Government of Western Australia
Department of Water and Environmental Regulation

Amended Works Approval

Works approval number	W6282/2019/1
Works approval holder	Piper Preston Pty Ltd
ACN	142 862 409
Registered business address	Ground Level, 239 Adelaide Terrace PERTH WA 6000
DWER file number	DER2019/000390
Duration	18/10/2019 to 17/10/2026
Date of amendment	10/03/2020
Premises details	Lake Way Potash Project Goldfields Hwy WILUNA WA 6646 Legal description – Mining tenement M53/796, M53/797, M53/798, M53/123 & M53/910, and part of mining tenement M53/53

Prescribed premises category description (Schedule 1, *Environmental Protection Regulations 1987*)	**Assessed maximum production/ design capacity**
Category 14: Solar salt manufacturing: premises on which salt is produced by solar evaporation.	50,000 tonnes per annual period
Category 54: Sewage facility: premises – (a) on which sewage is treated (excluding septic tanks); or (b) from which treated sewage is discharged onto land or into waters.	90 cubic metres per day

This works approval is granted to the works approval holder, subject to the attached conditions, on 10 March 2020, by:

Tim Gentle
MANAGER, RESOURCE INDUSTRIES REGULATORY SERVICES

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Works approval history

Date	Ref number	Summary of changes
01/03/2019	W6206/2018/1	Works approval for construction and installation of a temporary holding pond consisting of two sub-ponds in series, a 4 m deep trench beneath the temporary pond to collect seepage and groundwater inflows, and infrastructure to pump dewatering water from the adjacent Williamson's pit.
27/09/2019	L9208/2019/1	Licence for pumping up to 1.5 GL of water from Williamson's pit to the temporary holding pond, for the purpose of producing brine.
18/10/2019	W6282/2019/1	Works approval for construction of nine evaporation ponds (3 halite ponds, 4 kainite harvesting ponds, carnallite harvest pond and bitterns pond), for the purpose of producing brine as feed for a trial brine processing plant.
10/03/2020	W6282/2019/1	Works approval amendment, for construction of a field scale brine processing plant (50,000 tpa capacity), for the purpose of determining the viability of the commercial scale production of SOP from the Lake Way resource. Also includes construction of a sewage treatment plant to support a 300-bed mine camp.

Interpretation

In this works approval:

(a) the words 'including', 'includes' and 'include' in conditions mean 'including but not limited to', and similar, as appropriate;

(b) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

(c) where tables are used in a condition, each row in a table constitutes a separate condition;

(d) any reference to an Australian or other standard, guideline or code of practice in this works approval means the version of the standard, guideline or code of practice in force at the time of granting of this works approval and includes any amendments to the standard, guideline or code of practice which may occur from time to time during the course of the works approval;

(e) unless specified otherwise, any reference to a section of an Act refers to that section of the EP Act; and

(f) unless specified otherwise, all definitions are in accordance with the EP Act.

NOTE: This works approval requires specific conditions to be met but does not provide any implied authorisation for other emissions, discharges, or activities not specified in this works approval.

Works approval conditions

The works approval holder must ensure that the following conditions are complied with:

Infrastructure and equipment

1. The works approval holder must install and undertake the works for the infrastructure and equipment specified in Table 1, and to the requirements listed in that table.

2. Subject to condition 1, within 14 days of the completion of the works for the infrastructure and equipment specified in Table 1, the works approval holder must provide to the CEO an Environmental Compliance Report prepared by a licensed professional engineer that:

(a) lists and describes the completed works and any associated items of infrastructure and equipment listed in Table 1;
(b) identifies any discharge points listed in Table 2 to be operated;
(c) certifies whether or not each item of infrastructure or component of infrastructure specified in Table 1 has been constructed, complies with the corresponding requirements in that table and contains any material defects;
(d) contains as constructed plans for each item of infrastructure or component of infrastructure specified in Table 1; and
(e) is signed by a person authorised to represent the works approval holder and contains the printed name and position of that person within the company.

3. Subject to condition 2(c), where an item of infrastructure or component of infrastructure has been certified as not being constructed, or does not comply with the corresponding requirements, or contains material defects, the works approval holder must:

(a) correct the non-compliant or defective works, prior to re-certifying in accordance with condition 2(c); or
(b) provide to the CEO a description of, and explanation for, any departures from the requirements specified in Table 1 that do not require rectification and do not constitute a material defect along with the report required by condition 2.

Table 1: Infrastructure and equipment requirements table

Infrastructure	Requirements (design and construction)	Site plan reference
Brine harvesting infrastructure		
Halite pond 2	- walls to be constructed using an earthworks methodology (Schedule 2, Figure 2); - walls to be constructed from overburden waste rock and clay sourced from the Williamson's Pit waste rock dump which meets a permeability of $1x10^{-9}$ m/s; - walls constructed to a height of 1.5 metres to provide the following capacity: (i) 2 years of precipitate at 0.5 m/yr; (ii) operational brine height of 0.3 m; and (iii) a storm storage capacity of 0.2 m (based on a 1:100 year AEP rain event of 72 hours duration); - side slopes of the bunds will be at 1V:2H; - to be constructed to include a minimum 300 mm freeboard; and - to be lined with a HDPE liner;	'H2' as depicted in the 'Premises map' in Schedule 1
Halite pond 3	- walls to be constructed using a plastic sheet pile methodology (Schedule 2, Figure 1). Sheet piling will be to a depth of 2 metres around the full perimeter of the ponds; - walls constructed to a height of 1.5 metres to provide the following capacity: (i) 2 years of precipitate at 0.5 m/yr; (ii) operational brine height of 0.3 m; and (iii) a storm storage capacity of 0.2 m (based on a 1:100 year AEP rain event of 72 hours duration); - a 6 metre wide by 0.8 metre thick access track of mine waste is to be constructed around the perimeter of the sheet pile walls; - the access track is to be offset 1-2 m from the sheet pile wall; and	'H3' as depicted in the 'Premises map' in Schedule 1

Infrastructure	Requirements (design and construction)	Site plan reference
	- to be constructed to include a minimum 200 mm freeboard;	
Halite pond 4	- walls to be constructed using a plastic sheet pile methodology (Schedule 2, Figure 1). Sheet piling will be to a depth of 2 metres around the full perimeter of the ponds; - walls constructed to a height of 1.5 metres to provide the following capacity: (iv) 2 years of precipitate at 0.5 m/yr; (v) operational brine height of 0.3 m; and (vi) a storm storage capacity of 0.2 m (based on a 1:100 year AEP rain event of 72 hours duration); - a 6 metre wide by 0.8 metre thick access track of mine waste is to be constructed around the perimeter of the sheet pile walls; - the access track is to be offset 1-2 m from the sheet pile wall; and - to be constructed to include a minimum 200 mm freeboard;	'H4' as depicted in the 'Premises map' in Schedule 1
Kainite pond 1; Kainite pond 2; Kainite pond 3; Kainite pond 4; Carnallite pond	- walls to be constructed using a plastic sheet pile methodology. Sheet piling will be to a depth of 2 m around the full perimeter of the ponds; - walls constructed to a height of 1.7 m to provide the following capacity: (i) 1 year of precipitate at 1.2 m/yr; (ii) operational brine height of 0.3 m; and (iii) a storm storage capacity of 0.2 m (based on a 1:100 year AEP rain event of 72 hours duration); - a 6 metre wide by 0.8 metre thick access track of mine waste is to be constructed around the perimeter of the sheet pile walls; - the access track is to be offset 1-2 m from the sheet pile wall; and - o be constructed to include a minimum 200 mm freeboard;	'K1', 'K2, 'K3', K4' and 'C1' as depicted in the 'Premises map' in Schedule 1
Bitterns pond	- walls to be constructed using the earthworks methodology; - walls to be constructed from overburden waste rock and clay sourced from the Williamson's Pit waste rock dump which meets a permeability of $1x10^{-9}$ m/s; - walls to be approximately 2 m in height; - side slopes of the bunds will be at 1V:2H; - to be constructed to include a minimum 300 mm freeboard; and - to be lined with a HDPE liner;	'B1' as depicted in the 'Premises map' in Schedule 1
Brine treatment infrastructure		
Process plant – including attritioning circuits, flotation circuit and crystalliser	- design capacity of the plant – 595 m^3 per hour; - must be constructed in accordance with the specifications outlined in the drawing 'LY-SO4-7000-DE-BOD-0001' (Schedule 3);	'Process plant' as depicted in the 'process plant site layout' map in Schedule 1

Infrastructure	Requirements (design and construction)	Site plan reference

Rotary dryer	The dryer installed to dry salt must meet the following design requirements:
	- packaged dryer – model Maxon 8” KINEDIZER LE (or similar);
	- gas-fired (natural or LPG);
	- vent stack must be fitted with a stack monitoring port in accordance with AS 4323.1 and be of sufficient diameter to accommodate apparatus used for the monitoring off-gas;
	- the bag filter installed on the dryer must be:
	  - adequately sized to cater for maximum air volume;
	  - capable of minimising particulate emissions to less than 50 mg/m^3 during normal operations;
	  - fitted with a system for detection and isolation of broken bags; and
	  - fitted with means for automatically cleaning filter element(s);
	- must conduct monitoring of emissions at least once during commissioning and the time limited operations, for validation purposes;
		‘SOP product dryer’ and ‘SOP product dryer baghouse’ as depicted in the drawing LY-WOD-3020-ME-SKT-00001 (Schedule 3)

Sediment pond 1	- pond must be constructed to the dimensions specified for ‘sedimentation pond 1’ in drawing no. LY-GRS-3000-CV-DRW-00007; - embankment wall height must not exceed 1.5 metres above natural ground level; - outer embankments must be at least 1V:2H;	‘Sediment pond 1’ as depicted in the ‘process plant site layout’ map in Schedule 1
Sediment pond 2	- pond must be constructed to the dimensions specified for ‘sedimentation pond 2’ in drawing no. LY-GRS-3000-CV-DRW-00007; - embankment wall height must not exceed 1.5 metres above natural ground level; - outer embankments must be at least 1V:2H;	‘Sediment pond 2’ as depicted in the ‘process plant site layout’ map in Schedule 1
Reclaim brine pond	- pond must be constructed to the dimensions specified for ‘reclaim brine pond’ in drawing no. LY-GRS-3000-CV-DRW-00007; - walls must be constructed with material that meets a permeability of at least $1x10^{-9}$ m/s; - embankment wall height must not exceed 1.5 metres above natural ground level; - outer embankments must be at least 1V:2H; - must be lined with a HDPE lining at least 1.5 mm thick;	‘Reclaim brine pond’ as depicted in the ‘process plant site layout’ map in Schedule 1
Contaminated water collection pond	- pond must be constructed to the dimensions specified for ‘contaminated water collection pond’ in drawing no. LY-GRS-3000-CV-DRW-00007; - walls must be constructed with material that meets a permeability of at least $1x10^{-9}$ m/s; - embankment wall height must not exceed 1.5 metres above natural ground level; - outer embankments must be at least 1V:2H; - must be lined with a HDPE lining at least 1.5 mm thick;	‘Contaminated water collection pond’ as depicted in the ‘process plant site layout’ map in Schedule 1
Stockpile pad	- must be constructed with compacted overburden or	‘5000t halite

Infrastructure	Requirements (design and construction)	Site plan reference
(harvest salt feed prep and waste halite)	similar; - stockpile area must be bunded to contain surface water runoff; - drainage must be designed to divert surface water runoff to the reclaim brine pond;	waste stockpile' as depicted in the 'process plant site layout' map in Schedule 1
Mine camp infrastructure		
Sewage treatment plant	- packaged wastewater treatment plant – MBBR+90 system with 'Class A' upgrade; - must be constructed in accordance with the manufacturers specifications, as per drawing 'MAK5686B-VA-001' (Schedule 3);	'Waste water treatment plant' and 'Waste water treatment sprayfield' as depicted in the 'process plant site layout' map in Schedule 1
Irrigation spray field	- must comprise an area of at least 1.5 ha in size.	

