Amendment Report

Application for Licence Amendment

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L9208/2019/1
Licence Holder	Salt Lake Potash Limited
ACN	117 085 748
File Number	DER2019/000338
Premises	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
Date of Report	17/11/2020
Decision	Revised licence granted

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A/MANAGER, RESOURCE INDUSTRIES REGULATORY SERVICES
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Table of Contents

1. Decision summary

Licence L9208/2019/1 is held by Salt Lake Potash Limited (Licence Holder) for the Lake Way Potash Project (the Premises), located off the Goldfields Highway, Wiluna, Western Australia.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the operation of the Premises. As a result of this assessment, Revised Licence L9208/2019/1 has been granted.

The Revised Licence has been granted in a new format with existing conditions being transferred, but not reassessed, to the new format.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Amendment summary

On 27 May 2020, the Licence Holder submitted an application to the department to amend Licence L9208/2019/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The amendment application is to authorise the operation of two recently constructed evaporation ponds for the Licence Holder's Lake Way Sulfate of Potash (SOP) Demonstration Project.

The ponds were constructed under works approval W6282/2019/1 (held by Piper Preston Pty Ltd), and were previously referred to in this instrument as Halite ponds 3 & 4. They are now referred to as 'Pond 2'. These ponds are located on the Lake Way playa and will serve as a series of evaporation ponds to induce the sequential precipitation of salts from brine. The majority of brine will be sourced from a trench network that has been constructed and approved under the *Mining Act 1978*. Some water will also be sourced from exploration activities associated with the pump-testing of paleochannel bores.

The salts will be harvested and treated in a 'demonstration scale' processing plant to produce SOP, as part of determining the viability of a larger commercial scale operation. The demonstration scale processing plant is yet to be constructed (under W6282/2019/1) and as a result the ponds will be utilised to capture and store raw 'feed' material ahead of the construction of the processing plant.

The ponds have been commissioned and an Environmental Commissioning Report has been submitted (in accordance with condition 5 of W6282/2019/1) as part of the licence amendment application. No concerns were identified during the commissioning phase for Pond 2.

Figure 1 outlines the location of the ponds that have been constructed (shaded in blue) and the location of the remaining ponds to be constructed under W6282/2019/1 (unshaded). Pond 1 is already operated under licence L9208/2019/1.

