSC051	KPSC051-02	1.2	2.2	0.73	3.440	4,710	
KPSC051	KPSC051-03	2.2	3.2	0.52	2.189	4,185	
KPSC051	KPSC051-04	3.2	4.2	0.75	3.196	4,253	
KPSC053	KPSC053-01	0	1.4	0.32	0.946	2,973	
KPSC053	KPSC053-02	2.4	3	0.61	2.271	3,696	
KPSC054	KPSC054-01	0	1.5	0.47	1.324	2,811	
KPSC055	KPSC055-01	0	1	0.52	1.612	3,099	
KPSC055	KPSC055-02	1	1.9	0.59	1.621	2,732	
KPSC056	KPSC056-01	0	1.4	0.45	3.099	6,836	
KPSC056	KPSC056-02	2.6	3.1	0.97	8.002	8,286	
KPSC056A	KPSC056A-01	0	1.4	0.49	3.287	6,765	
KPSC057	KPSC057-01	0	1.1	0.63	3.011	4,794	7900
KPSC057	KPSC057-02	1.1	1.7	0.70	3.312	4,754	7900
KPSC058	KPSC058-01	0	1	0.34	1.842	5,352	
KPSC058	KPSC058-02	1	2.5	0.39	2.514	6,378	
KPSC058	KPSC058-03	2.5	4	0.54	2.498	4,635	
KPSC058	KPSC058-04	4	4.5	nd	4.490	nd	
KPSC062	KPSC062-01	0	0.85	0.55	1.313	2,377	
KPSC062	KPSC062-02	0.85	1.85	0.52	1.556	2,986	
KPSC065	KPSC065-01	0	0.5	0.51	1.719	3,384	
KPSC065	KPSC065-02	1	2	0.70	2.188	3,107	
KPSC065	KPSC065-03	2	2.8	0.71	2.224	3,150	

A5. Hydraulic Testing Data

A5.1. Bore Pumping Tests

Test Site	Lake	Dominant Stratigraphy	Aquifer Thickness (m)	Pumping Rate (m^3/day)	Aquifer Response	Aquifer Properties			
						Transmissivity (m^2/day)	Hydraulic Conductivity (m/day)	Storativity	Specific Yield (unit-less**)**
KLAC089	Mallee Well East	Lakebed Sediments	5.3	216	Unconfined	431	81	1.5 x 10^{-04}	-
KLAC088	Curtin North	Horseshoe Bend Siltstone	24.0	129	Leaky	27	1	1.2 x 10^{-03}	-
KLAC048	Island 5	Lakebed Sediments	14.5	432	Confined	368	25	3.9 x 10^{-03}	-
KLAC051	Island 4	Lakebed Sediments	12.7	415	Unconfined	165	13	2.1 x 10^{-03}	0.14
KLAC068	Skinny	Horseshoe Bend Siltstone	11.5	173	Unconfined	72	6	1.2 x 10^{-03}	0.11
KLAC063	Curtin Boundary	Horseshoe Bend Siltstone	13.5	104	Unconfined	163	12	3.4 x 10^{-02}	0.05
KLAC060	Island 1	Lakebed Sediments	8.5	43	Confined	37	4	3.1 x 10^{-03}	-
KLAC082	Miningere West	Horseshoe Bend Siltstone / Idracowra Sandstone	17.5	112	Unconfined	71	4	5.5 x 10^{-03}	0.02
KLAC033	Miningere	Horseshoe Bend Siltstone	14.5	259	Unconfined	119	8	-	-
KLAC029	Murphy's	Lakebed Sediments	2.5	61	Unconfined	88	35	1.5 x 10^{-01}	0.16

A5.2. Trench Pumping Trials

Summary

Site	Water level drawdown (m)	Trench Length (m)	Duration pumping (days)	Total volume pumped (m^3)	Average pumping rate (m^3/day)	Average Potassium Concentration (mg/L)	Comments
Pulcurra Trench	0.6	100	25.9	5,685	220	3,880	
Curtin Boundary Trench	1.2	100	25.8	4,518	175	4,420	
Miningere Trench	2.0	80	29.1	16,320	562	8,740	
Island 5 – Bore KLAC048	3.2	-	24.9	8,424	337	5,936	Trench excavation unstable. Long term bore test undertaken at KLAC048

Pulcurra Aquifer Test Derived Properties

Geological Unit	Parameter	Value
Lake Bed Sediments	Transmissivity	92 m^2/day
	Saturated Thickness	4 m
	Hydraulic Conductivity	23 m/day
	Specific Yield	0.17
Siltstone	Transmissivity	4 m^2/day
	Saturated Thickness	16 m
	Hydraulic Conductivity	0.25 m/day
	Specific Yield	-

Curtin Boundary Test Derived Aquifer Properties

Geological Unit		Parameter	Value
Upper Siltstone - (Highly Weathered Zone)	Fracture Zone	Transmissivity	240 m^2/day
		Saturated Thickness	3
		Hydraulic Conductivity	80 m/day
		Specific Yield	0.10
	Regional	Transmissivity	1.5 m^2/day
		Saturated Thickness	3 m
		Hydraulic Conductivity	0.5 m/day
		Specific Yield	0.02
Lower Siltstone	Fracture Zone	Transmissivity	85 m^2/day
		Saturated Thickness	17 m
		Hydraulic Conductivity	5 m/day
		Specific Yield	-
	Regional	Transmissivity	3.4 m^2/day
		Saturated Thickness	17 m
		Hydraulic Conductivity	0.2 m/day
		Specific Yield	-