Commissioning phase

Commissioning of brine harvesting infrastructure

4. The works approval holder must ensure the Environmental Commissioning phase is no greater than 6 calendar months for the ponds.

5. The works approval holder must submit to the CEO an Environmental Commissioning Report that;

(a) is received by the CEO within 60 calendar days of the completion of the Environmental Commissioning phase and, where applicable, in conjunction with an application for a licence if not already submitted.

6. The works approval holder must ensure the reports required by condition 5 of this works approval include:

(a) a summary of the commissioning activities undertaken, including timeframes;
(b) a review of performance of the as constructed pond against the design specification; and
(c) where they have not been met, measures proposed to meet the design specification, together with timescales for implementing the proposed measures.

Commissioning of brine treatment infrastructure

7. The works approval holder must notify the CEO, at least 7 days prior to, the commencement date of commissioning of each of the brine processing plant and the sewage treatment plant.

8. The works approval holder must not commission each of the brine processing plant and the sewage treatment plant for a period exceeding 3 months.

9. The works approval holder must notify the CEO, within 7 days after, the completion date of commissioning of each of the brine processing plant and the sewage treatment plant.

10. The works approval holder must provide to the CEO an Environmental Commissioning Report within 3 months of the completion date of commissioning of each of the brine processing plant and the sewage treatment plant.

11. The works approval holder must ensure the reports required by condition 10 of this works approval include:

(a) a summary of the commissioning activities undertaken, including timeframes and the amount of raw salt processed and sewage treated;
(b) a summary of the environmental performance of all plant and equipment as installed, including but not limited to:
    (i) brine processing plant;
    (ii) gas-fired dryer; and
    (iii) sewage treatment plant; and
(c) a review of performance against the manufacturers design specification; and
(d) where they have not been met, measures proposed to meet the manufacturer's design specification and conditions of this works approval, together with timescales for implementing the proposed measures.

Time limited operational phase

12. The works approval holder may conduct full brine processing operations for a period not exceeding 3 months from the completion date of commissioning the process plant, or until such time as a licence for full brine processing operations is granted, whichever is sooner.

13. Following the completion of commissioning the process plant, the works approval holder must not produce more than 50,000 tonnes per annum of SOP product.

Emissions

Air emissions

14. The works approval holder must ensure that waste emitted to air during the time limited operational phase is emitted in accordance with the requirements specified in Table 2.

Table 2: Authorised emission points to air table

Emission point reference	Emission point and source	Emission point height (m)	Emission limit (mg/m^3)[1]
A1	Gas-fired dryer vent stack	20 (minimum)	TSP <50 mg/m^3

Note 1: Determined via stack test (60 minute average).

Disposal of waste

15. The works approval holder must ensure that wastes produced from the brine treatment process during commissioning and the time limited operational phase is deposited in accordance with the requirements specified in Table 3.

Table 3: Waste disposal requirements table

Emission	Disposal requirements
Waste (halite) stockpile	Halite solids must be returned to the halite ponds
Reclaim brine pond	Brine must be transferred back to the on-lake pond system (recovery pond)
Bloedite waste solids	Bloedite solids must be transferred to the on-lake pond system (recovery pond)
Bitterns	Must be transferred to the bitterns pond

Disposal of treated effluent

16. Following construction of the sewage treatment plant, the works approval holder must ensure that treated wastewater is only discharged in accordance with the requirements specified in Table 4.

Table 4: Treated wastewater disposal requirements table

Waste type	Disposal requirements
Treated wastewater from the mine camp, treated via a package sewage treatment plant constructed in accordance with this works approval	Must only be discharged to the "Irrigation Spray Field", as shown in the map in Schedule 2

Monitoring

General

17. The works approval holder must ensure that:

(a) all water samples are collected and preserved in accordance with AS/NZS 5667.1;
(b) all groundwater sampling is conducted in accordance with AS/NZS 5667.11; and
(c) all laboratory samples are submitted to and tested by a laboratory with current NATA accreditation for the parameters being measured, unless indicates otherwise in the relevant table.

18. The works approval holder must ensure that six-monthly monitoring is undertaken at least 5 months apart.

19. The works approval holder must ensure that all monitoring equipment used on the Premises to comply with conditions of this works approval is calibrated in accordance with the manufacturer's specifications.

20. The works approval holder must, where the requirements for calibration cannot be practicably met, or a discrepancy exists in the interpretation of the requirements, bring these issues to the attention of the CEO accompanied with a report comprising details of any modifications to the methods.

Process monitoring

21. During the time limited operational phase, the works approval holder must undertake monitoring of the process specified in Table 5, for the parameters and in the units set out in that table.

Table 5: Process monitoring requirements table

Process description	Parameter	Units
Brine extraction	Amount of brine extracted from trenches	Gigalitres
Processing of harvested salt	Amount of salts processed from ponds	Wet tonnes
	Amount of SOP produced	
Disposal of waste (halite)	Amount of waste (halite) disposed	

Radium and actinium isotope monitoring

22. The works approval holder must undertake monitoring in accordance with the requirements specified in Table 6.

Table 6: Monitoring of radium and actinium isotope requirements table

Monitoring point reference	Parameter	Unit	Averaging period	Frequency
Halite ponds 1 – 3; Kainite ponds 1 – 4; Bitterns pond; and Carnallite pond	Gross alpha Gross beta	Bq/L	Spot sample	Six-monthly

Records and reporting

23. The works approval holder must maintain accurate and auditable books including information, reports, and data required by this works approval during the commissioning and time limited operational phase:

(a) process monitoring required by condition 21;
(b) radium and actinium isotope monitoring required by condition 22; and
(c) complaints received under condition 25.

24. The books specified under condition 23 must:

(a) be legible;
(b) if amended, be amended in such a way that the original version(s) and any subsequent amendments remain legible and are capable of retrieval;
(c) be retained by the works approval holder for the duration of the works approval; and
(d) be available to be produced to an inspector or the CEO as required.

25. The works approval holder must record the following information in relation to complaints received by the works approval holder (whether received directly from a complainant or forwarded to them by the Department or another party) about any alleged emissions from the Premises:

(a) the name and contact details of the complainant, (if provided);
(b) the time and date of the complaint;
(c) the complete details of the complaint and any other concerns or other issues raised; and
(d) the complete details and dates of any action taken by the works approval holder to investigate or respond to any complaint.

Definitions

In this works approval, the terms in Table 7 have the meanings defined.

Table 7: Definitions

Term	Definition
ACN	Australian Company Number
AS 4323.1	means the Australian Standard AS 4323.1 *Stationary Source Emissions Method 1: Selection of sampling positions*
AS/NZS 5667.1	means the Australian Standard AS/NZS 5667.1 *Water Quality – Sampling – Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*
AS/NZS 5667.11	means the Australian Standard AS/NZS 5667.11 *Water Quality – Sampling – Guidance on sampling of groundwaters*
averaging period	means the time over which a limit is measured or a monitoring result is obtained
books	has the same meaning given to that term under the EP Act
Bq/L	Bequerels per litre
CEO	means Chief Executive Officer of the Department CEO for the purposes of notification means: Director General Department Administering the *Environmental Protection Act 1986* Locked Bag 10 JOONDALUP DC WA 6919 info@dwer.wa.gov.au
commission/ commissioning	means a period of time to allow for stabilisation and optimisation of the process following input of raw materials under operation conditions (including emissions) on the works approval for the limited period of operations required
condition	means a condition to which this works approval is subject under s.62 of the EP Act
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act
discharge	has the same meaning given to that term under the EP Act
emission	has the same meaning given to that term under the EP Act
Environmental Compliance Report	means a report to satisfy the CEO that the works have been constructed in accordance with the works approval
Environmental Commissioning Report	means a report that: (a) documents the environmental commissioning activities undertaken; (b) demonstrates the Premises can operate to the specification detailed in the works approval application; (c) demonstrates all environmental conditioning activities have concluded; and (d) confirms emissions and discharges from the Premises meet the required specifications
EP Act	means the *Environmental Protection Act 1986* (WA)
EP Regulations	means the *Environmental Protection Regulations 1987* (WA)
freeboard	means the distance between the maximum water surface elevations and the top of retaining banks or structures at their lowest point.
HDPE	High Density Polyethylene

material defect	means a defect in any item, whether tangible or intangible, that substantially prevents the item from operating or functioning as designed or according to its specifications
NATA	National Association of Testing Authorities, Australia
NATA accredited	means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis
Premises	the premises to which this works approval applies, as specified at the front of this works approval and as shown on the map in Schedule 2 to this works approval
prescribed premises	has the same meaning given to that term under the EP Act
professional engineer	means a person holding current certification from the Institution of Engineers Australia (IEAust)
six-monthly	means the two inclusive periods from 1 January to 30 June and 1 July to 31 December in the same year
SOP	sulfate of potash
spot sample	means a discrete sample representative of the time and place at which the sample is taken
stack test	means a discrete set of samples taken over a representative period at normal operating conditions
time limited operational phase	means full mining and mineral processing activities permitted under this works approval, subject to conditions, whilst an application for an amendment to the licence for the Premises is being assessed
TSP	Total Suspended Particulates
works approval	refers to this document, which evidences the grant of the works approval by the CEO under s.54 of the EP Act, subject to the conditions
works approval holder	refers to the occupier of the Premises being the person to whom this works approval has been granted, as specified at the front of this works approval