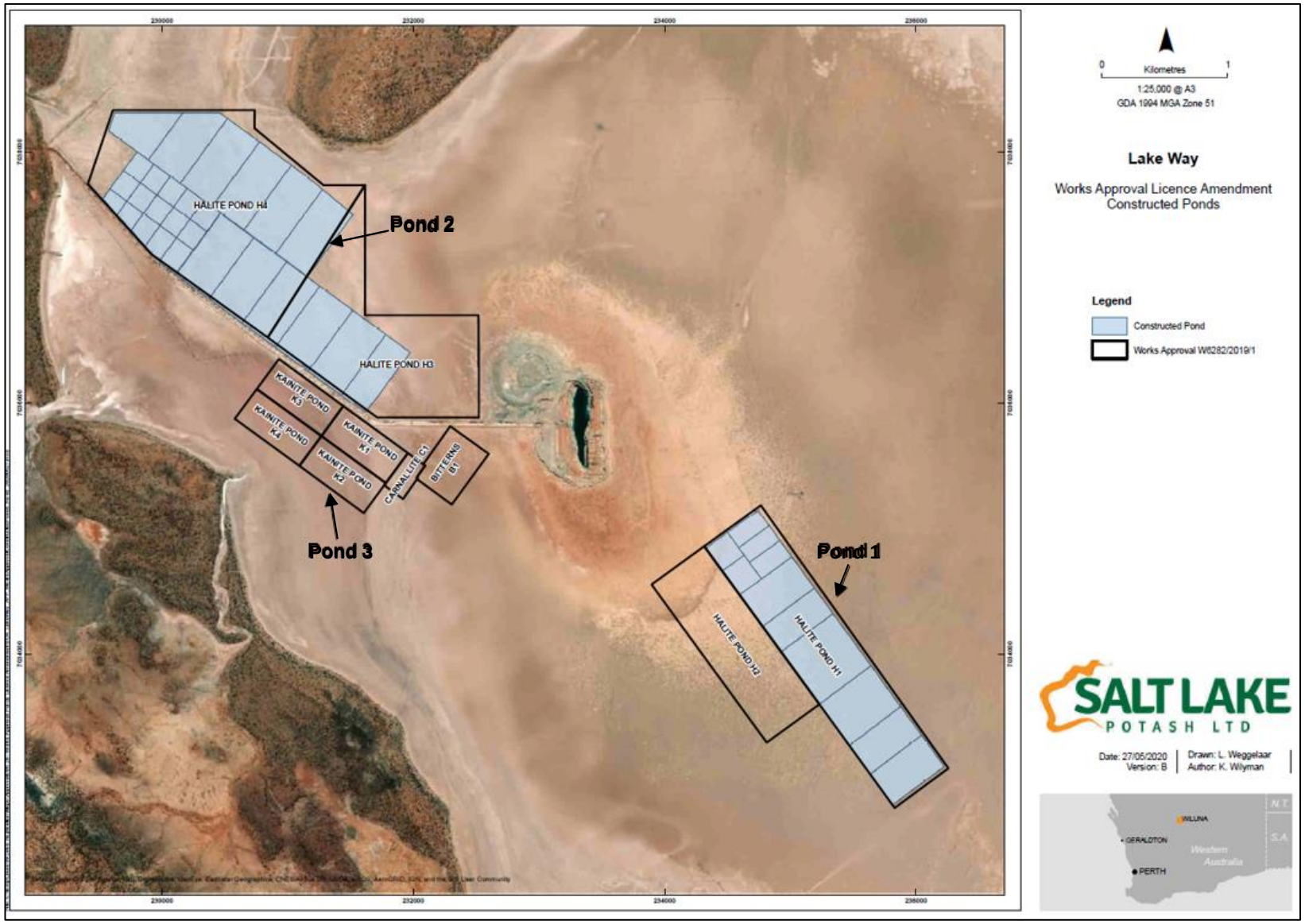

Figure 1: Layout of constructed ponds

2.2.1 Works Approval W6282/2019/1

In October 2019, works approval W6282/2019/1 was granted for the construction of a series of evaporation ponds on the Lake Way playa, to produce brine as feed for a proposed SOP demonstration plant. Five types of ponds would be constructed 'on-lake' and cover a disturbance footprint of around 700 hectares: four halite ponds (including a temporary pond constructed under a previous works approval (W6206/2018/1), four kainite ponds, a carnallite pond and a bitterns pond. The purpose of these ponds is to produce harvest salts as feed for a processing plant. W6282/2019/1 was amended on the 10 March 2020 to also authorise construction of a demonstration scale processing facility (approved throughput of 50,000tpa).

Construction of the ponds commenced in October 2019 and a partial compliance report was submitted to DWER in June 2020 to certify the constructed works for halite ponds 3 & 4 (now collectively referred to as 'Pond 2'; see Table 1), which were completed in February 2020.

The compliance report indicates that following issuing of the works approval, the licence holder is proposing a staged construction approach, whereby only Pond 2 will be constructed at this stage and operated together with the existing 'Temporary Holding Pond/ Halite pond 2' under L9208/2019/1 (now referred to 'Pond 1'; see Table 1). Construction has been deferred for the four kainite ponds (now referred to as 'Pond 3'), and the carnallite pond and bitterns pond will be incorporated into Pond 2, when required.

Several other changes have been made by the licence holder following issue of the works approval in relation to the configuration of internal walls within the external perimeter of the ponds, to reflect further modifications to the salt production process (see below). The licence holder has suggested that to accommodate potential future changes, the licence should reference pond 'envelopes', instead of each individual internal cell within a pond. This ensures consistency with the Department of Mines, Industry Regulation and Safety (DMIRS) Mining Proposal for the project and will provide flexibility to allow further re-configuration of the internal cells as operations require. Construction requirements of the basal layers and external walls of each pond will remain unchanged, consistent with the design specifications in the works approval.

A summary of the updated pond classification and construction status is provided below in Table 1.

Table 1: Pond classification and construction status

Works approval reference	Mining proposal reference and reference used in this Licence amendment	Status
Halite pond H1 (Temporary Holding Pond)	Pond 1	Constructed and operated under L9208/2019/1 (referred to as Temporary Holding Pond in licence).
Halite pond H2	N/A	Construction deferred.
Halite ponds H3 & H4	Pond 2	Construction partially complete (12 halite cells and 3 kainite cells constructed to date). Partial compliance document submitted as part of this licence amendment. Carnallite and bitterns ponds will be incorporated into Pond 2 at a later stage. Subject of this licence amendment.
Kainite ponds K1 – K4	Pond 3	Construction deferred.
Carnallite pond C1	N/A	Construction deferred.

		Will be incorporated into Pond 2 when required.
Bitterns pond B1	N/A	Construction deferred. Will be incorporated into Pond 2 when required.

The construction completion report, submitted with the compliance report, also indicates a number of departures from design that were current at the time of the original works approval, including:

- H3 and H4 (Pond 2) has been split into multiple cells with some halite cells now earmarked to be kainite cells;
- adoption of HDPE-lined earthen embankments for the majority of the product (kainite) ponds, rather than the sheet pile option;
- a reduction in the sheet pile embedment depth of 2 m, based on updated seepage analyses that indicated the relationship of the sheet pile toe to the geology was more important than the absolute depth in reducing seepage;
- actual wall heights varying between 1.5 m and 1.9 m based on the ground surface elevation;
- deferment of constructing the carnallite pond. The former internal boundaries between the halite/carnallite and kainite/carnallite walls have now become external walls;
- construction of baffles within the halite ponds at a steeper slope angle, with a wider embankment crest. The potential consequence is the side slopes may slump from their current angle to a slope closer to the design angle, which the constructing engineer did not consider would affect the function of the baffles;
- traffic berms on the embankment crest of the filled ponds have not been constructed;
- embankment fill was not moisture conditioned prior to placement. This may cause some settlement upon saturation, requiring top-up to maintain constructed levels;
- some seepage has been observed in some sheet pile clutches, where the gasket does not appear to seal the clutch; and
- use of surplus sheet piles (horizontally placed) as baffles for the kainite ponds, instead of the planned earthen baffles.

The construction completion report has been referred to DMIRS for a geotechnical review. Comments provided indicate that DMIRS have no concerns regarding the structural stability of the ponds (refer section 4).

The departures listed above are not considered to have increased the risk to public health, amenity or the environment and as a result, DWER considers that all aspects of the Works Approval in relation to Halite ponds 3 & 4 (now referred to as Pond 2) have been complied with.

2.3 Part IV of the EP Act

The Licence Holder referred the Lake Way SOP Demonstration Plant proposal (which includes Pond 2) to the Environmental Protection Authority (EPA) on 8 March 2019 under Section 38 of the *Environmental Protection Act 1986* (EP Act). In considering the potential direct and indirect impacts of the Demonstration Plant proposal on Flora and Vegetation, Terrestrial Fauna, Subterranean Fauna and Social Surroundings, the EPA had regard to the following:

- the high environmental values but the relatively short duration of planned activities;
- there being existing disturbance and infrastructure on and off-playa at Lake Way due to historical mining activities that are being utilised for the Demonstration Plant to reduce the impacts of the proposal;
- the mitigation strategies proposed to avoid and minimise impacts, for example, location of on-playa infrastructure to avoid direct impacts on *Tecticornia* dominated vegetation;

- monitoring of hydrological regimes and implementation of adaptive management measures through an Environmental Monitoring and Management Plan should the monitoring indicate that responses are required to minimise impacts to *Tecticornia* vegetation;
- use of dewatering from existing mine pits as the water source for the proposal; and
- presence of other statutory processes including Part V of the EP Act and the *Mining Act 1978*.