Miningere Test Derived Aquifer Properties

Geological Unit	**Parameter**	**Value**
Weathered and Fractured Siltstone (High Transmissivity Zone)	Transmissivity	220 m^2/day
	Saturated Thickness	20 m
	Hydraulic Conductivity	11 m/day
	Specific Yield	0.04
Weathered Siltstone (Low Transmissivity Zone)	Transmissivity	8 m^2/day
	Saturated Thickness	20 m
	Hydraulic Conductivity	0.4 m/day
	Specific Yield	0.02

Island 5 Test Derived Aquifer Properties

Geological Unit	Parameter	Value
Unconfined aquifer (lakebed sediments)	Transmissivity	96 m^2/day
	Saturated Thickness	1.2 m
	Hydraulic Conductivity	80 m/day
	Specific Yield	0.10
Confining layer (lakebed sediment, sticky clays)	Transmissivity	0.006 m^2/day
	Saturated Thickness	1.5 m
	Vertical Hydraulic Conductivity	0.0003 m/day
	Specific Storage	2.27 e^{-4}
Confined aquifer (weathered siltstone)	Transmissivity	211 m^2/day
	Saturated Thickness	12 m
	Hydraulic Conductivity	17.6 m/day
	Specific Storage	2.3 e^{-4}
Regional aquifer Beyond Lake Boundaries	Transmissivity	1.0 m^2/day
	Saturated Thickness	14.7 m
	Hydraulic Conductivity	0.07 m/day
	Specific Yield	0.01

Appendix B Production Plan Appendices

B1. Production Model Input Data

B1.1. Transient Recharge Data

Rainfall date	Model Day	Recharge (m/day) 1mm threshold	Recharge (m/day) 5mm threshold	Recharge (m/day) 10mm threshold
11/01/1990	11	0.015	0.012	0.008
15/01/1990	15	0.005	0.001	0.000
20/01/1990	20	0.005	0.002	0.000
1/02/1990	32	0.012	0.009	0.004
18/02/1990	49	0.014	0.010	0.006
18/05/1990	138	0.008	0.005	0.000
23/05/1990	143	0.062	0.058	0.054
1/07/1990	182	0.001	0.000	0.000
15/07/1990	196	0.001	0.000	0.000
31/08/1990	243	0.016	0.012	0.008
6/10/1990	279	0.001	0.000	0.000
7/12/1990	341	0.009	0.006	0.002
25/01/1991	390	0.020	0.017	0.012
28/03/1991	452	0.001	0.000	0.000
30/03/1991	454	0.007	0.004	0.000
1/05/1991	486	0.001	0.000	0.000
29/05/1991	514	0.005	0.002	0.000
4/06/1991	520	0.000	0.000	0.000
19/06/1991	535	0.002	0.000	0.000
8/07/1991	554	0.003	0.000	0.000
22/07/1991	568	0.014	0.011	0.006
25/09/1991	633	0.003	0.000	0.000
3/11/1991	672	0.004	0.001	0.000
13/11/1991	682	0.009	0.006	0.002
24/11/1991	693	0.010	0.006	0.002
7/12/1991	706	0.001	0.000	0.000
24/01/1992	754	0.009	0.006	0.001
8/02/1992	769	0.002	0.000	0.000
15/04/1992	836	0.001	0.000	0.000
17/04/1992	838	0.006	0.002	0.000
18/05/1992	869	0.003	0.000	0.000
21/05/1992	872	0.002	0.000	0.000
26/05/1992	877	0.012	0.008	0.004
9/06/1992	891	0.018	0.014	0.010
6/08/1992	949	0.000	0.000	0.000
28/08/1992	971	0.003	0.000	0.000
31/08/1992	974	0.016	0.013	0.009
25/09/1992	999	0.013	0.010	0.006
29/09/1992	1003	0.005	0.002	0.000
3/10/1992	1007	0.021	0.018	0.014
10/10/1992	1014	0.021	0.018	0.014
3/12/1992	1068	0.001	0.000	0.000
12/12/1992	1077	0.001	0.000	0.000
21/01/1993	1117	0.002	0.000	0.000
25/01/1993	1121	0.001	0.000	0.000
4/02/1993	1131	0.001	0.000	0.000
16/04/1993	1202	0.001	0.000	0.000
18/04/1993	1204	0.002	0.000	0.000
9/05/1993	1225	0.002	0.000	0.000