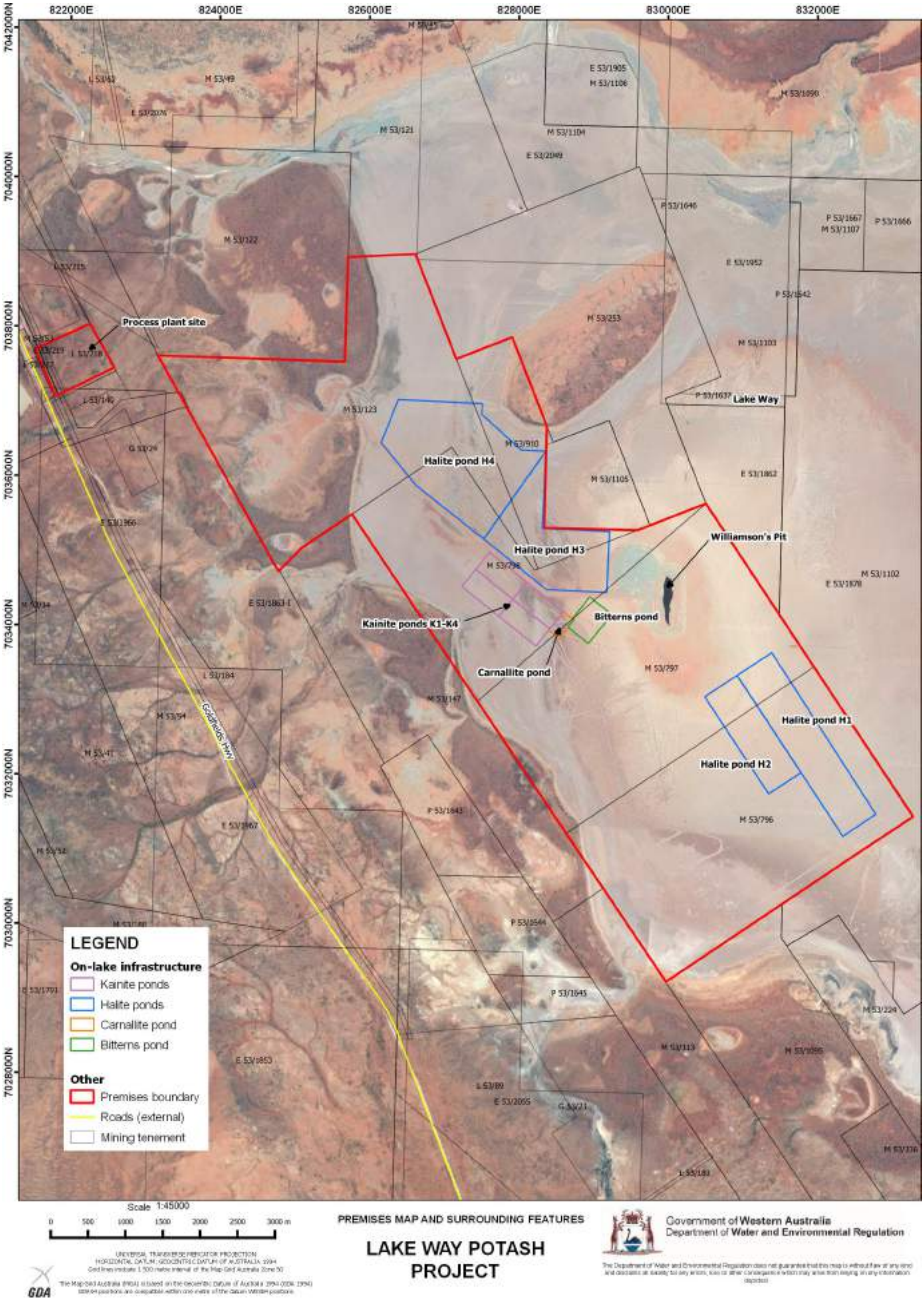
---

END OF CONDITIONS

Schedule 1: Maps

Premises map

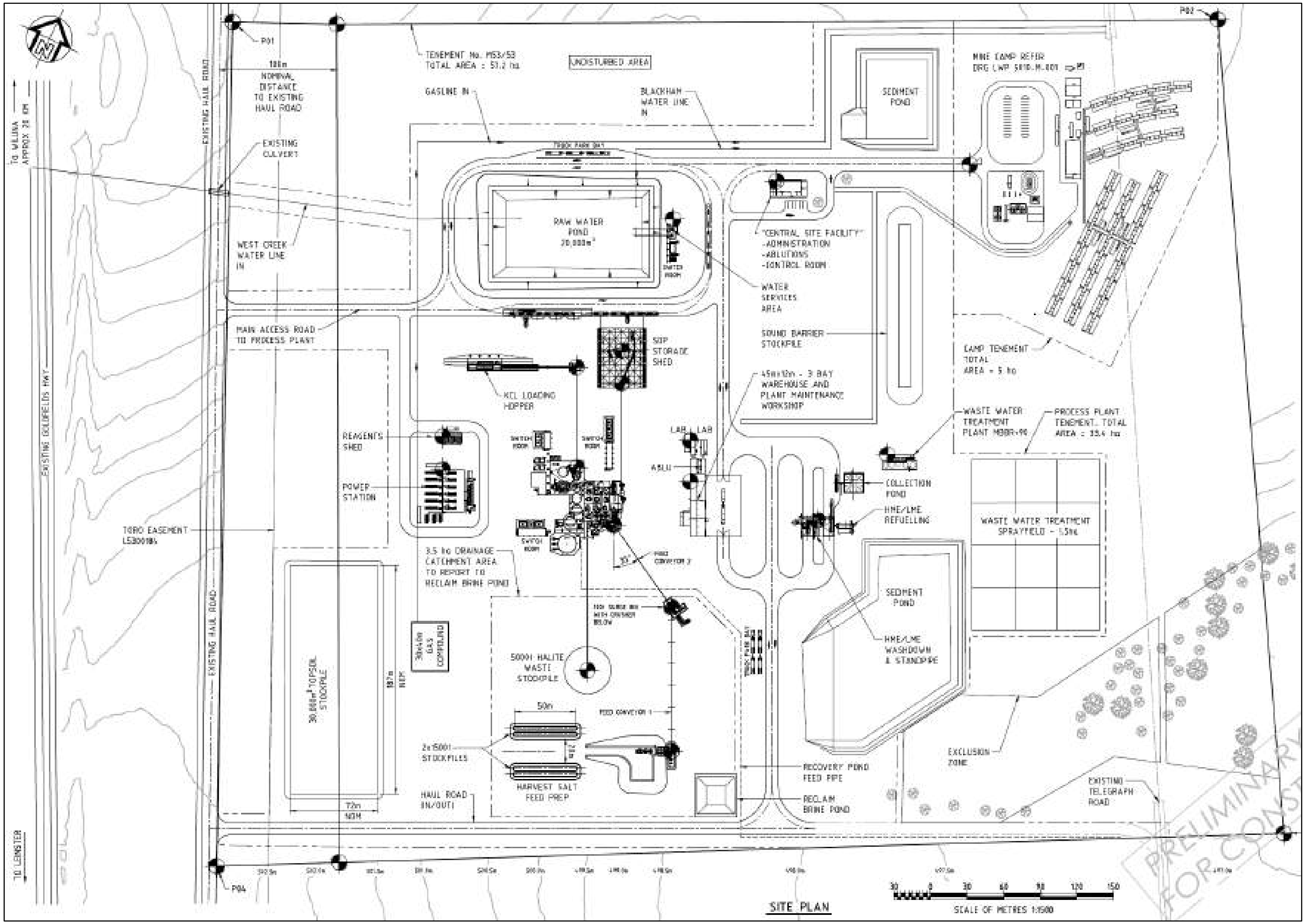
The boundary of the prescribed premises is shown in the map below.



Schedule 1: Maps

Process plant site layout map

The site layout of the processing plant area is shown in the map below.



Schedule 2: Pond construction specifications

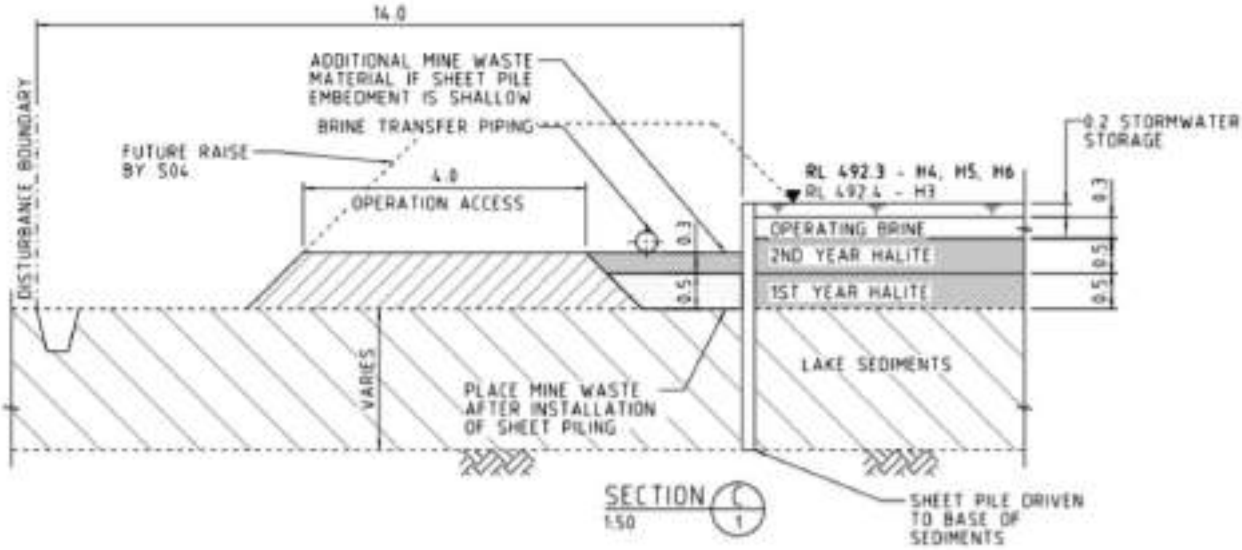


Figure 1 Typical sheet pile wall design (Halite pond shown)

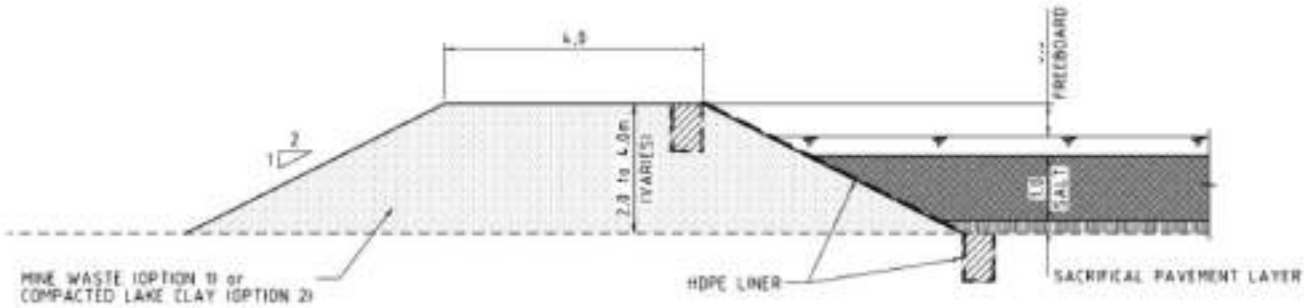


Figure 2 Typical earthworks wall design (Halite pond shown)

Schedule 3: Drawings

The drawings and documents referenced in Table 1 are listed below, with the drawings attached thereafter.