As a result the EPA considered that the likely environmental effects of the Demonstration Plant proposal are not so significant as to warrant formal assessment. The EPA is of the view that the potential impacts of the Demonstration Plant proposal can be adequately managed by the Licence Holder's mitigation measures and dealt with by other statutory processes (including Part V of the EP Act).

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guidance Statement: Risk Assessments* (DER 2017).

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operations which have been considered in this Amendment Report are detailed in Table 2 below. Table 2 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

Table 2: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Hypersaline water / concentrated brine (high in total dissolved solids)	Storage of hypersaline water / brine within ponds - Seepage of hypersaline water / brine through base/walls of Ponds - Pond bund wall failure and/or overtopping	Direct discharge to land /surface water (lake playa) Infiltration through soils to groundwater	<u>Seepage controls</u> • Pond walls have been constructed using plastic sheet pile / HDPE liner to minimise seepage from embankments; • The base of the ponds has been constructed of clay material that meets a permeability of $1x10^{-9}$ m/s. This will minimise seepage from the pond floors. • The embankments have been designed by a certified engineer with experience in embankment construction; • During the commissioning process a hard 'salt pavement' is created which 'seals' the pond floor and walls. This reduces seepage of concentrated brine from within the pond cells. Data provided by the Licence Holder

Emission	Sources	Potential pathways	Proposed controls

			indicates that currently the 'salt pavement' within Pond 1 is approximately 450mm in height.
			
			<u>Overtopping / failure controls</u>
			• Ponds will retain a 300mm operational freeboard at all times;
			• Pond 2 (H3 &H4) is designed to a height of 1.5m to provide the following capacity:
			  ○ Two years of precipitate at 0.5m/year;
			  ○ Operational brine height of 0.3m (freeboard); and
			  ○ A storm storage capacity of 0.2m (based on a 1 in 100 annual exceedance probability rain event of 72 hours duration).
			• Daily inspections of pipelines, discharge points, Pond 2 embankments (including crest, toe and perimeter drainage) will be undertaken to identify any issues (such as leaks or unusual changes); and
			• Additional inspections will be undertaken immediately after heavy rains or any unusual events related to the Premises to ensure that the embankments and all infrastructure are functioning as required.

Pond water containing Naturally occurring radioactive materials (NORM) (radium and actinium isotopes)	Groundwater that is being pumped / transported into the ponds Precipitation during process / concentrated in ponds.	Direct – contact through skin or ingestion by wildlife (water birds).	Daily inspections will be undertaken of the ponds to ensure fauna trapped in the ponds are removed.
Pond water containing Selenium (an element of environmental concern in salt lakes)	Groundwater that is being pumped/transported into the ponds.	Direct ingestion of invertebrates living within the pond water Selenium can bio magnify within the food web.	Daily inspections will be undertaken of the ponds to ensure fauna trapped in the ponds are removed.

3.1.2 Receptors

In accordance with the *Guidance Statement: Risk Assessment* (DER 2017), the Delegated Officer has excluded employees, visitors and contractors of the Licence Holder from its

assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation.

The site is located in the north-eastern Goldfields, on the Norseman-Wiluna greenstone belt. The local area is a major mineral province with several operating gold and nickel mines, and numerous prospects for uranium, rare earths and base metals. The climate is considered to be arid to semi-arid, with the area characterised by undulating areas of sandplain and granite outcrop, and by ephemeral creek lines which drain into large salt lakes.

There are no human receptors within 10 km of the Premises boundary. The closest human receptors are Blackham Resources mine camp (~13 km north) and Nganganawilli community (~15 km north). Wiluna townsite is approximately 15 km north of the Premises boundary.

Table 3 below provides a summary of potential environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guidance Statement: Environmental Siting* (DER 2016)).

Table 3: Sensitive environmental receptors and distance from prescribed activity

Environmental receptors	Distance from prescribed activity
Surface water Lake Way Lake Way is an episodic salt lake, approximately 270km^2 in size. It is one of the most northern lakes in the palaeodrainage system known as the 'Salinaland'. Sporadic high rainfall leads to overflow from surrounding lakes, specifically Lake Violet, into Lake Way. The majority of catchment inflow to Lake Way comes from the north of the lake. In times of sufficient flooding, this water continues from Lake Way, via outflow of the palaeoriver southeast, to Lake Maitland.	Ponds are located within the Lake Way playa.
Threatened Flora *Tecticornia* dominated vegetation (includes diverse and novel taxa including conservation significant species) (no surveys have been completed to identify the individual *Tecticornia* species) *Tecticornia* species are on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) list of threatened flora (status listed as vulnerable)	At Lake Way. EPA's report regarding the determination not to assess the demonstration plant project noted that there was potential for the demonstration plant project (that includes Pond 2 – the subject of this amendment) to cause indirect impacts on *Tecticornia* vegetation. Conservation significant *Tecticornia* protected by Ministerial Statement 1051 for the Wiluna Uranium Project that is adjacent to the premises are unlikely to be impacted by this proposal.
Threatened Fauna / Conservation significant species Twenty-nine vertebrate species of conservation significance may occur in the Lake Way area in which the Premises is located according to Bamford, 2020. Most notable is the presence of a possibly undescribed lizard (*Lerista* 'Lake Way') in the gypsum soils close to Lake way, the presence of a population of brush-tailed	On or near Lake Way where the Premises is located.