Rainfall date	Model Day	Recharge (m/day) 1mm threshold	Recharge (m/day) 5mm threshold	Recharge (m/day) 10mm threshold
13/05/1993	1229	0.028	0.025	0.021
25/05/1993	1241	0.001	0.000	0.000
2/06/1993	1249	0.004	0.001	0.000
5/06/1993	1252	0.012	0.009	0.005
12/06/1993	1259	0.007	0.004	0.000
7/07/1993	1284	0.005	0.001	0.000
16/08/1993	1324	0.004	0.000	0.000
28/08/1993	1336	0.002	0.000	0.000
7/09/1993	1346	0.006	0.003	0.000
3/10/1993	1372	0.020	0.016	0.012
14/10/1993	1383	0.003	0.000	0.000
16/10/1993	1385	0.004	0.000	0.000
2/11/1993	1402	0.002	0.000	0.000
16/11/1993	1416	0.005	0.001	0.000
24/11/1993	1424	0.003	0.000	0.000
8/12/1993	1438	0.043	0.039	0.035
15/12/1993	1445	0.038	0.035	0.031
22/12/1993	1452	0.001	0.000	0.000
8/01/1994	1469	0.002	0.000	0.000
13/01/1994	1474	0.005	0.002	0.000
11/02/1994	1503	0.001	0.000	0.000
18/02/1994	1510	0.001	0.000	0.000
1/03/1994	1521	0.051	0.048	0.044
4/04/1994	1555	0.012	0.009	0.005
7/06/1994	1619	0.011	0.008	0.003
16/11/1994	1781	0.008	0.005	0.001
25/11/1994	1790	0.001	0.000	0.000
29/11/1994	1794	0.004	0.001	0.000
23/12/1994	1818	0.010	0.007	0.003
7/01/1995	1833	0.003	0.000	0.000
19/01/1995	1845	0.047	0.043	0.039
4/02/1995	1861	0.003	0.000	0.000
4/03/1995	1889	0.016	0.013	0.009
13/04/1995	1929	0.001	0.000	0.000
15/06/1995	1992	0.005	0.002	0.000
9/10/1995	2108	0.001	0.000	0.000
5/11/1995	2135	0.006	0.002	0.000
18/11/1995	2148	0.014	0.010	0.006
21/11/1995	2151	0.014	0.011	0.007
30/11/1995	2160	0.003	0.000	0.000
13/12/1995	2173	0.003	0.000	0.000
23/12/1995	2183	0.033	0.030	0.026
1/02/1996	2223	0.001	0.000	0.000
26/02/1996	2248	0.001	0.000	0.000
26/06/1996	2369	0.000	0.000	0.000
3/07/1996	2376	0.009	0.006	0.002
6/07/1996	2379	0.002	0.000	0.000
19/07/1996	2392	0.001	0.000	0.000
27/07/1996	2400	0.019	0.016	0.011
29/09/1996	2464	0.001	0.000	0.000
19/10/1996	2484	0.002	0.000	0.000
4/12/1996	2530	0.003	0.000	0.000
7/12/1996	2533	0.008	0.004	0.000
12/12/1996	2538	0.006	0.003	0.000
14/12/1996	2540	0.000	0.000	0.000
18/12/1996	2544	0.006	0.003	0.000

Rainfall date	Model Day	Recharge (m/day) 1mm threshold	Recharge (m/day) 5mm threshold	Recharge (m/day) 10mm threshold
14/01/1997	2571	0.001	0.000	0.000
28/01/1997	2585	0.023	0.020	0.015
5/02/1997	2593	0.007	0.003	0.000
13/02/1997	2601	0.055	0.051	0.047
9/05/1997	2686	0.023	0.020	0.016
16/05/1997	2693	0.013	0.010	0.006
29/05/1997	2706	0.008	0.004	0.000
13/07/1997	2751	0.009	0.006	0.001
2/09/1997	2802	0.004	0.001	0.000
11/09/1997	2811	0.001	0.000	0.000
24/09/1997	2824	0.002	0.000	0.000
5/10/1997	2835	0.004	0.001	0.000
11/10/1997	2841	0.002	0.000	0.000
10/11/1997	2871	0.019	0.015	0.011
14/11/1997	2875	0.004	0.001	0.000
8/12/1997	2899	0.020	0.017	0.013
8/02/1998	2961	0.002	0.000	0.000
16/03/1998	2997	0.026	0.023	0.019
11/04/1998	3023	0.009	0.005	0.001
23/04/1998	3035	0.045	0.041	0.037
2/05/1998	3044	0.000	0.000	0.000
14/06/1998	3087	0.003	0.000	0.000
21/06/1998	3094	0.026	0.022	0.018
4/07/1998	3107	0.002	0.000	0.000
20/07/1998	3123	0.022	0.018	0.014
25/07/1998	3128	0.008	0.005	0.000
28/07/1998	3131	0.009	0.006	0.002
30/07/1998	3133	0.007	0.003	0.000
3/08/1998	3137	0.005	0.002	0.000
24/09/1998	3189	0.019	0.015	0.011
16/10/1998	3211	0.005	0.001	0.000
30/10/1998	3225	0.002	0.000	0.000
6/11/1998	3232	0.005	0.002	0.000
15/12/1998	3271	0.004	0.001	0.000
19/12/1998	3275	0.006	0.003	0.000
21/12/1998	3277	0.002	0.000	0.000
29/12/1998	3285	0.005	0.002	0.000
14/01/1999	3301	0.037	0.033	0.029
2/02/1999	3320	0.001	0.000	0.000
5/02/1999	3323	0.015	0.012	0.008
25/02/1999	3343	0.001	0.000	0.000
23/03/1999	3369	0.019	0.015	0.011
8/06/1999	3446	0.003	0.000	0.000
14/06/1999	3452	0.002	0.000	0.000
6/08/1999	3505	0.003	0.000	0.000
9/08/1999	3508	0.001	0.000	0.000
13/10/1999	3573	0.004	0.000	0.000
27/10/1999	3587	0.007	0.003	0.000
30/10/1999	3590	0.002	0.000	0.000
6/11/1999	3597	0.008	0.005	0.001
18/11/1999	3609	0.003	0.000	0.000
26/11/1999	3617	0.018	0.015	0.011
10/12/1999	3631	0.020	0.017	0.013
12/12/1999	3633	0.003	0.000	0.000
18/12/1999	3639	0.035	0.031	0.027
21/12/1999	3642	0.002	0.000	0.000

Rainfall date	Model Day	Recharge (m/day) 1mm threshold	Recharge (m/day) 5mm threshold	Recharge (m/day) 10mm threshold
23/12/1999	3644	0.002	0.000	0.000
	Annual average(m)	0.146	0.104	0.073