Drawing no.	**Description**
LY-WOD-3020-ME-SKT-00001	Process mechanical – process mill
LY-GRS-3000-CV-DRW-00007	Process plant ponds – setout plans and sections
MAK5686B-VA-001	MBBR sewage treatment plant – GA drawing
Document no.	**Description**
LY-SO4-7000-DE-BOD-0001	Process plant & NPI – basis of design

REV.	REVISION DESCRIPTION	DATE	DRAWN BY	DESIGNED BY	DWG. CHECK	DESIGN CHECK	LEAD ENG./ DEPT. MGR.	P. ENG./ PROJ. MGR.
A	ISSUED FOR INFORMATION	25JAN2020	GJD	GJD	RRA	RRA	[signature]	[signature]

NO.	DWG. NO.	REFERENCE DRAWINGS
8		
7		
6		
5		
4		
3		
2		
1		

ENGINEERING REVIEW		
PROJ. MGR.		
DEPT. LEAD		
DESIGN CHECK		
DWG. CHECK		
DESIGNED BY		
DRAWN BY	GJD	01NOV2019

SALT LAKE POTASH LTD

APPROVAL
BY DATE

NOT FOR CONSTRUCTION

PROJECT NO. 205538 SCALE 1:150

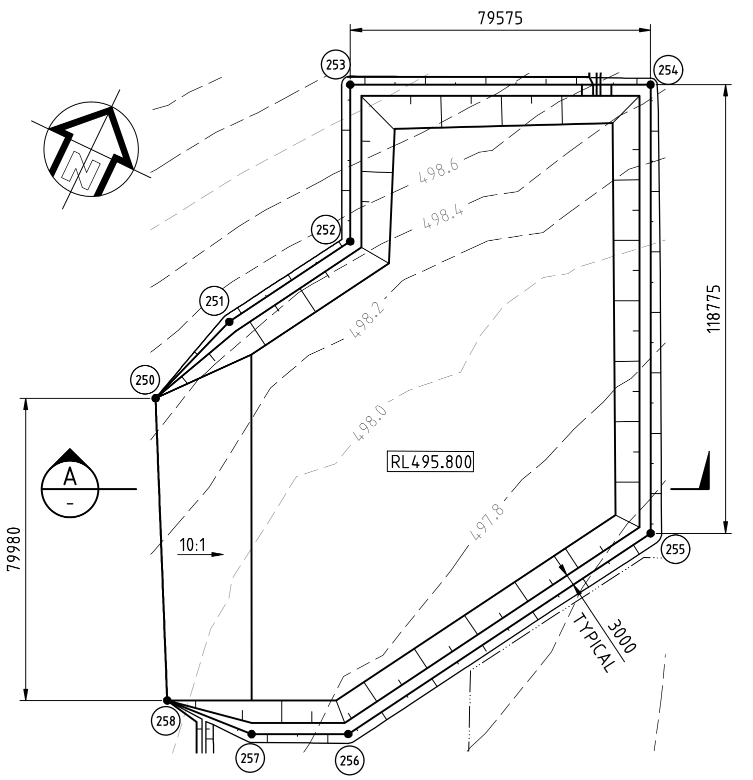
wood.

SALT LAKE POTASH PROJECT
PROCESS
MECHANICAL
PROCESS MILL
PLAN AT TO PEDESTAL EL. 501.250

DRAWING NO. LY-WOD-3020-ME-SKT-00001 REV. A

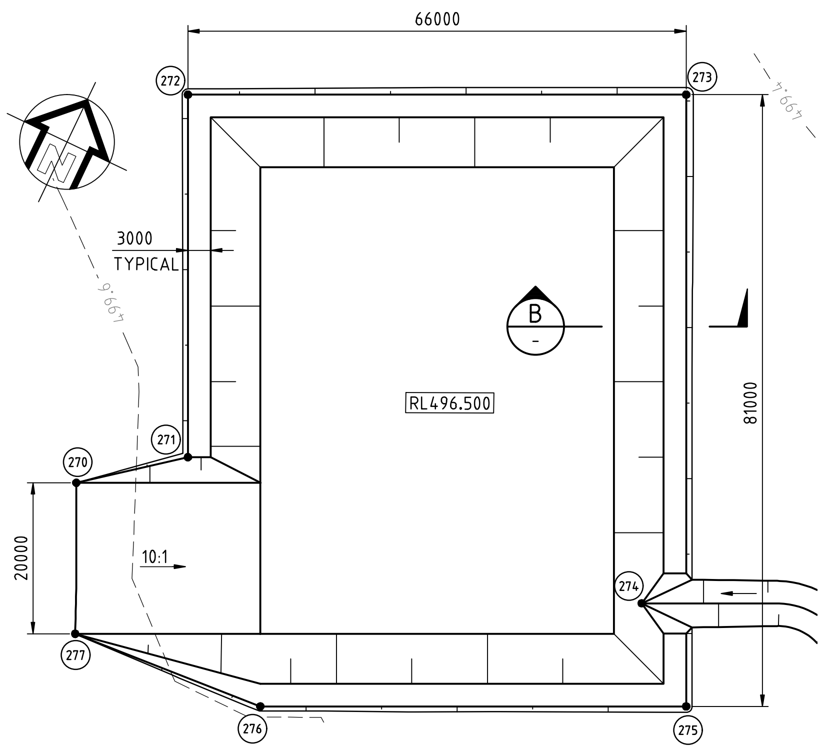
NOTES

1. FOR NOTES REFER TO DRAWING LY-GRS-3000-CV-DRW-00005



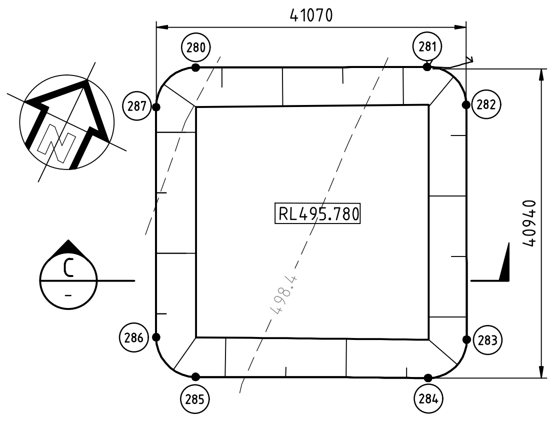
SEDIMENTATION POND 1

SCALE 1:1000



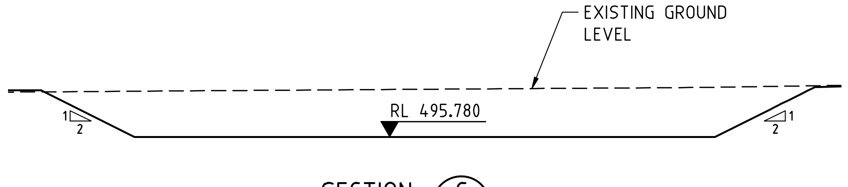
SEDIMENTATION POND 2

SCALE 1:500



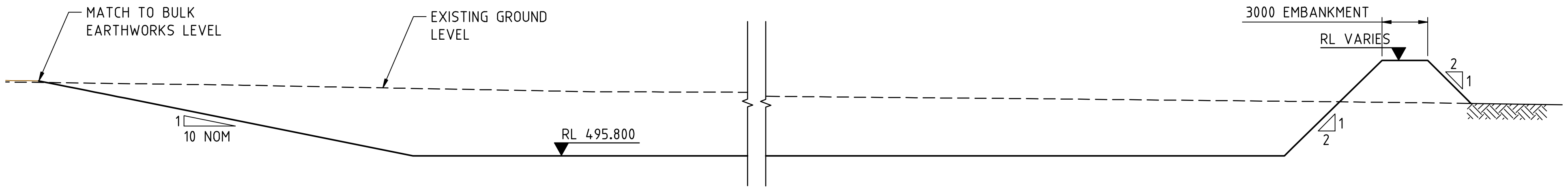
RECLAIM BRINE POND

SCALE 1:500

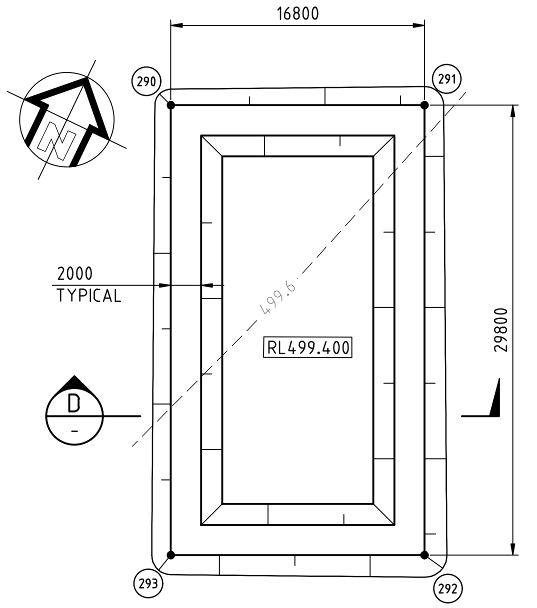


SECTION C
1:200

PONDS SETOUT			
SETOUT	EASTING	NORTHING	RL
250	225370.278	7038542.384	498.333
251	225378.490	7038569.259	499.507
252	225397.385	7038602.731	499.507
253	225378.525	7038639.737	500.381
254	225449.429	7038675.860	499.217
255	225503.363	7038570.035	498.870
256	225456.098	7038486.309	498.870
257	225433.304	7038474.668	498.870
258	225409.371	7038472.467	498.031
270	225199.521	7038943.435	499.548
271	225211.150	7038953.175	499.800
272	225189.359	7038995.944	499.800
273	225248.164	7039025.907	499.800
274	225273.479	7038963.203	498.336
275	225284.938	7038953.735	499.800
276	225234.685	7038928.130	499.800
277	225208.468	7038925.547	499.567
280	225341.084	7038412.955	498.403
281	225368.362	7038426.946	498.291
282	225375.255	7038424.824	498.281
283	225389.429	7038397.151	498.314
284	225387.174	7038390.302	498.320
285	225359.683	7038376.453	498.403
286	225352.635	7038378.749	498.425
287	225338.799	7038405.903	498.425
290	225336.775	7038686.544	500.100
291	225348.180	7038692.356	500.100
292	225359.893	7038669.368	500.100
293	225348.488	7038663.556	500.100