Mulgara east of Lake Way and the occasional presence of migratory and other water birds (some of conservation significance) on Lake Way when conditions are suitable (Bamford, 2020).	
Groundwater Groundwater is saline to hypersaline, and occurs in the bedrock, palaeochannels and in overlying alluvial, colluvial and calcrete deposits. There is no fresh groundwater in the region – limited areas of brackish groundwater can occur in the upper reaches of some catchments.	The shallow near surface aquifer (0 to 1.1 m) comprises a high porosity, moderate transmissivity sandy clay. The deeper aquifer (1.1 to 10 m) consists of several horizons of clay and sandy clay.
Surface geology Soil type is SV5: Saline soils associated with salt lakes	Within the Premises.

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guidance Statement: Risk Assessments* (DER 2017) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the Licence Holder has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the Licence Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the Licence Holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 4.

The Revised Licence L9208/2019/1 that accompanies this Amendment Report, authorises emissions associated with the operation of the Premises i.e. operation of Pond 2 and Existing Pond 1.

The conditions in the Revised Licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 4: Risk assessment of potential emissions and discharges from the Premises operation

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
Storage of hypersaline water / concentrated brine within Pond 2	Discharge of hypersaline water / brine to surface of Lake Way playa	Direct discharge via overtopping of ponds	Lake Way sediments Surrounding vegetation	Refer to Section 3.1.1	C = Slight L = Unlikely **Low Risk**	Y	**Existing condition 2:** Operational requirements of infrastructure updated to include Pond 2 (freeboard). **Existing Condition 3:** Inspections, updated to include daily inspections of Pond 2. **Condition 1 added to limit annual production of Sulphate of Potash concentrate to 50 000 tonnes per annual period.**	Given the Licence Holder's controls the risk of this event occurring is unlikely. Minimal impact is expected to occur due to the hypersaline nature of Lake Way's sediments and surrounding environment. The Licence Holder's controls have been deemed sufficient to manage this risk event and as a result they have been conditioned within the licence as per *DWER Guidance statement; Risk Assessments (2017).*
	Seepage of hypersaline water through base or walls of Pond 2	Infiltration through soils into groundwater	Groundwater	Refer to Section 3.1.1	C = Slight L = Unlikely **Low Risk**	Y	**Existing condition 2:** Operational requirements of infrastructure updated to include Pond 2 (freeboard). **Existing Condition 3:** Inspections, updated to include daily inspections of Pond 2.	Seepage modelling for the ponds carried out by Groundwater Science in September 2019 indicated that seepage from the Halite ponds (of which Pond 2 forms part of) would have an estimated seepage rate from 0.035 to 0.066mm/day (Groundwater science, 2019). Given the Licence Holder's controls the risk of this event occurring is unlikely. Minimal impact is expected to occur due to the hypersaline nature of Lake Way's sediments and surrounding environment. The Licence Holder's controls have been deemed sufficient to manage this risk event and as a result they have been conditioned within the licence as per *DWER Guidance statement; Risk Assessments (2017).*
	Naturally occurring radioactive materials (NORMS) within pond water /sediments.	Direct contact through skin or via ingestion resulting in toxicity and wildlife death.	Fauna including conservation significant water bird species	Refer to Section 3.1.1	C = Slight L = Unlikely **Low Risk**	Y	**Existing Condition 3:** Inspections, updated to include daily inspections of Pond 2 (for trapped fauna).	Dickson (1985) has investigated saline groundwater beneath and adjacent to salt lakes in the south western Yilgarn region of WA and has reported high levels of radium (Ra) and actinium (Ac) isotopes due to the leaching of granitic bedrock by hypersaline water. The concentration of the salts from this groundwater may result in the accumulation of NORMS within the ponds. The most sensitive environmental receptors for chemical constituents in water in the evaporation ponds on Lake Way are likely to be birds that may visit the ponds. There are no published water quality criteria for assessing the radiological impacts of radium-226 and radium-228 for birds or other wildlife that come into contact with a hypersaline water body. Additionally, detailed dose calculations would be required using ERICA or a similar model to derive specific criteria for such a scenario. However, as a first approximation, the methodology used by the Department of Health (DoH) for deriving non-potable water quality criteria for domestic bores could be adapted for the scenario where birds visit the evaporation ponds infrequently and come into contact with the water, but do not drink the water in the ponds (Ingestion of water is not likely by water-birds as related studies of birds accessing mine storage dams has determined that wildlife will not drink hypersaline water greater than 50,000 milligram per litre (mg/L) (MERIWA, 2008)).

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
								The DoH approach to determining non-potable water quality criteria for human receptors, is to multiply the drinking water criteria for specific chemical constituents by a factor of ten. Adapting this approach for radium isotopes for animal receptors in the evaporation ponds at Lake Way would mean that the ANZECC 2000 livestock water quality criteria would be multiplied by ten. This would give the following interim water quality criteria for radium isotopes in the evaporation pond brine: Radium-226 = 50 Bq/L Radium-228 = 20 Bq/L These concentrations greatly exceed levels that are currently being measured in the evaporation ponds (April 2020 data indicates Radium-226 = average concentration of 1.612 Bq/L and Radium-228 = average concentration of 1.65 Bq/L) and are unlikely to be exceeded during their operation. Therefore, ongoing monitoring of radium in water in the ponds is not considered to be necessary. Although uranium has a radioactive isotope, this element is predominantly of concern to wildlife because of its chemical toxicity. There are no published Australian water quality criteria for the protection of wildlife from uranium in saline evaporation ponds. However, the US Fish and Wildlife Service has recommended that uranium concentrations do not exceed 0.5 mg/L in saline water to protect aquatic receptors and wildlife (Duff *et al*., 1997). This concentration greatly exceeds levels that are currently being measured in the evaporation ponds water and is unlikely to be exceeded during their operation. Therefore, ongoing monitoring of uranium in water in the ponds is not considered to be necessary. One of the main pathways for NORMs to impact receptors (water birds that may potentially visit the ponds) is through ingestion of algae / invertebrates that may inhabit the ponds. The Licence holder has stated within the application documents that the growth of algae or invertebrates is unlikely to occur within the evaporation ponds due to the hypersaline nature of the pond water (>200,000 m/L total dissolved solids). This statement is not entirely supported as the beta carotene producing algae *Dunaliella sp*. commonly grows in high salt environments (Oren A, 2014), however due to the fact that the salt pavement within the ponds will be removed on a regular basis it is unlikely that a build-up of algae / invertebrates will occur for birds to feed off. Therefore, it has been determined that this risk event probably will not occur in most circumstances. The Licence Holder proposes daily inspections of the ponds which will identify the presence of any trapped fauna. This will be conditioned within the Licence.
	Pond water containing Selenium	Direct via ingestion of invertebrates living with pond sediment.	Fauna including conservation significant water bird species	Refer to Section 3.1.1	*C = Moderate* *L = Unlikely* ***Medium Risk***	N	**Existing Condition 2:** Inspections, updated to include daily inspections of Pond 2 (for trapped fauna). **<u>New conditions 4 and 5: Bird</u>**	Selenium is considered to be an element of environmental concern within salt lakes. This is because of its ability to biomagnify in food webs in these water features, and to affect the health of bird populations (Brix *et al*, 2004). Monitoring data (from August 2020) for selenium concentrations within the ponds indicate levels are at or below 0.25mg/L which is