B2. Production Model Output Data

B2.1. Production Profiles

Lake	Miningere					MinSkin				
Starting Grade (Kg Potasium / m3)	7.276					3.247				
Trench Length (m)	6,000					8,000				
Time (months)	Brine Volume (m3)	Potassium Mass (kg)	Flow Rate (m3/day)	Potassium Production rate (kg/day)	Potassium Concentration (kg/m3)	Brine Volume (m3)	Potassium Mass (kg)	Flow Rate (m3/day)	Potassium Production rate (kg/day)	Potassium Concentration (kg/m3)
1	668,362	4,782,922	21,914	156,817	7.156	787,143	2,512,632	25,808	82,381	3.192
2	1,058,905	7,609,862	12,805	92,687	7.238	1,146,031	3,673,021	11,767	38,046	3.233
3	1,372,807	9,880,582	10,292	74,450	7.234	1,365,196	4,381,442	7,186	23,227	3.232
4	1,645,827	11,850,472	8,951	64,587	7.215	1,507,081	4,837,658	4,652	14,958	3.215
5	1,891,180	13,615,497	8,044	57,870	7.194	1,607,037	5,157,286	3,277	10,480	3.198
6	2,115,033	15,221,439	7,339	52,654	7.174	1,685,634	5,407,444	2,577	8,202	3.183
7	2,321,657	16,699,201	6,775	48,451	7.152	1,753,062	5,621,443	2,211	7,016	3.174
8	2,513,747	18,069,918	6,298	44,942	7.136	1,814,640	5,816,364	2,019	6,391	3.165
9	2,707,858	19,451,843	5,896	41,972	7.119	1,877,706	6,015,246	1,915	6,040	3.154
10	2,864,065	20,561,148	5,564	39,512	7.101	1,929,980	6,179,628	1,862	5,855	3.145
11	3,025,561	21,705,726	5,295	37,527	7.087	1,986,278	6,355,733	1,846	5,774	3.128
12	3,161,133	22,664,662	5,070	35,864	7.073	2,035,543	6,509,420	1,842	5,748	3.120
24	4,683,098	33,247,129	4,127	28,697	6.953	2,705,933	8,540,326	1,818	5,507	3.029
36	5,955,011	41,831,106	3,485	23,518	6.749	3,366,667	10,462,044	1,810	5,265	2.908
48	7,153,442	49,723,748	3,283	21,624	6.586	4,026,645	12,308,874	1,808	5,060	2.798
60	8,333,905	57,297,411	3,234	20,750	6.416	4,685,843	14,086,593	1,806	4,870	2.697
72	9,512,635	64,659,241	3,229	20,169	6.246	5,344,432	15,798,534	1,804	4,690	2.599
84	10,690,319	71,814,668	3,227	19,604	6.076	6,003,020	17,448,477	1,804	4,520	2.505
96	11,866,959	78,769,240	3,224	19,054	5.911	6,661,609	19,039,258	1,804	4,358	2.415
108	13,042,671	85,528,884	3,221	18,520	5.749	7,320,197	20,573,725	1,804	4,204	2.330
120	14,217,479	92,099,740	3,219	18,002	5.593	7,978,786	22,054,268	1,804	4,056	2.248
132	15,391,488	98,487,887	3,216	17,502	5.441	8,637,490	23,482,957	1,805	3,914	2.169
144	16,564,772	104,698,971	3,214	17,017	5.294	9,296,079	24,861,582	1,804	3,777	2.093
156	17,737,490	110,738,203	3,213	16,546	5.150	9,954,668	26,192,335	1,804	3,646	2.021
168	18,909,524	116,611,065	3,211	16,090	5.011	10,613,256	27,476,839	1,804	3,519	1.950
180	20,081,200	122,322,863	3,210	15,649	4.875	11,271,845	28,716,755	1,804	3,397	1.883

Lake	Lyndavale West					Skinny				
Starting Grade (Kg Potasium / m3)	3.244					4.068				
Trench Length (m)	17,000					8,000				
Time (months)	Brine Volume (m3)	Potassium Mass (kg)	Flow Rate (m3/day)	Potassium Production rate (kg/day)	Potassium Concentration (kg/m3)	Brine Volume (m3)	Potassium Mass (kg)	Flow Rate (m3/day)	Potassium Production rate (kg/day)	Potassium Concentration (kg/m3)
1	3,315,404	10,662,463	108,702	349,589	3.216	1,002,031	4,016,454	32,853	131,687	4.008
2	4,916,046	15,804,331	52,480	168,586	3.212	1,313,710	5,276,994	10,219	41,329	4.044
3	5,941,949	19,078,715	33,636	107,357	3.192	1,477,853	5,932,321	5,382	21,486	3.992
4	6,667,109	21,379,589	23,776	75,438	3.173	1,583,296	6,349,871	3,457	13,690	3.960
5	7,218,036	23,115,216	18,063	56,906	3.150	1,661,997	6,660,899	2,580	10,198	3.952
6	7,659,977	24,491,084	14,490	45,110	3.113	1,727,414	6,918,891	2,145	8,459	3.944
7	8,029,367	25,635,810	12,111	37,532	3.099	1,787,781	7,156,475	1,979	7,790	3.936
8	8,349,851	26,625,419	10,508	32,446	3.088	1,847,707	7,390,995	1,965	7,689	3.913
9	8,659,076	27,574,354	9,392	28,821	3.069	1,911,920	7,641,113	1,950	7,597	3.895
10	8,902,130	28,314,950	8,657	26,379	3.047	1,966,275	7,851,834	1,936	7,506	3.877
11	9,151,277	29,068,505	8,169	24,707	3.025	2,024,956	8,078,211	1,924	7,422	3.858
12	9,360,656	29,697,350	7,831	23,519	3.003	2,076,078	8,274,539	1,912	7,343	3.840
24	12,076,056	37,383,144	7,364	20,842	2.830	2,720,053	10,670,624	1,746	6,498	3.721
36	14,733,172	44,271,311	7,280	18,872	2.592	3,343,820	12,918,158	1,709	6,158	3.603
48	17,374,129	50,546,011	7,236	17,191	2.376	3,963,951	15,092,077	1,699	5,956	3.506
60	20,001,836	56,255,638	7,199	15,643	2.173	4,581,379	17,202,467	1,692	5,782	3.418
72	22,618,105	61,453,725	7,168	14,241	1.987	5,196,722	19,256,432	1,686	5,627	3.338
84	25,224,663	66,187,757	7,141	12,970	1.816	5,810,757	21,258,513	1,682	5,485	3.261
96	27,822,128	70,493,341	7,116	11,796	1.658	6,423,500	23,212,428	1,679	5,353	3.189
108	30,412,575	74,412,932	7,097	10,739	1.513	7,036,139	25,120,457	1,678	5,227	3.114
120	32,996,883	77,990,991	7,080	9,803	1.385	7,647,718	26,985,046	1,676	5,108	3.049
132	35,575,278	81,265,355	7,064	8,971	1.270					
144	38,149,474	84,269,587	7,053	8,231	1.167					
156	40,719,290	87,035,130	7,041	7,577	1.076					
168	43,285,846	89,593,517	7,032	7,009	0.997					
180	45,849,442	91,975,427	7,024	6,526	0.929					