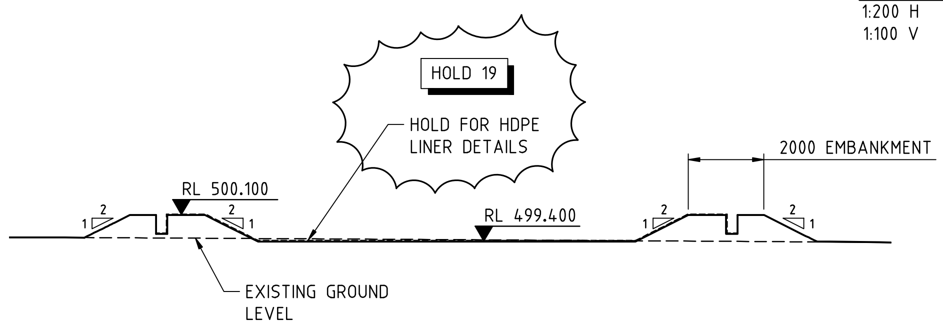


SECTION A
1:200 H
1:100 V

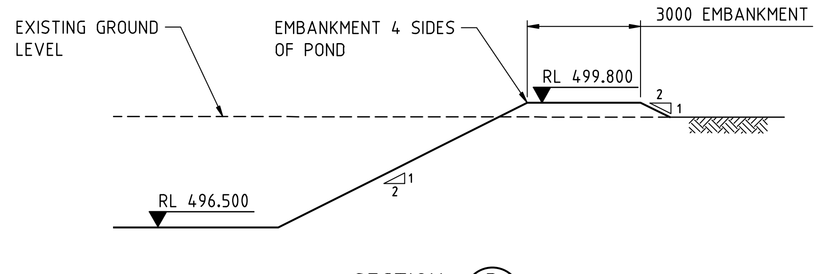


CONTAMINATED WATER COLLECTION POND

SCALE 1:200



SECTION D
1:100



SECTION B
1:100

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	TECH APP	PROJ APP
BULK EARTHWORKS PLAN	3000-CV-DRW-00005	0	23.12.19	APPROVED FOR CONSTRUCTION	RAK	TN	MT	RK

WHEN IN DOUBT-ASK
DO NOT SCALE

GR ENGINEERING SERVICES LTD
ENGINEERING CONSULTANTS AND CONTRACTORS
ACN 121 542 738
71 Daly Street, Ascot
Western Australia. 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001

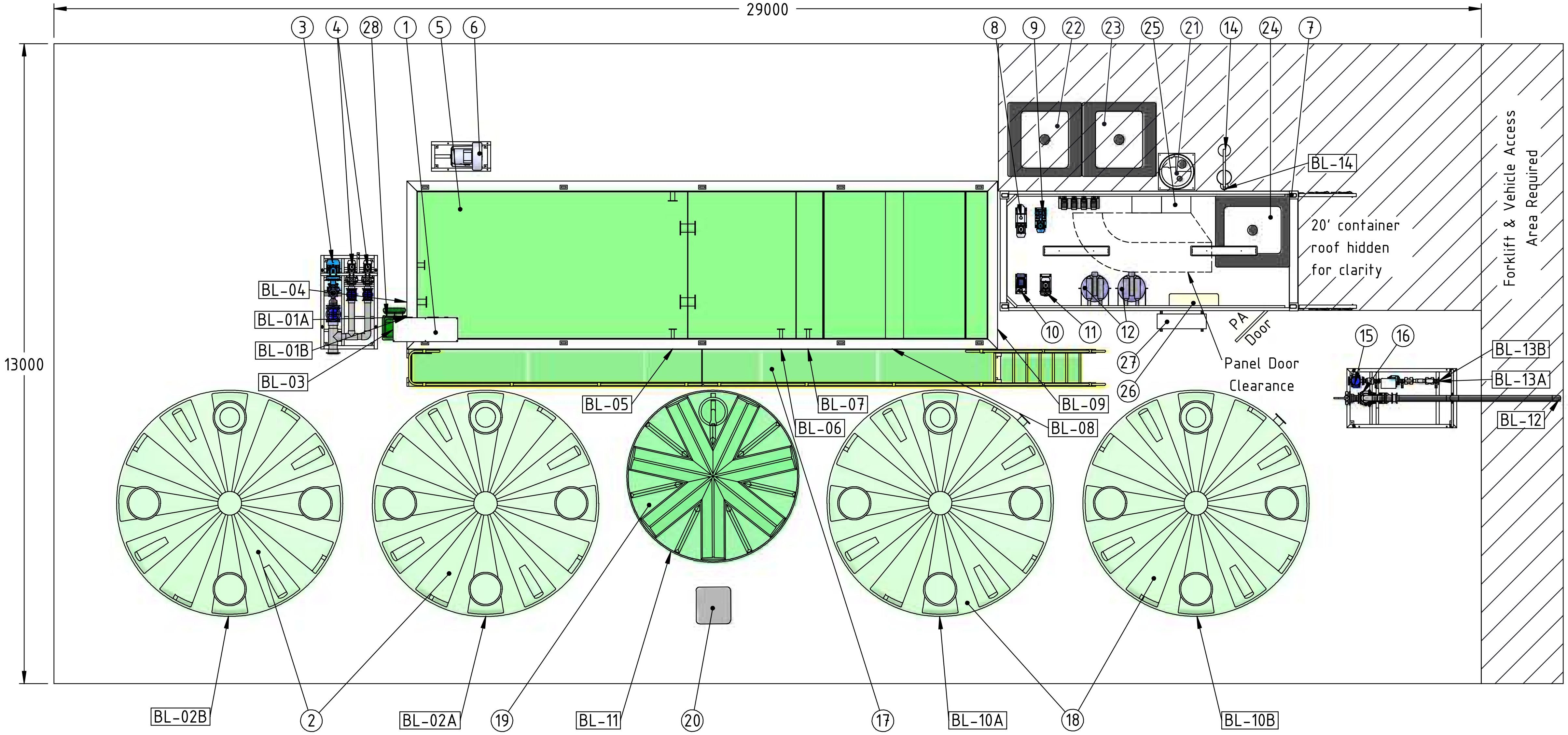
DRAWN	RAK	20.12.19
CHECKED	TN	20.12.19
DESIGNED	RS	20.12.19
TECH APP	MT	20.12.19
PROJ APP	RK	23.12.19
CLIENT APP	DF	23.12.19

SALT LAKE POTASH LIMITED
LAKE WAY PROJECT
PROCESS PLANT
PONDS - SETOUT PLANS AND SECTIONS

	SCALE	JOB No	DRG No	REV
A1	AS SHOWN	12560	LY-GRS-3000-CV-DRW-00007	0

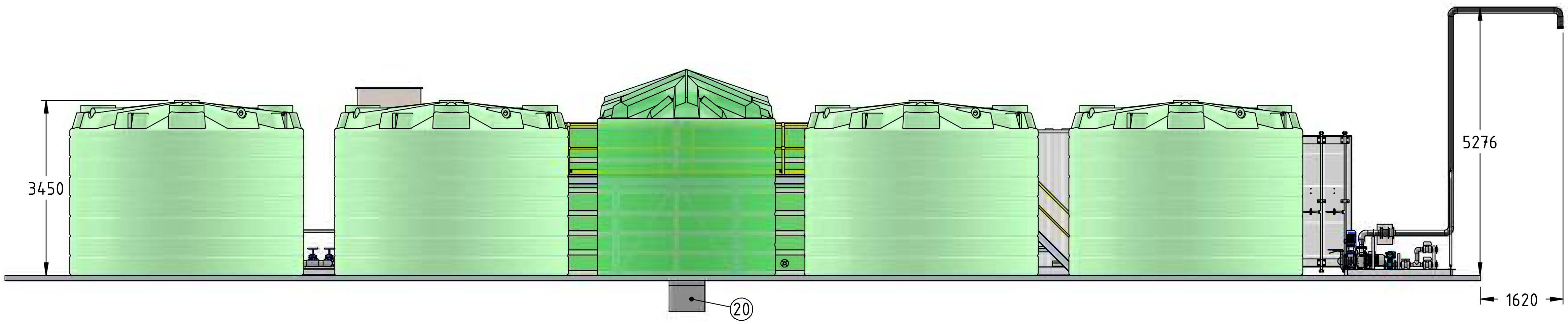
M:\12560 - Salt Lake\DRG\3000\LY-GRS-3000-CV-DRW-00007.dwg - 23/12/2019 - 9:53am - Raphael.Kozlowski

Item No.	Description	Qty.
1	Solids Inlet Bar Screen	1
2	50kL Balance Tank	2
3	Balance Tank Mixing Pump	1
4	Bireactor Feed Pump	2
5	Bioreactor Tank	1
6	Aeration Blower	1
7	20' ISO HC Shipping Container (Plant Room)	1
8	RAS/WAS Pump	1
9	MLR Pump	1
10	MMF Feed/Backwash Pump	1
11	Treated Effluent Recirculation Pump	1
12	Media Filter	2
13	LED Light	2
14	Safety Shower	1
15	Irrigation Pump	1
16	Standpipe Pump	1
17	Access Platform	1
18	50kL Treated Effluent Tank	2
19	30kL Sludge Tank	1
20	250L Supernatant Transfer Tank	1
21	200L MAK-CSPL Bunded Dosing Tank & Pump	1
22	1000L MAK-MFC6 Bunded Dosing Tank and Pump	1
23	1000L MAK-SCR Bunded Dosing Tank and Pump	1
24	1000L MAK-NACL Bunded IBC & Pump	1
25	MCC/Control Panel	1
26	Split System - Internal Wall Unit	1
27	Split System - AC Compressor	1
28	Solids Waste Bin (By Others)	1



Battery Limits

BL No.	Description	Connection
BL-01A	Raw Sewage Inlet	DN80 Table 'E' Flange
BL-01B	Raw Sewage Inlet	DN80 Table 'E' Flange
BL-02A	Balance Tank A Drain	DN100 Table 'E' Flange
BL-02B	Balance Tank B Drain	DN100 Table 'E' Flange
BL-03	Solids Waste Chute	DN100 Hose
BL-04	Bioreactor Overflow	DN100 Table 'E' Flange
BL-05	Aerobic Zone 1 Drain	DN50 Table 'E' Flange
BL-06	Anoxic Zone Drain	DN50 Table 'E' Flange
BL-07	Aerobic Zone 2 Drain	DN50 Table 'E' Flange
BL-08	Clarifier Drain	DN50 Table 'E' Flange
BL-09	Buffer Zone Drain	DN50 Table 'E' Flange
BL-10A	Treated Effluent Tank A Drain	DN80 Table 'E' Flange
BL-10B	Treated Effluent Tank B Drain	DN80 Table 'E' Flange
BL-11	Sludge Tank Trucked Waste Outlet	3" Camlock Connection
BL-12	Standpipe Discharge	DN100 Steel Pipe
BL-13A	Treated Effluent to Station A	DN50 Table 'E' Flange
BL-13B	Treated Effluent to Station B	DN50 Table 'E' Flange
BL-14	Safety Shower Potable Water Supply	1" BSP(M) Connection



Notes:
1. Dimensions are indicative only, to be confirmed during fabrication.