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
		Selenium is an element of environmental concern in salt lakes and can biomagnify within the food web, affecting the health of bird populations					**monitoring**	at the limit of detection for the method used. There are no published Australian criteria for selenium concentrations in salt lakes and saline evaporation pond water. However, detailed food-web investigations in the Great Salt Lake in the United States of America has suggested that a suitable selenium water quality criterion to protect bird life in salt lakes is 0.027 mg/L (Brix *et al*., 2004). As the limit of detection for the sampling carried out at the ponds is at 0.25mg/L it is unclear as to whether this trigger level is being exceeded. The hypersaline nature of the pond water suggests that birds will be unlikely to ingest the water (related studies of birds accessing mine storage dams has determined that wildlife will not drink hypersaline water greater than 50,000 mg/L (MERIWA, 2008)) and therefore impacts from ingestion are unlikely to occur. The main possible pathway for selenium to impact receptors (water birds that visit the ponds) is through ingestion of algae/invertebrates that might inhabit the ponds. The Licence holder has stated within the application documents that the growth of algae or invertebrates is unlikely to occur within the evaporation ponds due to the hypersaline nature of the pond water (200,000 m/L total dissolved solids). This statement is not entirely supported as the beta carotene producing algae *Dunaliella sp*. commonly grows in high salt environments (Oren A, 2014), however due to the fact that the salt pavement within the ponds will be removed on a regular basis it is unlikely that a build-up of algae / invertebrates will occur for birds to feed off. Therefore, it has been determined that this risk event probably will not occur in most circumstances. This risk assessment has determined that it is unlikely that a food source (algae / invertebrates) for birds will develop within the ponds due to the regular removal of the salt pavement. However, there is some uncertainty around this statement as water birds have been found to use salt evaporation and crystalliser ponds as a source of food in other jurisdictions (J Takekawa *et al*, 2001). To provide certainly in the likelihood of the risk event occurring, the Delegated Officer considers it necessary to add a condition to the licence requiring the Licence Holder to undertake daily visual monitoring of bird use of the ponds over a 12-month period. This limited monitoring regime will improve knowledge and confidence as to whether birds access the ponds or not, which will help inform future risk assessments as per *DWER Guidance statement; Risk Assessments (2017).*

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guidance Statement: Risk Assessments* (DER 2017).

Note 2: Proposed Licence Holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

4. Consultation

Table 5 provides a summary of the consultation undertaken by the department.

Table 5: Consultation

Consultation method	Comments received	Department response
Department of Mines, Industry Regulation and Safety (DMIRS). Response received 21/08/2020	At the request of DWER, a geotechnical review has been completed to assess design variations made to Salt Lake Potash Halite and Kainite evaporation ponds against their original design proposals. Halite pond 2, Kainite Pond 1-4, Carnallite pond and Bitterns pond are not included in this review as their constructions have been deferred. Based on the review, it is understood that there are some variations to the initial proposed designs of Halite and Kainite ponds. Therefore, based on the geotechnical review of design proposal and construction completion report, the following comments have been made: The proposed design consisted of 3 options and Option 3 had 3 sub-options. Options 1 and 2 consist of overburden waste rock fill sourced from former gold mining and unlined bunds constructed from compacted lake clay respectively. The Option 3 is for sheet pile walls. The ponds were constructed using Options 1 and 3 for Kainite and Halite ponds respectively. The as-built halite baffles slope face which is 2H:1V is steeper than the proposed design slope face of 2.25H:1V. This is a slight design variation, and looking at the practical construction considerations in building such embankments and considering its height and width, this may be within the limits. DMIRS expect Salt Lake Potash to provide the following to complete this review: • Present the seepage modelling and field permeability testing results and their impact on the design change of Halite ponds PVC sheet piles. • Comment on the use of non-moisture conditioned fill in embankment and baffles construction has no impact on its stability. • Comment that there is enough embedment depth (into undisturbed ground) of vertical posts to support the stability of sheet pile baffles of the Kainite ponds. • Other comments that do not relate to this amendment It is noted that the area of phreatic surface is 0.3 to 0.5m below Lake Surface (Coffey, 2019 Report.	The Delegated Officer has had regard for advice received by DMIRS, and has determined that seepage modelling is not required due to the determination of low risk to the environment as a result of potential seepage from ponds. The remaining comments were noted and a follow up letter was sent to licence holder requesting clarification on outstanding matters. Licence holder responded on 11/9/2020 providing further information to address DMIRS and DWER remaining queries.