Lake	Curtin Boundary					Miningere West				
Starting Grade (Kg Potasium / m3)	4.330					5.596				
Trench Length (m)	3,500					4,000				
Time (months)	Brine Volume (m3)	Potassium Mass (kg)	Flow Rate (m3/day)	Potassium Production rate (kg/day)	Potassium Concentration (kg/m3)	Brine Volume (m3)	Potassium Mass (kg)	Flow Rate (m3/day)	Potassium Production rate (kg/day)	Potassium Concentration (kg/m3)
1	338,518	1,441,582	11,099	47,265	4.259	458,783	2,523,011	15,042	82,722	5.499
2	532,722	2,277,662	6,367	27,412	4.305	696,699	3,848,416	7,801	43,456	5.571
3	690,784	2,957,454	5,182	22,288	4.301	851,744	4,712,655	5,083	28,336	5.574
4	831,398	3,560,150	4,610	19,761	4.286	954,886	5,284,869	3,382	18,761	5.548
5	960,906	4,113,648	4,246	18,147	4.274	1,030,179	5,700,218	2,469	13,618	5.516
6	1,082,653	4,632,700	3,992	17,018	4.263	1,089,388	6,026,101	1,941	10,685	5.504
7	1,198,409	5,125,177	3,795	16,147	4.254	1,139,437	6,300,962	1,641	9,012	5.492
8	1,309,194	5,595,476	3,632	15,420	4.245	1,184,302	6,546,829	1,471	8,061	5.480
9	1,423,977	6,081,649	3,486	14,766	4.236	1,229,445	6,793,604	1,371	7,495	5.467
10	1,518,396	6,480,682	3,363	14,213	4.226	1,267,042	6,998,577	1,339	7,301	5.452
11	1,617,741	6,899,762	3,257	13,740	4.218	1,307,753	7,219,820	1,335	7,254	5.435
12	1,702,348	7,255,935	3,164	13,321	4.210	1,343,347	7,412,587	1,331	7,209	5.416
24	2,687,149	11,338,396	2,671	11,071	4.145	1,807,617	9,870,311	1,259	6,665	5.294
36	3,523,391	14,705,134	2,291	9,224	4.026	2,260,400	12,207,427	1,241	6,403	5.162
48	4,322,128	17,848,997	2,188	8,613	3.936	2,711,832	14,485,090	1,237	6,240	5.045
60	5,113,820	20,889,200	2,169	8,329	3.840	3,162,500	16,709,147	1,235	6,093	4.935
72	5,904,904	23,850,151	2,167	8,112	3.743	3,612,684	18,882,888	1,233	5,955	4.829
84	6,695,443	26,733,643	2,166	7,900	3.648	4,062,417	21,008,057	1,232	5,822	4.725
96	7,485,523	29,541,931	2,165	7,694	3.554	4,512,150	23,086,958	1,232	5,696	4.623
108	8,275,086	32,277,048	2,163	7,493	3.464	4,961,637	25,120,701	1,231	5,572	4.525
120	9,064,341	34,941,174	2,162	7,299	3.375	5,410,675	27,110,441	1,230	5,451	4.431
132						5,859,712	29,057,522	1,230	5,334	4.336
144						6,308,750	30,963,003	1,230	5,220	4.243
156						6,757,788	32,827,923	1,230	5,109	4.153
168						7,206,825	34,653,292	1,230	5,001	4.065
180						7,655,863	36,439,963	1,230	4,895	3.979