PO Box 2625 Malaga WA 6944
Telephone: +61 8 9249 8007
Email: info@makwater.com.au
Web: www.makwater.com.au

Reference Drawing No.	Reference Drawing Title	Rev	Date	Description	Notes	DRN	CHK	APP
MAK5686B-VJ-001->005	Piping & Instrumentation Diagram (P&ID)	A	3/12/2019	Issued for Internal Review	-	RG	PF	PF
		B	3/12/2019	Issued for Client Review	-	RG	PF	PF
		C	22/01/2020	Issued for Client Review	-	RG	LC	PF

Project No.: 5686B
Salt Lake Potash LTD.
MBBR+100-A-X-S-I-P-X STP
GA Drawing

All dimensions in mm | Scale: 1:100 | Sheet 1 of 2
Commercial in Confidence | Paper Size: A3
Client Document No.: LY-CP0090-4060-E24-00001
MAK Document No.: MAK5686B-VA-001
Rev: C

9. PROCESS DESIGN PARAMETERS

This section of the BoD provides a summary of the process design. For detail refer to the Lake Way Process Design Criteria, document LY-WOD-3000-PR-DCR-0001.

9.1 Introduction

Saltwater brine is extracted from the lake and is evaporated in a series of evaporation ponds to produce a harvest salt which is rich in potassium, namely Schoenite, Kainite and Carnallite.

The basic process flowsheet overview sketch is shown below.

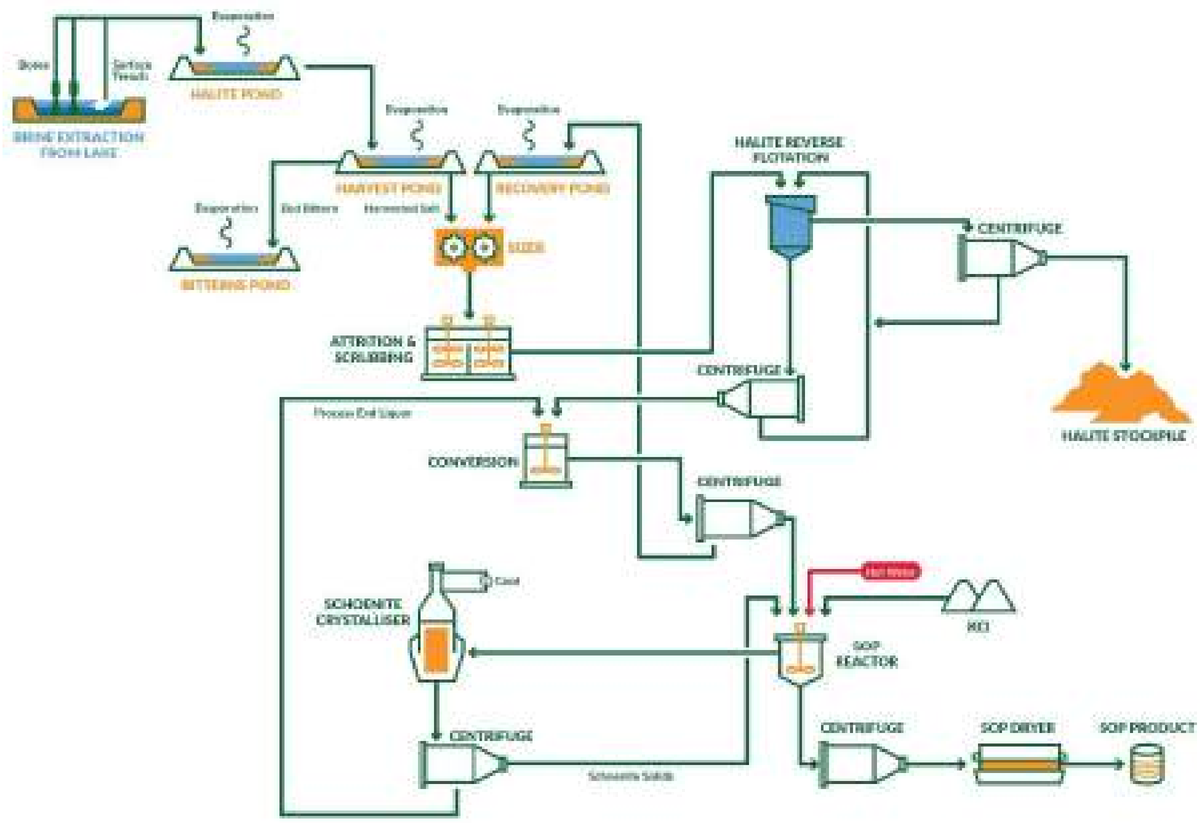


Figure 10: Lake Way Process Flowsheet Sketch

The purpose of this section is to describe the unit processes within the SOP process plant. Kainitic and Carnallitic salts are harvested and improved through a series of process plant unit operations to remove impurities and convert the potassium salts to Schoenite and finally to SOP.

The design of the process plant is predicated on it receiving a consistent blend of Harvest Salt from Kainite, Carnallite and Recovery Ponds.

Drained salts to be delivered to the plant feed preparation area by haul truck. The feed preparation area includes a receiving hopper with grizzly and transfer conveyor to harvest salt surge bin with apron feeder and roll type lump breaker.

The sized harvest salt blend will be fed to attrition/scrubbing banks to liberate waste halite salts before reverse froth flotation at ambient temperature. Flotation tails consisting of mostly halite are de-brined, via a centrifuge, and the resulting halite solids are deposited on halite waste stockpile, for subsequent disposal back on lake. A portion of the halite is split off the drag feeder to react with recovery brine in the bloedite reaction tank before being sent to the recovery pond system. Similarly, the reverse flotation concentrate, consisting mainly of potassium salts are debrined in the conversion centrifuge with the resulting brines from both the flotation concentrate and tails are recycled back to the flotation brine tank.

The concentrated potassium bearing salts from the flotation step are fed to conversion tanks where they are contacted with a high sulphate conversion brine and Kainite and Carnallite are turned into schoenite. The high sulphate brine used for schoenite conversion also dissolves residual halite and magnesium sulphate from flotation.

The schoenite concentrate, from conversion, is sent to the sodium chloride (NaCl) leach tank to dissolve any remaining halite, if necessary, with the addition of water. The schoenite slurry is then de-brined via a centrifuge with the schoenite cake being fed into the SOP crystalliser system. The spent conversion brine centrate is pumped, via the bloedite reaction tank, to the recovery pond located on-lake, to recover the dissolved potassium which is recycled back to the plant as feed salt.

The SOP crystalliser system involves many recycle streams. This stage of the process plant essentially combines schoenite, from the schoenite conversion step, water at the appropriate process conditions to convert the schoenite feed salt to high quality SOP. KCl may also be added during this reaction to increase SOP yield.

Sulphate rich brine from the SOP crystalliser overflow is cooled in a schoenite cooling crystalliser to produce secondary schoenite which is recycled to feed the SOP crystalliser. The remaining cooled crystalliser mother liquor is recycled back to the process for conversion of kainite salts to schoenite.

A slurry from the SOP leach tank, consisting of high-grade SOP in sulphate rich brine, will be dewatered and dried in direct gas-fired rotary dryer. SOP from the rotary dryer is sent to be stored, before being loaded into trucks for transport to market.

The plant layout maximises gravity feed opportunities and minimises pumping and material transfer requirements throughout the process flow. Allowance for site topography, cultural and climatic conditions, and proximity to the on-lake evaporation ponds were high priority constraints considered during the design process.

9.2 Process Plant Schedule

The process plant production is to be based upon the design capacity defined in the PDC, to agreed product specifications.

The plant K recovery shall meet the target criteria in Table 9-1.

Table 9-1: Plant Recovery

Description	Units	Value	Ref
Recovery Pond Recovery (K)	%	> 90	SO4
Flotation Recovery (K)	%	> 93	SO4
Overall Process Plant K Recovery	% (target)	> 85	SO4

The SOP product shall meet the criteria in Table 9-2.

Table 9-2: SOP Product Specification

Description	Units	Design	Comment
SOP (K_2SO_4) Product grade	%	> 98	> 96 Min
Potassium (K) grade	%	> 44	> 42 Min
K_2O grade	%	> 53	> 52 Min
Chloride, Cl-	%	< 0.1	< 0.5 Max
Magnesium, Mg	%	< 0.2	< 1.0 Max
Moisture	%	< 1.0	< 1.0 Max
Insolubles	%	< 0.1	< 1.0 Max
Particle Size	Mm	0.1 – 0.5	95% retained

9.3 Harvest Salts

The design of the process plant is predicated on it receiving a blend of Harvest Salt from the Kainite and Carnallite ponds and Recovered Salts from the Recovery Pond. The design composition is summarised in Table 9-3.