	Ref: PERGE227886AD). Therefore, it would be advisable for DWER to appraise potential ground water contamination due to brine water ponding. The Use of sealants in brine water environment instead of sheet pile clutches may also require good evidence to confirm it is leak proof.	
Department of Mines, Industry Regulation and Safety (DMIRS). Response received 14/09/2020.	No further concerns.	Noted.
Other Direct Interest Stakeholder advised of proposal on 17/7/2020	No comments received.	N/A
Licence Holder was provided with a draft amendment (V1) on 17/09/2020 and (V2) on 29/10/2020.	See Appendix 1.	

5. Conclusion

Based on the assessment in this Amendment Report, the Delegated Officer has determined that a Revised Licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

5.1 Summary of amendments

Table 6 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

Table 6: Summary of licence amendments

Condition no.	Proposed amendments
Cover page	Restructured to clearly indicate what prescribed activities have been risk assessed. In line with current licence template.
Explanatory notes	Deleted, consistent with current DWER template. This guidance is now available in DWER's Guide to Licensing (June 2019).
Interpretation	Updated, consistent with current DWER template (based on recent legal advice).
History	Added to Licence, consistent with current DWER template.
Condition numbers	Have changed due to the addition of new conditions.
Condition - Emissions	Deleted, this condition is considered to unnecessarily duplicate the legislation.
Condition 1 – Production limit	New condition added to restrict annual production limit for Category 14 to 50 000 tonnes per annual period which is the maximum throughput expected and authorised under the Demonstration plant project.
Condition 2 – Infrastructure and Equipment	Table updated to include Pond 2. Reference to 'trench' removed. Reference to 'manufacturer's recommendations' updated to 'manufacturer's specifications'. Infrastructure location added. Reference to freeboard requirements updated.

Condition 3	Table updated to include Pond 2. Reference to 'temporary holding pond' and trench removed. Inspection requirements updated to include confirmation of freeboard and structural integrity of ponds. Reference to 'pipelines transferring dewater' has been expanded to say 'pipelines transferring dewater from the Williamson Pit'.
Conditions 4 & 5	New bird monitoring conditions added to the licence.
Condition 6 – Records and reporting	Complaints condition updated to be consistent with wording in current DWER template.
Condition 7	AACR condition updated to be consistent with wording in current DWER template. Due date for AACR extended out to 30th September to provide 30 additional days for submission of annual report. Original submission date was only 1 day after the end of the annual period.
Condition 8 & 9	Conditions updated consistent with wording in current DWER template.
Conditions 10	Annual reporting requirements added. Standard condition added to licences of similar complexity. Due date added to match new due date of AACR.
-	Condition regarding complying with a Department request has been deleted as is unnecessary.
Definitions	Definitions removed: 'Compliance Report', 'Department Request', 'DWER', 'Environmental Harm', 'Implementation Agreement or Decision', 'Inspector', 'Material Environmental Harm', 'Pollution', 'Primary Activities', 'Serious Environmental Harm', 'Unreasonable Emission', 'Waste' – conditions which contained these references have been removed, consistent with current DWER template, as part of this amendment.
	Definitions added: 'AACR' – replaces 'Compliance Report'
	Definitions modified: 'CEO'.
Schedule 1: Maps	Premises map updated to depict new ponds.
Schedule 2: Primary Activities	Removed as considered redundant. Consistent with current DWER template.

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Appendix 1: Summary of Licence Holder's comments on risk assessment and draft conditions

Condition	Licence Holder Response	DWER response
Comments received on 23 September 2020		
Prescribed premise category description Assessed maximum productions capacity – 25,000 tonnes per annual period.	The production limit should be set at 50,000 tonnes per annum SOP as per the existing works approval W6282/2019/1. The production limit should apply to the product SOP only.	Noted. 25 000 tonnes was the original assessed category threshold on the Existing Licence. This was mistakenly left unchanged. The throughput has been updated to the correct amount.
1. Production Limit The licence holder must ensure the premises production limits specified in Table 1 are not exceeded. Production limit 25,000 tonnes per annual period.	The production limit should be set at 50,000 tonnes per annum SOP, as per the licence application.	Noted. 25 000 tonnes was the original assessed category threshold on the Existing Licence. The throughput limit has been updated to the correct amount.
2. Infrastructure and Equipment Table 2. Infrastructure and Equipment Pond 1 condition trench	Pond 1 Condition trench – Construction, operation and closure of trenches is managed under the *Mining Act 1978.* Trenches have been included within SO4's Mining Proposal and Mine Closure Plan. The conditioning trench now forms part of the broader trench network and should not be incorporated into the licence amendment.	<u>Conditioning trench</u> The conditioning trench has not been incorporated into the licence amendment as it was existing infrastructure on the Licence. A change was made to the name of the trench since the 'temporary pond' is now called 'Pond 1'. The purpose or use of the conditioning trench has changed. DWER notes the trench now forms a part of the broader trench network, therefore the