Lake	Swansons North					Swansons				
Starting Grade (Kg Potasium / m3)	3.315					4.308				
Trench Length (m)	17,000					6,600				
Time (months)	Brine Volume (m3)	Potassium Mass (kg)	Flow Rate (m3/day)	Potassium Production rate (kg/day)	Potassium Concentration (kg/m3)	Brine Volume (m3)	Potassium Mass (kg)	Flow Rate (m3/day)	Potassium Production rate (kg/day)	Potassium Concentration (kg/m3)
1	1,609,027	5,240,393	52,755	171,816	3.257	1,078,168	4,620,275	35,350	151,484	4.285
2	2,247,683	7,347,878	20,940	69,098	3.300	1,701,687	7,266,547	20,443	86,763	4.244
3	2,572,056	8,418,995	10,635	35,119	3.302	2,185,451	9,307,529	15,861	66,917	4.219
4	2,780,709	9,104,720	6,841	22,483	3.286	2,585,571	10,983,025	13,119	54,934	4.187
5	2,936,767	9,614,690	5,117	16,720	3.268	2,926,956	12,400,812	11,193	46,485	4.153
6	3,069,333	10,046,904	4,346	14,171	3.260	3,224,026	13,624,230	9,740	40,112	4.118
7	3,191,140	10,443,179	3,994	12,993	3.253	3,486,210	14,698,500	8,596	35,222	4.097
8	3,308,476	10,824,081	3,847	12,489	3.246	3,721,476	15,656,038	7,714	31,395	4.070
9	3,434,365	11,231,744	3,823	12,382	3.238	3,951,287	16,585,412	6,980	28,227	4.044
10	3,541,415	11,577,473	3,813	12,314	3.230	4,131,538	17,309,169	6,420	25,779	4.015
11	3,657,454	11,951,039	3,805	12,248	3.219	4,313,941	18,036,391	5,980	23,843	3.987
12	3,758,952	12,276,671	3,796	12,179	3.208	4,464,324	18,631,513	5,624	22,257	3.957
24	5,138,907	16,603,692	3,742	11,734	3.136	6,096,855	24,710,097	4,427	16,484	3.723
36	6,496,963	20,756,240	3,721	11,377	3.058	7,478,297	29,326,634	3,785	12,648	3.342
48	7,851,039	24,803,368	3,710	11,088	2.989	8,839,815	33,393,758	3,730	11,143	2.987
60	9,203,194	28,756,303	3,705	10,830	2.923	10,198,107	37,027,972	3,721	9,957	2.676
72	10,553,409	32,618,433	3,699	10,581	2.860	11,553,441	40,310,975	3,713	8,995	2.422
84	11,902,612	36,395,218	3,696	10,347	2.799	12,906,383	43,314,658	3,707	8,229	2.220
96	13,251,815	40,089,776	3,696	10,122	2.738	14,256,935	46,094,931	3,700	7,617	2.059
108	14,601,018	43,706,040	3,696	9,908	2.680	15,605,280	48,695,119	3,694	7,124	1.928
120	15,950,220	47,247,616	3,696	9,703	2.625	16,951,832	51,148,230	3,689	6,721	1.822
132										
144										
156										
168										
180										

Appendix C JORC Code 2012 Table 1 Checklist

C1. Section 1 Sampling Techniques and Data

Criteria	JORC Code explanation	Commentary

Sampling techniques	• *Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling.*
	• *Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.*
	• *Aspects of the determination of mineralisation that are Material to the Public Report.*
	• *In cases where 'industry standard' work has been done this would be relatively simple (eg 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (eg submarine nodules) may warrant disclosure of detailed information.*
		• Geological Samples were obtained as Sonic Core, Vibracore, excavated Trenches, and chips from Aircore drillholes.
		• Brine Samples were obtained as follows:
		  • Sonic Core and vibracore :Brine samples pumped from cased piezometers and open holes
		  • Aircore: Brine samples taken from inside return from the cyclone at the end of each drill rod (3m) where brine yields were available
		  • Trenches: Brine samples pumped from the trenches during test pumping.
		  • Hand Dug Pits: Brine samples taken from the pit immediately after excavation

Drilling techniques	• *Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).*	• Sonic Core drilling • Vibracore drilling • Aircore drilling • Trench excavation with machinery • Hand Dug pits
Drill sample recovery	• *Method of recording and assessing core and chip sample recoveries and results assessed.* • *Measures taken to maximise sample recovery and ensure representative nature of the samples.* • *Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.*	• Geological recovery was typically 100% for all drilling methods • Brine sample recovery was 100% for all drilling methods except aircore. Not all drilled intervals yielded water to aircore drilling. The variable recovery is related to the permeability of the material and is not expected to produce a sampling bias for brine concentration.
Logging	• *Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.* • *Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography.* • *The total length and percentage of the relevant intersections logged.*	• Core and chips are logged by a supervising geologist. The level of detail is adequate to identify the host stratigraphic unit and support the Mineral Resource estimation, mining studies. Geological logging is qualitative.
Sub-sampling techniques and sample preparation	• *If core, whether cut or sawn and whether quarter, half or all core taken.* • *If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry.* • *For all sample types, the nature, quality and appropriateness of the sample preparation technique.* • *Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples.* • *Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling.*	• No Subsampling was undertaken.

Criteria	JORC Code explanation	Commentary
	• *Whether sample sizes are appropriate to the grain size of the material being sampled.*	
Quality of assay data and laboratory tests	• *The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.* • *For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc.* • *Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.*	• Brine assay was undertaken by inductively coupled plasma atomic emission spectroscopy (ICP-AES). • Total porosity was determined gravimetrical by weighing a wet and then dry sample. • Specific yield was determined in the laboratory gravimetrically by weighing a sample before and after centrifuge; and in the field by analysis of bore and trench pumping tests using standard hydrogeological methods of data analysis. • Geophysical tools were not used. • QAQC of brine samples comprised checks of charge balance, ionic ratios and duplicate samples sent to a secondary laboratory. QA/QC of porosity determination is not possible since the sample is destroyed by testing. A large set of samples were sent to two different laboratories and the resultant data set was compared and found comparable.
Verification of sampling and assaying	• *The verification of significant intersections by either independent or alternative company personnel.* • *The use of twinned holes.* • *Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.* • *Discuss any adjustment to assay data.*	• The are no significant intersections. The deposit is quite homogenous. • No twinned holes were drilled • Data entry was done in the field to minimise data transposition errors. • Assay data was not adjusted
Location of data points	• *Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.* • *Specification of the grid system used.* • *Quality and adequacy of topographic control.*	• Drill collars were located by hand held GPS • GDA 94 Zone 53 is used as the coordinate system. Part of the project is within Zone 52 however the coordinates were reprojected to Zone 53 to provide a consistent data set. • Topographic Control is provided by the 1-Second DEM produced by geoscience Australia. The control is adequate for this flat lying deposit
Data spacing and distribution	• *Data spacing for reporting of Exploration Results.* • *Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied.* • *Whether sample compositing has been applied.*	• In very general terms 498 data points inform an indicated resource with a 124 km extent providing a data density of 4 data points per square kilometre. This is a comparatively high data density for a brine resource. However, some data is clustered around trial trenches, and the data is generally located close to the lake edges due to access constraints to the centre of lakes. • The data density is appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. The Brine grade and geology are quite homogenous within lakes
Orientation of data in relation to geological structure	• *Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type.* • *If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.*	• The mineralisation is flat, and all holes are vertical. • No sampling bias is introduced
Sample security	• *The measures taken to ensure sample security.*	• Samples were collected by the supervising geologists and submitted to the assaying laboratory. No specific measures were undertaken to ensure sample security
Audits or reviews	• *The results of any audits or reviews of sampling techniques and data.*	• No audits or review were undertaken