Table 9-3: Harvest Salt Composition

Composition	UNIT	Kainite POND	Carnallite POND	Average fresh feed salt
Halite (NaCl)	% w/w	41.5	14.8	40.2
Kainite (KCl.MgSO4.3H2O)	% w/w	13.1	21.1	13.5
Leonite (K2SO4.MgSO4.4H2O)	% w/w	11.7	-	11.1

Composition	UNIT	Kainite POND	Carnallite POND	Average fresh feed salt
Schoenite ($K_2SO_4.MgSO_4.6H_2O$)	% w/w	11.3	-	10.7
Epsomite ($MgSO_4.x7H_2O$)	% w/w	21.7	-	20.6
Keiserite ($MgSO_4.xH_2O$)	% w/w	-	30.9	1.6
Carnallite ($KCl.MgCl_2.6H_2O$)	% w/w	-	29.6	1.5
Other Salts	% w/w	1.7	3.6	0.8
Moisture	% w/w			10
%K (dry basis)	% w/w			6.7
Estimated Feed Salts (wet)	Mtpa	1.607	0.088	1.695

9.4 Materials Handling Data

Table 9-4: Salt Properties

Description	Units		
Salt specific gravity (S.G.)	t/m3	2.1	
		Uncompacted	Compacted
Bulk density (Harvest Salt ROM)	t/m3	1.1	1.4
Bulk density SOP	t/m3	1.3	1.6
Bulk density KCl	t/m3	1.2	
Angle of repose unadjusted for conveying			
- ROM and waste salt	degrees	34	
- Lump and fines product, KCl	degrees	30	
Conveyor surcharge angle	degrees	20	
Conveyor surcharge angle - fines	degrees	15	
Sizings			
ROM Feed - Top size	mm	400	
ROM Feed – Post Grizzly	mm	80	

References:

Jenike & Johanson – Harvest Salt Material Testwork Report (Document No. LY-GRS-3010-PR-RPT-0001

Jenike & Johanson – SOP Material Testwork Report (Document No. LY-GRS-3080-PR-RPT-00001)

9.5 Process Description

The Process Plant operations include feed sizing, flotation, conversion, crystallisation, drying and storage & loadout processes.

The following detailed process description sections relate to the Process Plant. These are referenced by the relevant WBS sub area coding for the operation. Refer to Appendix C for the WBS coding.

9.5.1 Area 3010 – Feed Preparation

Salts from the Kainite ponds, and those from the Carnallite and Recovery ponds, will be stockpiled on playa prior to haulage as a blended feed to the process plant.

The blended feed salt will be transported from the playa storage by haul trucks. At the Feed Prep area, a FEL to dump the feed salt into a receiving hopper fitted with a grizzly which is located above the harvest transfer conveyor. Provision shall be allowed for short term storage of harvest salt by the receiving hopper.

Salt is drawn out of the receiving hopper via transfer conveyor to the harvest salt surge bin. The bin has a small volume and thus retention time to limit the potential for plugging. The function of the harvest salt surge bin being to provide a controlled, measured rate via a volumetric feeder to the process plant. The attrition circuit drag feeder draws from the bin, at a controlled rate and salt is delivered to a roll type lump breaker which breaks up lumps in the feed. The lump breaker product is discharged onto the harvest salt transfer conveyor 2 which then directs feed to the Attrition Scrubbing Feed Tank.

The area contains a reclaim brine pond and reclaim brine pumps to ensure water or brine run-off containment from the Feed Preparation area.

9.5.2 Area 3020 – Attrition/Flotation

Crushed and blended harvest salt is transferred from the feed preparation area and fed to the Attrition Scrubbing Feed Tank into which brine from the Flotation Brine Tank is used to slurry the solids. A solids density of 70 % w/w is targeted for attritioning.

The attrition scrubbing feed tank slurry gravitates to a bank of attrition-scrubbing cells which are fitted with high intensity agitators to break down the salt to smaller particles and provide a scrubbing action. The main function of the attrition-scrubbers is to break down the smaller lumps that might have survived the lump breaker and to disaggregate the individual salt crystals. In addition, the scrubbing action helps to physically liberate the individual halite salt crystals from the potassium salts and clean the salt surfaces to aid flotation.

The attritioned salt slurry gravitates from the attrition scrubbing cells to a slurry feed box where it is further diluted with flotation brine to 45-55% solids.

The diluted slurry is pumped via sizing screen feed pumps to Derrick type sizing screens. Oversize reports to in a cage mill for size reduction with discharge recycled back to the attrition scrubbing feed tank, while screen undersize reports to the Flotation Conditioning Tanks.

The attritioned salt slurry is conditioned for flotation by the addition of flotation collector. The flotation collector is prepared in reagent mixing tank, then decants to a reagent holding tank and metered to the flotation conditioning tanks. The pH is adjusted to around 4.5 by the addition of sulphuric acid. Following the conditioning step, flotation brine is used to dilute the slurry to the target solids concentration before entering the rougher column flotation unit.

A reverse flotation configuration is used employing self-aspirated Jameson cell rougher column whereby waste halite is floated and the valuable K salts report to the flotation underflow. The floated waste halite is referred to as tails and the underflow (potassium products) is referred to as concentrate.

The rougher concentrate (potassium rich) is pumped to a scavenger column to remove any remaining NaCl crystals. The scavenger flotation concentrate is sent to a bank of hydro-cyclones to thicken the slurry, while the overflow from the cyclones report to a thickener to capture fines. The underflow from both the hydro-cyclones and the thickener are combined and the densified conversion feed slurry reports to the Conversion Feed Hopper then pumped to the Conversion centrifuge. The conversion centrifuge filter cake reports to the schoenite conversion reaction tanks, while the clarified brine from the thickener overflow and the conversion centrifuge centrate are recycled to the flotation brine tank.

The flotation tails (halite) from the Rougher and Scavenger flotation are analysed for residual potassium before passing to the Halite Tails Centrifuge Feed Tank, which is agitated. The slurry from the halite centrifuge feed tank gravitates to the halite centrifuge and the dry cake discharges onto a drag feeder where a portion of the halite solids report to Bloedite reaction tank via Bloedite Reaction Tank Feed Conveyor. The majority of the halite tails are transferred to the Salt tailings stockpile via the Halite Tails Conveyor. Stacked halite is then loaded by FEL onto trucks for disposal back on the playa.

The halite centrate is collected and recirculated back to the Flotation Brine Tank, by the halite centrate pumps.

The attritioning and flotation area contains a sump pump to ensure water containment from the Flotation area. Additionally, the salt tailings pile area drains to a reclaim brine pond which has a pump to ensure containment of brine from the tailings area.

9.5.3 Area 3030 – Conversion

Filter cake from the Conversion Centrifuge is fed to two Conversion Tanks in series via a feed launder and is reacted with a sulphate rich conversion brine from the Conversion Brine Tank to convert the harvest salts to schoenite.

The harvest salts comprise a mixture of potassium containing double salts, predominantly schoenite ($K_2SO_4.MgSO_4.6H_2O$), kainite ($KCl.MgSO_4.3H_2O$) and carnallite ($KCl.MgCl_2.6H_2O$) which all have to be converted to schoenite prior to SOP production. The sulphate-rich conversion brine (from the crystalliser mother liquor) is used for this purpose. By contacting the conversion brine with the harvest salt, the following reactions ensues:

Kainite decomposition:

$$2KCl.MgSO_4.3H_2O(s) + MgSO_4(aq) \rightarrow K_2SO_4.MgSO_4.6H_2O(s) + MgCl_2(aq)$$

Carnallite decomposition:

$$2KCl.MgCl_2.6H_2O(s) + 2MgSO_4(aq) \rightarrow K_2SO_4.MgSO_4.6H_2O(s) + 2MgCl_2(aq)$$

The converted schoenite salt slurry from the conversion tanks gravitates to the NaCl leach tank to dissolve any residual halite, if necessary, post flotation and conversion reactions, with the addition of water. The Schoenite slurry is required to be thickened via a set of hydrocyclones, while the overflow from the cyclones report to a thickener to capture fines. The underflow from both the hydro-cyclones and the thickener are combined and the densified slurry is then de-brined by the Primary Schoenite centrifuge. The primary centrifuge filter cake is fed into SOP Crystalliser by the SOP Feeder.

Following the conversion reactions above, the conversion brine is 'spent'. The spent conversion brine is saturated in schoenite but also contains other impurities therefore reports to the Bloedite Reaction Tank. The Bloedite Reaction Tank combines a portion of the waste Halite tails salt and spent conversion brine in a mix tank reactor to promote formation of Bloedite in a lean brine solution. The brine is then transferred to Recovery Pond by the Recovery Pond Feed Pumps.

The area contains a sump and sump pump to ensure water containment from the Conversion area.

9.5.4 Area 3040 – Crystallisation

Note: The harvest salt from Lake Way carries a stoichiometric excess of sulphate with respect to potassium for the production of Potassium Sulphate. KCl may be added as a reagent to the crystallisation circuit to take advantage of the excess sulphate which can be converted to K_2SO_4. The design therefore allows for the strategic addition of KCl. The plant will be designed with two operating modes; with or without KCl addition. All equipment required to operate without KCl (such as the schoenite cooling crystalliser, chillers and water heaters etc) will be included in the base design for the plant.

Schoenite filter cake is fed to an open top, atmospheric SOP crystalliser by a feeder, where the metathesis reaction or double replacement reaction occurs that converts schoenite to SOP. Heated raw water is added to the SOP centrate tank (for SOP fines destruction) and returned to the SOP Crystalliser, to allow for the metathesis reaction to proceed. The crystalliser operates at elevated temperatures (nominally 50 ^{O}C) to maximise SOP yield. A slurry from the SOP Crystalliser flows to the SOP Leach Tank where the remaining water is added to complete the reaction and purify the SOP product.

The SOP metathesis reaction where schoenite is converted to SOP may be expressed as a simplified reaction as;

$$K_2SO_4.MgSO_4.6H_2O(s) + Water + Heat \rightarrow K_2SO_4(s) + MgSO_4\ (aq) + Water$$

When KCl is added to the crystalliser it is added to the SOP centrate tank where it is dissolved and added as a solution.

The KCl is fed from the KCl loading area to the SOP centrate tank for pre-mixing with the heated raw water prior to delivery to SOP crystalliser. Adding KCl increases the concentration of potassium ions in the SOP crystalliser and reacts with the excess of sulphate ions to increase the overall SOP production yield.

In the situation where KCl is added to the SOP crystalliser reaction, a simplified equation may be expressed as;

$$2K_2SO_4.MgSO_4.6H_2O(s) + 2KCl(aq) + Water \rightarrow 3K_2SO_4(s) + 2MgCl(aq) + Water$$

The SOP slurry from the SOP leach tank is pumped to the SOP Centrifuge where residual mother liquor is removed. The centrate reports to the SOP Centrate tank where water is added to dissolve any SOP fines (and KCl if added) and is returned to the SOP Crystalliser. The SOP centrifuge cake (product) discharges to the product drying area.

Due to the materials being handled are soluble salts, only a sparingly amount of water is added for the metathesis reaction to occur, however a significant portion of the schoenite still dissolves which results in crystalliser Mother Liquor which is saturated in potassium. The SOP crystalliser is designed with draft tubes that ensures the slurry discharges from the bottom and a clear, clarified warm mother liquor reports to the overflow. The SOP crystalliser overflow gravitates to the SOP Liquor Tank is pumped to the Schoenite Crystalliser and cooled via a chiller circuit and barometric condenser to recover secondary schoenite. The secondary schoenite slurry is thickened in a head tank and settler tank and de-brined via the Secondary Schoenite Centrifuge.