Condition	Licence Holder Response	DWER response
Mobile Equipment	Mobile Equipment – The mobile equipment maintenance was included in the works approval and licence associated with the Williamson Pit dewatering. Following conversations with DWER, infrastructure regulated under category 14: Solar salt manufacturing includes both the evaporation ponds and the process plant. Mobile equipment maintenance will be managed under the *Mining Act 1978* through implementation of the Mining Proposal and Project Management Plan.	licence will be updated to remove reference to the conditioning trench. <u>Mobile equipment</u> The request to remove this condition has been approved based on the fact mobile equipment maintenance will be managed under the *Mining Act 1978* through an implementation of the Mining Proposal and Project Management Plan.
3. Infrastructure and Equipment The licence holder must undertake monitoring of site infrastructure and operations in accordance with the requirements of Table 3.	Table 3 – Remove conditioning trench as described above. Table 3 – Remove pipelines and trenches as per comment above for conditioning trench and mobile equipment.	Please see comments above regarding the conditioning trench. Reference to the conditioning trench will be removed from the licence. The monitoring requirement of pipelines was placed on the Existing Licence in 2019 as there were pipelines associated with the Williamson Pit dewatering. Reference to 'trenches' will be removed. Please confirm whether dewater is still being transferred to Pond 1, if not then this requirement can be removed.
4. Monitoring - Process Monitoring Table 4.	The monitoring proposed does not align to the operation of the pond network and associated processing plant. Brine is pumped from the trenches into the pond network where the harvest salts are produced. It is believed that DWER are referring to brine abstraction which is measured and reported under the RIWI act 1914 as part of the annual Groundwater licence report for GWL202044(2). Note that the 'production of brine' is different to the dry tonnes of SOP produced per annum – the volume of SOP produced per annum is from the processing plant, and would be measured as direct production.	Noted. This condition has been removed.
5. Monitoring – Pond water and Sediment Quality Monitoring	The Licence holder provided comments disputing the need for sediment monitoring for NORMS. Reasons provided for this are:	The draft risk assessment of NORMs was conducted in accordance with the departments'

Condition	Licence Holder Response	DWER response
Condition 10/ Table 5.	- The pathway (birds eating invertebrates / algae) for NORMS to impact bird does not exist as the pond water will be too saline to support the growth of any normal algae. - The ponds will be periodically harvested to remove the salt growing on the base of these ponds and this halite salt will be stockpiled as dry salt elsewhere. - Algal and other organic matter will not accumulate in sediments on the base of these ponds (because it will be too saline for them to grow there), but even if they were able to, these sediments (mainly crystals of NaCl) will be harvested and stockpiled as dry material on a regular basis preventing any possibility of a process of accumulation developing. - Any fauna that visits the halite precipitation ponds will be deterred from eating or drinking by the high salinity that will characterise the water. There will be no direct contact with the sediments through skin because the sediments will be under a layer of highly saline water that would deter any such contact. Similarly there is not expected to be any algal growth on top of the crystals growing under the evaporating brine, nor any invertebrates able to feed on the algal material and so there is no food chain to transfer uranium or radium from algal matter to feeding birds Licence Holder disagrees with the sampling method as; - the base of the ponds will be more like a pavement than a sediment, which will make the proposed sampling far more difficult and will involve chiselling the material from the middle of the pond from an underwater location. - The requirement is to sample every six months – which will be immediately after when the monitoring point has been harvested meaning there would be no accumulation there. - It makes no sense to sample for uranium or radium in samples that are essentially precipitated crystalline salt sitting on the floor of the ponds, when neither uranium nor radium would precipitate as part of that process and therefore any uranium or radium would	Guidance Statements: Risk Assessments (2017) and Setting Conditions (2015). A recommendation for monitoring of selected NORMS in sediment in the ponds was made by the departments principal hydrogeologist, based on an understanding that birds in other jurisdictions around the world can and do at times access hypersaline water in evaporation ponds for a range of reasons, including accessing potential food sources such as algae and invertebrates. The information provided in Licence Holder's comment has been considered by the Delegated Officer, who has also had regard for the salt production process which is likely to reduce the potential for food sources such as algae and invertebrates to form within the ponds. The regular removal of the salt pavement and the constant presence of water within the evaporation ponds is likely to be a key factor in prohibiting the colonisation of organic matter in sediments in the ponds. Notwithstanding this, given the uncertainty as to whether birds will actually access the ponds at this point in time, as an alternative monitoring control to confirm if there is a possible source and pathway for receptors (birds) to be exposed to potential NORMs in sediment, the Delegated Officer has conditioned the requirement to conduct daily visual monitoring and recording of any birds accessing the ponds for a period of 12 months to provide this certainty and further inform future risk assessments. The risk assessment of NORMs has been revised (refer Table 4). Licence condition 10 (table 5) has been removed and replaced with the requirement for bird monitoring (condition 4).

Condition	Licence Holder Response	DWER response
	simply be in liquid entrained within the crystal structure - especially in a context where it has been deemed not necessary to measure the water for either uranium or radium because the concentration in that water is acknowledged to be so low as to not require any monitoring. The process of crystallisation is very specific to sodium chloride within the halite precipitation pond – the initial crystals encourage further crystals to grow on the same structure meaning that it is only sodium chloride that grows on the crystals – that is why nothing more than trivial amounts of uranium and radium would be captured by that process. The Licence holder provided comments disputing the need for sediment monitoring for Selenium: - The 'potential pathway' for selenium as identified in Table 4 was "via ingestion of invertebrates living with (sic) pond sediment". The identified ability to biomagnify within the food web affecting the health of bird populations which was referenced to Brix et al (2004), relies critically upon the resident invertebrates to perform the biomagnification. The halite precipitation ponds will not have any invertebrate population to perform the biomagnification and will not have a resident bird life to feed upon them; in short there is neither a potential pathway nor a receptor to be impacted.	
6. Monitoring – Pond water and Sediment Quality Monitoring Condition 11.	Condition 11 relates to necessary actions required if concentration levels identified in Condition 10 are exceeded. On the basis that Condition 10 should be removed (for reasons – see above), Condition 11 should also be removed.	See comments above. Condition 11 has been removed.
Additional Comments	The ponds shown are the as-constructed footprint and not consistent with what was submitted for approval?	The Premises boundary map used was generated from shape file data provided to DWER as a suitable premises boundary map was not provided within the application. The map needs to show the outer embankment boundary of each pond (train) that has been constructed and not the internal pond structure.