C2. Section 2 Reporting of Exploration Results

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	• *Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.* • *The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.*	• The project tenure comprises three Exploration License Applications submitted by Verdant Minerals effective 2/9/2019; ELA32249, ELA32250 and ELA32251. Parkway Minerals holds a 15% interest in this tenure through its JV with Verdant Minerals. • The granting of a Mineral Lease will require either a Native Title Mining Agreement (NTMA) or an Indigenous Land Use Agreement (ILUA) before any activity under the Mineral lease can commence. • The project will require approval from NTEPA under the The Environment Protection Act 2019 (EP Act) • There are no known impediments to obtaining a license to operate in the area
Exploration done by other parties	• *Acknowledgment and appraisal of exploration by other parties.*	• The project was evaluated in the late 1990's by Northern Territory Evaporites. Evaporation trials to produce Mirabilite (Na2SO4·10H2O) were undertaken before uncertainty regarding tenure resulted in project abandonment in 1999. • From 2012 to 2014 significant exploration work was undertaken by Rum Jungle Resources (now Verdant Minerals) to evaluate the potash deposit. That work forms the basis for the current Mineral Resource Estimate.
Geology	• *Deposit type, geological setting and style of mineralisation.*	• The deposit is a brine hosted potash deposit, hosted in Lake bed sediments and underlying weathered siltstones. • The Potash, Sulphate and Magnesium minerals are dissolved in brine which is contained in the pore spaces within the host sediments.

Drill hole Information	• *A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes:*
	  o *easting and northing of the drill hole collar*
	  o *elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar*
	  o *dip and azimuth of the hole*
	  o *down hole length and interception depth*
	  o *hole length.*
	• *If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.*
		• Refer to Appendix A1 of the report.
		• No data is excluded

Data aggregation methods	• *In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated.* • *Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.* • *The assumptions used for any reporting of metal equivalent values should be clearly stated.*	• Data aggregation was undertaken only for aircore drillholes. Multiple samples were taken down hole. These were aggregated to calculate a length weighted average concentration for each hole. The rationale is that mining via trenches is not vertically selective and brine from the full thickness of the deposit will flow to the trench. • No high-grade intercepts are aggregated. Vertical variability in brine concentration was negligible. • No Metal equivalents are reported
Relationship between mineralisation	• *These relationships are particularly important in the reporting of Exploration Results.* • *If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported.*	• Holes are vertical and the deposit is flat lying. The intersected thickness is equivalent to the actual thickness.

Criteria	JORC Code explanation	Commentary
widths and intercept lengths	- *If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').*	
Diagrams	- *Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.*	- Maps are included in the report. A conceptual cross section of the deposit type is also shown.
Balanced reporting	- *Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.*	- All data is included
Other substantive exploration data	- *Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.*	- Substantive exploration data for this deposit are the hydrogeological aquifer properties pertinent to mining a brine resource as detailed in the 2019 AMEC Guidelines for Brine Deposit Evaluation. - Hydraulic Conductivity and Transmissivity determination are reported - Total Porosity and Specific Yield determination is reported - Salt Lake rainfall recharge and run-off is evaluated in detail.
Further work	- *The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling).* - *Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.*	- No extension drilling is planned

C3. Section 3 Estimation and Reporting of Mineral Resources

Criteria	JORC Code explanation	Commentary
Database integrity	• *Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes.* • *Data validation procedures used.*	• Data was received in digital format to reduce transcription errors. • Data validation comprised checks for consistency in parameters.
Site visits	• *Comment on any site visits undertaken by the Competent Person and the outcome of those visits.* • *If no site visits have been undertaken indicate why this is the case.*	• The Competent Person, Mr Ben Jeuken has undertaken multiple site visits from 2012 to 2014. These included management and supervision of bore pumping tests in July and August 2012, management and supervision of trench pumping trials in July to October 2013, and site reconnaissance for scoping studies in March 2014.
Geological interpretation	• *Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit.* • *Nature of the data used and of any assumptions made.* • *The effect, if any, of alternative interpretations on Mineral Resource estimation.* • *The use of geology in guiding and controlling Mineral Resource estimation.* • *The factors affecting continuity both of grade and geology.*	• The confidence in the geological interpretation is reasonable. Thickness of sedimentary units is inferred from relatively wide spaced drilling; however the geological setting is not structural controlled, it is a Lacustrine sedimentary system that exhibits low variability. • The thickness of the geological units has the effect of changing the overall porosity applied in the mineral resource estimate and also the hydraulic conductivity that determines flow rates in the reserve evaluation.
Dimensions	• *The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.*	• The extent of the Mineral Resource estimate is the extent of specific Playa Lakes as defined in the 1:250,000 topographic data set and checked against detailed aerial imagery. • The top of the Mineral Resource is the top of the water table measured at drillholes and test pits • The base of the resource is the base of the drilling intersections. The mineralisation is open at depth but the depth of the Resource is constrained by the depth of drilling.
Estimation and modelling techniques	• *The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used.* • *The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data.* • *The assumptions made regarding recovery of by-products.* • *Estimation of deleterious elements or other non-grade variables of economic significance (eg sulphur for acid mine drainage characterisation).* • *In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed.* • *Any assumptions behind modelling of selective mining units.* • *Any assumptions about correlation between variables.* • *Description of how the geological interpretation was used to control the resource estimates.* • *Discussion of basis for using or not using grade cutting or capping.* • *The process of validation, the checking process used, the comparison of model data to drill hole data, and use of reconciliation data if available.*	• The top and base of the Resource were defined by interpolation of top and bottom intercepts measured at drillholes to developed gridded surfaces. The thickness of each unit was calculated as the difference between the top and bottom elevations of the unit. • Spatial distribution of solute concentration was interpolated in 2 dimensions using Ordinary Kriging interpolation, 1500m search radius, minimum 1 data point per sector with one search expansion within the Mapinfo Discover software suite. Lakes that met this search criteria (one datapoint within 3000 m) were classified as Indicated. Interpolation up to 3000 m is consistent with the conceptual understanding of a relatively homogenous brine resource. • Porosity (Total and Specific Yield) was assigned as a uniform parameter for each stratigraphic unit as the median value of the full data set for that stratigraphic unit. • The resource was calculated as the product of thickness, porosity, and brine concentration for each stratigraphic unit. • No check estimates are available, or production records are available • No recovery by-products is considered • No deleterious elements are considered • Block modelling was not undertaken • Selective mining is not considered. Each playa lake is reported separately as a distinct mining unit