The secondary schoenite centrifuge cake is recycled to the SOP Crystalliser and the cooled centrate (mother liquor) reports to the Conversion Brine tank and used in the Schoenite Conversion reaction.

The SOP Crystalliser and Schoenite Crystallisers are complex vendor packages and contain many discrete processes and recycle streams to maximise product quality and recovery.

9.5.5 Area 3050 – Drying

The SOP filter cake from the SOP Centrifuges in the crystallisation area is conveyed via the SOP Product Dryer Feed Conveyor to be dried in a direct gas-fired rotary dryer. The dryer solids report to SOP Product Conveyor for load out. Dryer off gas reports to the dust capturing cyclones and the cyclone overflow reports to a dust collector baghouse. The cyclone underflow with most of the larger off-gas dust report via the SOP product conveyor to the Product storage and loadout area.

The dust collector baghouse dust discharges via the dust collection mix tank for reuse in the SOP centrate tank. The dedusted gases are extracted by the extraction fan and discharge to atmosphere. Emission specifications will determine the dust collection configuration.

The SOP product conveyor is covered, to protect the product from rain and dust minimisation.

9.5.6 Area 3060 - Granulation (Compaction)

The plant layout will include provision for a future compaction plant. The compaction plant will be typical for the Potash industry and produce compacted granules of typical size 2-4 mm.

9.5.7 Area 3070 - KCl Storage and Handling

The design will include provision for receiving and handling KCl, with loadout to process plant and minimising rehandling. KCl will be delivered as bulk product via side tipping trailers. The KCl is metered from the KCl receiving hopper to the SOP centrate tank via the KCl addition conveyor, where it is dissolved in water and adder to the process (refer to crystalliser section).

The KCl conveyors and feeders are covered to prevent rain ingress and to minimise dust.

The minimum specification for KCl to be added to the process is provided in Table 9-5.

Table 9-5: KCl Reagent Feed Specification

Description	Units	Value
Grade	% K2O	>58%
Sodium (Na)	% Na	< 1%
Magnesium (Mg)	%Mg	< 0.5
Insolubles	%	< 0.1%
Moisture	%	Any
Colour	-	White
Size	mm	Any
Granular / Powder		Powder preferred
Anticaking		Allowed
Dedusting		None*
Bulk Density	t/m^3	1.2
Angle of Repose		33°

*Dedusting not desired due to potential interference with the process, however may be considered pending product testing.

9.5.8 Area 3080 – Product Storage and Loadout

Dried SOP from the Drying Area to report to an enclosed storage via a stacking conveyor. Product storage to be nominal 2 days plant capacity. Product to be cooled prior to transfer to storage.

A front-end-loader will support the handling of the SOP and loadout to trucks for transport on road to port.

9.5.9 Area 3110 – Reagents

The plant reagents include:

- Flotation collector such as Armoflote 619 supplied by AkzoNobel in 800kg IBC. The area contains a collector storage tank. Dosing of collector is by dosing pump.
- Sulphuric acid (e.g. 98% H_2SO_4) supplied in 2000kg IBC for flotation pH adjustment and collector activation. The area contains a sulphuric acid storage tank. Dosing of sulphuric acid to the flotation circuit is via sulphuric acid dosing pumps
- Chemicals to clean the reverse osmosis (RO) membranes used for plant water treatment in the 3120 Utilities and Services area.
- Anticaking agents (if required) are added following Drying and prior to the Product Storage, via a ribbon mixer, to prevent product clumping.

The reagent storage area provides shaded storage for chemicals for weather and sun protection and is well ventilated. The storage area contains appropriate segregation for non-compatible chemicals. The area contains a reagents area sump.

The area contains a reagents area safety shower.

9.5.10 Area 3120 Utilities and Services Area

The Utilities and Services area contains the water systems and compressed air.

The water systems include raw water pond and associated pumps, plant raw water tank and pumps, plus potable water systems including safety showers.

The compressed air system consists of a master and slave compressor arrangement, air dryer, air filter to provide high quality instrument air to both the instrument air and plant air receivers.

9.5.11 Area 3130 Solution Management

The Solutions Management area contains major process tanks that are fundamental to the process. These include the Flotation Brine tank, the Conversion Brine tank and associated pumps and piping. Brine is constantly recycled within the plant via these tanks to maximise potassium recovery in the process plant.

Excess brine is generated during the process (due to the addition of water in the SOP Crystalliser) which dissolves some of the salt being processed. This excess brine reports to the recovery pond.

A Mother Liquor Dump Tank and associated pump and piping will also be provided, which is capable of holding the volume from the largest of the crystalliser vessels, to allow the system to be drained for scheduled maintenance without having to dispose of the valuable brine.

The Solution Management area contains the following equipment:

- Flotation brine pumps and flotation brine tank
- Recovery Pond feed pumps and brine transfer pipeline, discharging to recovery pond
- Conversion brine pumps and Conversion brine tank
- Mother Liquor Dump tank and associated pumps

9.5.12 Recovery Pond

The Recovery Pond receives excess flotation brine from the plant. A recovery pond is included as part of the process plant system and produces similar types of harvest salt to the kainite pond.

Mass flowrate of brine and temperature is given by the Study mass balance estimate, refer below:

Table 9-6: Recovery Pond Chemistry

H_2O % w/w	Cl % w/w	K % w/w	Mg % w/w	Na % w/w	SO_4 % w/w	Brine Output Temp °C
71	4.4	2.4	4.3	1.2	16.7	25

Source: WOOD mass balance, No KCl case; ref 203998-3000-F-101

The design of the recovery pond will allow for operation and harvesting in a similar fashion to that of the kainite pond, with the following criteria:

- Feed flowrate to the recovery pond will be a constant flow from the process plant and therefore pond system will be designed to handle the oversupply of brine in the low evaporation periods with a preconcentration/surge pond;
- The pond system to be designed to maintain 30cm to 50cm brine depth;
- There will be parallel trains of recovery ponds to allow for harvesting;
- Each recovery pond train will contain baffles to promote the separation of undesirable waste salts from potassium bearing salts, and to maximise evaporation rate and minimise evaporation area;

- The brine exiting the recovery pond shall be devoid of economical K and report to the main pond system, namely Bitterns pond.

9.6 Water

Water is an essential reagent in the process plant for the operation of the SOP crystalliser. Water is added to the crystalliser in controlled amounts to purify the SOP crystals and dissolving Mg and residual NaCl from the SOP crystalliser feed salt. The amount of water required by the process plant is dictated by the amount of Mg that is required to be removed by the circuit.

The estimated total raw water requirement for the Project, including process and utility water, is summarised in Table 9-7.

Table 9-7: Annualised Water Usage

Area	Type	Use	Usage GL/a	Note
Process Plant	Raw	Raw Water to Process Plant incl Crystalliser	1.72	Calculated, incl. 8% contingency
Ponds and Plant	Raw	General Flushing, Washing	0.04	Calculated
Ponds and Plant	Raw	Dust Suppression	0.04	Estimated; 5 Water carts/day
Plant/Camp	Raw	Potable Water Treatment for Plant/Camp Potable water, Safety Showers	0.03	Calculated
Total			1.83	

Note: Refer to section 12.4 for water quality information.

9.7 Sampling

Sampling and on-line analysis is required to continuously monitor the plant performance (recovery). The online analysers need to be calibrated regularly by sampling.

All sampling will be conducted manually with the equipment designed with safe access points and sampling tools and techniques to allow minimal or no disruption to the process. All samples will report to the plant laboratory for processing and analysis (refer to section 12.10).

The general sampling philosophy and routine plant sampling is described below.

- Plant Feed (Salt)
  - One sample per shift made from 2-hr composites. The sample will be cut at the end of the 3010-FE-002 Feeder making sure the whole width of the belt is cut.
  - The sample will be assayed in the ICP for all ions and a fraction of the sample will be checked for PSD.

- Crystalliser Feed (Salt)
  - One sample per shift made from 2-hr composites of the debrined flotation product feeding the crystalliser. The sample will be taken from the belt filter (or solids conveyor if centrifuge is employed), making sure the whole width of the belt is cut.
  - The sample will be assayed in the ICP for all ions.
- Plant (Salt) Tails
  - One sample per shift made from 2-hr composites. The sample will be cut at the end of the Halite Belt Filter making sure the whole width of the belt is cut.
  - The sample will be assayed in the ICP for all ions.
  - Online analysis of float tails from both rougher and scavenger flotation to measure potassium mis-reporting to tails.
- Crystalliser ML (brine)
  - Samples will be taken from the Crystalliser ML brine (sample location TBD based on layout and accessibility) every two hours. Each sample will be ICP'd for all ions.
  - Important: Mg and Na ions are required to be reported to operations (control room) as a matter of priority to allow for necessary plant operational control adjustments.
- SOP Product
  - One sample per shift made from 2-hr composites. The sample will be cut at the end of the SOP product conveyor (TBC depending on layout) making sure the whole width of the belt is cut.
  - The sample will be assayed in the ICP for all ions and a fraction of the sample will be check for PSD.

9.8 Process Waste Outputs

The following sections provide a summary of the salt waste from the process plant.

9.8.1 Solid Waste (Salt)

The main waste stream from the process plant is halite salt which is removed from the feed salt via flotation. The waste halite will be dewatered and conveyed to a waste halite stockpile in the vicinity of the process plant, via a fixed halite tails stacker.

The halite reporting to the waste halite stockpile is expected to be as much as 40% of the fresh harvest salts. The waste salt stockpile capacity, adjacent the process plant, has a nominal capacity of 5,000t. At capacity, the diameter of the waste stockpile is 40 metres, with a conical stockpile height of approx. 13m.

Stacked halite will be loaded by FEL onto trucks for disposal back on the playa.

The waste halite stockpile will have a brine/run-off collection area to manage excess brine as it drains out of the wet halite stockpile.

Waste salts generated in the recovery pond (namely magnesium sulphate salts, or bloedite) are periodically harvested as a potential co-product. Harvesting of magnesium sulphate (approximately 360 ktpa) is done similar to halite ponds of the main pond system. Waste salts from the pond network are stockpiled in a separate area on lake for disposal or reclaim for reprocessing as appropriate.

9.8.2 Liquid Waste (Bitterns)

The process plant contains a number of recycle streams in an effort to recover all available potassium and sulphate from the resource. Due to the addition of water in the crystalliser an excess of salty brine is generated. This represents the liquid waste from the plant.

The excess plant brine reports to a recovery pond, to recover potassium and sulphate as salt, then remaining brine (bitterns), which is a concentrated MgCl2 solution, will be transferred to the Bitterns Pond which is constructed on the lake and will be part of the larger on-lake evaporation pond system.

The On-Lake Bitterns pond, similar to halite pond construction, will be unlined and designed to hold the bitterns brine so it can be returned to the lake playa at a controlled rate.