Condition	Licence Holder Response	DWER response
		DWER requested a map showing the position of Pond 1 and Pond 2 (clearly labelled) and the entire premises boundary displayed.
Additional Comments	The Australian Standard stipulated in the draft licence (AS/NZS 5667.12:1999 -Guidance on sampling of bottom sediments) is intended for use in sampling "…sedimentary materials from inland rivers and streams; lakes and similar standing bodies; and estuarine and harbour areas". It is not evident SO4 that this standard is intended for use in sampling industrial pondage. Salt precipitate in an industrial pond system is not comparable to transported sediment in natural water bodies.	The condition referring to this standard has been removed.
Comments received on 5/11/2020		
Condition /page	**Licence Holder Response**	**DWER response**
Decision report - administrative errors	Licence holder has pointed out a few administrative errors in report.	These errors have been corrected.
Decision report page 3 - "The majority of brine will be sourced as pump testing water from a series of palaeochannel bores (authorised for up to 1.5 Gigalitres (GL)), which will be discharged into a 6 km unlined exploration trench and conveyed to the ponds."	This is incorrect. The majority of brine will be sourced from the trench network constructed on the mining leases, approved under the *Mining Act 1978*. Some water will be sourced from exploration activities associated with the pump-testing of paleochannel bores. The paleochannel bores are authorised up to 2GL per annum of abstraction.	Statement has been updated as per licence holder's comments.
Decision report page 10 – first row of table	SO4 notes that the lerista and the mulgara are not located on the lake playa surface but are associated with the acacia scrublands and dunal systems to the east of the lake. There is no potential impact on these species with the construction and operation of the ponds.	Noted. Table 3 states that Lerista and the Milgara are located near (and not on) Lake Way.
Decision report page 8 - Final row in the table relating to Selenium and "Direct ingestion	SO4 has previously provided substantial data that clarifies this matter and demonstrates that the risk associated with Selenium is negligible.	The draft risk assessment of NORMs / selenium was conducted in accordance with the departments' *Guidance Statements: Risk*

Condition	Licence Holder Response	DWER response
of invertebrates living within the pond water"	SO4 draws the DWER's attention to the commentary within the cited articles that sulfate is known to reduce selenate bioavailability and the lake is high in sulphate. The purpose of the halite ponds is to drop out halite from the brine, thereby reaching saturation levels of halite salt and creating an environment unsuitable to support growth of algae.	*Assessments (2017) and Setting Conditions (2015)* and was supported by technical advice from the Departments senior hydrogeologist. The risk rating for selenium has been determined 'medium' based on a moderate consequence to the receptor (mid level onsite impacts) should the risk event occur. The likelihood has been assigned as unlikely due to the mechanism involved in harvesting of salts, which the licence holder advises will be a key factor in prohibiting the colonisation of organic matter in the base of the ponds. The Delegated Officer notes however, that this is a new premises and there remains some uncertainty as to whether organic matter may still accumulate in some areas of the ponds over the varying timeframes associated with processing of the salts. There also remains uncertainty as to whether birds will actually access the ponds throughout different times of the year. As an alternative monitoring control to confirm if there is a possible source and pathway for receptors (birds) to be exposed to selenium in the base of the ponds, the Delegated Officer has conditioned the requirement to conduct daily visual monitoring and recording of any birds accessing the ponds for a period of 12 months to provide this certainty and further inform future risk assessments. Should the monitoring data indicate that birds are unlikely to access the ponds / accessing ponds in very low numbers, or that birds that do access the ponds are not foraging for algae / invertebrates due to none being present, then the monitoring requirements may be removed from the licence.
Decision report page 11 - Last row of table referring to NORMS – "The concentration of the salts from this groundwater may result in the accumulation of NORMS within the ponds."	SO4 disagrees with the conclusions drawn by DWER. Dixon himself in another article states that If the water is aerated first, a sediment containing ferric hydroxide forms and this compound is a natural scavenger of radium. Aeration also removes any highly radioactive radon gas (http://www.ecosmagazine.com/?act=view_file&file_id=EC45p8.pdf) We therefore suggest that the risk of NORMS generation is negligible and should not require management.	
Decision report page 13 - Row refers to Selenium within the sediments	SO4 has previously provided substantial data that clarifies this matter and demonstrates that the risk associated with Selenium is negligible. SO4 draws the DWER's attention to the commentary within the cited articles that sulfate is known to reduce selenate bioavailability and the lake is high in sulphate. The purpose of the halite ponds is to drop out halite from the brine, thereby reaching saturation levels of halite salt and creating environment unsuitable to support growth of algae. The concentrations of salts are also unlikely to present a suitable environment for birdlife.	
Decision report page 20- Commentary relating to NORMs in sediment	SO4 suggests that reference to 'sediment' is misleading. The sediment in question is actually the halite that has fallen out of solution. It is rock salt and not a sediment in nature. Works completed by SO4 to date in abstracting the halite pavement material to date has found that an excavator or similar is required to break this material up	

Condition	Licence Holder Response	DWER response
Condition 1	SO4 seeks to confirm that the Premises production limit of 50,000 tonnes per annual period refers to the production of Sulphate of Potash concentrate (SOP)	DWER can confirm that the production limit refers to the production of Sulphate of Potash concentrate.
Condition 3, Table 3	Suggest the reference to “Pipelines transferring dewater” is amended to “Pipelines transferring dewater from the Williamson Pit”	Condition has been updated as per licence holder’s comments.
Condition 4, Table 4	Suggest the wording regarding “Number and species (if known) of water birds accessing the ponds” is revised as follows “Number and species (if able to be identified at the time of inspection) of water birds accessing the ponds”. This ensures that assessment is not overly onerous and is focussed on the number of birds, which is really the aim of the monitoring exercise.	Condition has been updated as per licence holder’s comments.
General comments	We note that dewater is still being transferred to Pond 1 from the Williamson Pit to Pond 1 and also attach the revised Prescribed Premises map for your records and inclusion within the instrument once issued. Assuming the changes above are addressed, we confirm that we are happy to waive the 21-day comment period.	Reference to the pipeline has been retained within the licence. Premises map in Schedule 1 has been updated with the map provided by the licence holder.