Criteria	JORC Code explanation	Commentary
		• Correlation between variable is not assumed • The geological setting is understood to be flat and homogenous, this interpretation was used as the basis for quite distant interpolation. • Grade cutting or capping was not used as there were no outliers in the data. Each lake was reasonably homogenous. • No reconciliation data were available.
Moisture	• *Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.*	• Tonnages are reported as minerals dissolved in brine contained within pore spaces of the host sediment. • Porosity determination is addressed under sampling techniques and data
Cut-off parameters	• *The basis of the adopted cut-off grade(s) or quality parameters applied.*	• The minimum average grade for any Lake is 2.4 kg/m^3. This value is comparable to the minimum grade of other projects. Within a lake, no cut-off grades are applied because the mining method is not selective.
Mining factors or assumptions	• *Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.*	• Mining is assumed to occur via gravity drainage of brine to trenches excavated into the Lake bed surface. • A modifying factor of 0.34, is applied to the Mineral Tonnage contained in Total Porosity. This modifying factor defines the proportion of the Mineral Tonnage that meets the criteria of reasonable prospects of economic recovery. • The basis for the modifying factor is simulation of a 15 year mine plan by brine flow and solute transport simulation as outlined in Section 3 of the report.
Metallurgical factors or assumptions	• *The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.*	• The aMES™ based development concept forms the basis of this evaluation. The activated Minerals Extraction System, or aMES™ is an innovative process technology that enables the treatment of concentrated brine solutions to recover valuable minerals. Potash will be recovered by a combination of evaporation pond reconcentration and membrane treatment to produce enriched mixed salt for subsequent processing to SOP.
Environmen-tal factors or assumptions	• *Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.*	• The aMES™ based development concept aims to improve the sustainability profile of the KLPP, compared to conventional potash projects. In particular, the relatively small project footprint, recycled wastewater streams, elimination of reagents, all represents major improvements in the environmental sustainability of the KLPP and are expected to deliver positive impacts to key stakeholders • Environmental impacts will include a lowering of the water table beneath the lakes; disturbance of the lake surface and production of a waste salt (mainly sodium chloride)
Bulk density	• *Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples.* • *The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc), moisture and differences between rock and alteration zones within the deposit.* • *Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.*	• Bulk density is not relevant to a brine resource. Brine is assay and reported as a mass per unit volume of brine.

Criteria	JORC Code explanation	Commentary
Classification	- *The basis for the classification of the Mineral Resources into varying confidence categories.* - *Whether appropriate account has been taken of all relevant factors (ie relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data).* - *Whether the result appropriately reflects the Competent Person's view of the deposit.*	- The Mineral Resource Estimate is classified as an Indicated Resource. - The estimate is sufficient to support mine planning and evaluation of the economic viability of the deposit
Audits or reviews	- *The results of any audits or reviews of Mineral Resource estimates.*	- No audits or reviews were undertaken.
Discussion of relative accuracy/ confidence	- *Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate.* - *The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used.* - *These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.*	Brine resources are very different to solid mineral resources. Brine production rate to a bore or trench is proportional to the hydraulic conductivity (permeability) of the host rock. This places a physical limitation on production rate that cannot be exceeded. The production rate will decline over time as the brine resource is depleted in proximity to a bore or trench. The production rate over longer time periods will be dependent on the rate of rainfall and run-of infiltration to the brine aquifer. The brine concentration reported in the mineral resource is the starting point for production. This concentration will decline over time as the brine body is depleted and replaced by infiltrating recharge from rainfall and run-off and lateral inflow of lower concentration groundwater. The capacity to mobilise a fraction of the potassium hosted in bound porosity is dependent on chemical equilibration of recharge from rainfall and run-off. The degree of equilibration is assumed from laboratory test work and has inherent uncertainty. The cumulative effect of these characteristics is that the accuracy and confidence in a brine mineral resource declines with duration of mining. Over time: - Flow rate will decline and is dependent on variable and uncertain recharge - Brine grade will decline and is dependent on variable and uncertain recharge - The final proportion of the resource that can be recovered is dependent on chemical equilibration of recharge and on the duration of mining. The Resource is classified as an Indicated Resource on the basis that the estimate is adequate to inform mine planning (production modelling as described in Section 3).