



Application for Works Approval

Part V Division 3 of the Environmental Protection Act 1986

Works Approval Number	W6711/2022/1
Applicant	EcoMag Dampier Pty Ltd
ACN	622 727 208
File number	DER2022/000212
Premises	Karratha Demonstration Magnesium Recovery Plant 1 Millars Road, Gap Ridge WA 6714 Part of Lot 267 on deposited plan 93179 City of Karratha As defined by the coordinates in Schedule 2 of the works approval
Date of report	28 November 2022
Decision	Works approval granted

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	1
2. Scope of assessment	1
2.1 Regulatory framework	1
2.2 Application summary and overview of the premises	1
2.2.1 Part IV Ministerial Statements and assessments	11
2.2.2 EcoMag and WRS Bioproducts Wildlife Hazard Risk Assessment	12
2.2.3 <i>Contaminated Sites Act 2003</i> Basic Summary of Records Search Response	12
2.2.4 Exemption of planning and development approval	13
3. Risk assessment	15
3.1 Source-pathways and receptors	15
3.1.1 Emissions and controls	15
3.1.2 Receptors	19
3.2 Risk ratings	22
4. Consultation	25
5. Conclusion	26
References	27
Appendix 1: Summary of applicant’s comments on risk assessment and draft conditions	28
Appendix 2: Application validation summary	31
Table 1: Proposed applicant controls	15
Table 2: Sensitive human and environmental receptors and distance from prescribed activity	19
Table 3: Risk assessment of potential emissions and discharges from the premises during construction and commissioning.	23
Table 4: Consultation	25
Figure 1: Location of the project site within the Rainstorm Lease.	3
Figure 2: Site layout depicting the Demonstration Plant (the Project site) and Rainstorm’s site.	4
Figure 3: The ponds the bitterns are pumped in from and out to. Bitterns are pumped in from concentration pond #4 and spent bitterns are pumped out to the spent bitterns evaporation pond. Water from reverse osmosis (RO) is pumped in from the desalination plant.	5
Figure 4 Simplified process flowchart.	6
Figure 5: Magnesium Recovery Process Flowsheet 1 of 3	7
Figure 6: Magnesium Recovery Process Flowsheet 2 of 3	8

Figure 7: Magnesium Recovery Process Flowsheet 3 of 39
Figure 8: Storage tanks, a steel framed shed and office block to be repurposed..... 10
Figure 9: Contaminated Sites on the Premises. 14
Figure 10: Point source emission locations from the Rotary Dryer/Kiln and the CCM Calciner.
..... 18
Figure 11: Distance to residential receptor20
Figure 12: Distance to Karratha airport21

1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from emissions and discharges during the construction and operation of the premises. As a result of this assessment, works approval W6711/2022/1 has been partially granted to allow construction and commissioning phases only.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this decision report, the Department of Water and Environmental Regulation (the department; DWER) 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 Application summary and overview of the premises

On 17 May 2022, EcoMag Dampier Pty Ltd (the applicant) submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act). The application is to undertake construction works relating to a 'demonstration magnesium recovery plant' (the project) at the premises.

The project is to be located within Lot 267 on Deposited Plan 93179 (the 'Leasehold'), approximately 8 km north-west of the Karratha town centre. Rainstorm Dust Control Pty Ltd (Rainstorm) is a dust control specialist and the lessee of the Leasehold (Figure 1). The applicant has signed a "Ancillary Land Use and Compensation Agreement" with Rainstorm for access and use of a 0.5 ha portion of the Leasehold for the purposes of bitterns processing (Figure 2). The Leasehold was previously developed by Aurora Algae Pty Ltd (Aurora) as a test site for aquaculture between 2011 and 2013 (ABC News, 2013), therefore the site already contains some infrastructure. Infrastructure includes six storage ponds, a steel framed shed, five solution storage tanks, concrete pads, a portable office, and an ablution block.

Rainstorm has entered into a Bitterns Supply Agreement with Dampier Salts Limited (DSL) which, subject to the Agreement's terms, allows Rainstorm to access Bitterns from DSL's Mineral Lease and to supply those Bitterns to EcoMag.

Magnesium production process

The applicant holds exclusive rights to use new technology and process to produce high purity magnesium product from the waste streams of existing solar salt production facilities. The applicant proposes to utilise the waste liquid bitterns stream discharged by the nearby Dampier Salt Operations provided by Rainstorm, combined with sea water as feed for the process. Dampier Salts Limited is regulated separately under licence L7182/1997/11 and their operations are not considered further in this decision report.

The magnesium will be removed from the feed water, with waste solution being a mixture of processed spent bitterns and wash liquor (via reverse osmosis concentrate). In the absence of rainfall, the concentration of magnesium remains relatively constant in the source stream.

Rainstorm currently pumps bitterns from the waste bitterns channel into their six Bitterns Concentrator Ponds outside the Leasehold boundary (Figure 2). Here subsequent evaporation takes place to produce their higher concentration magnesium solutions. In Bitterns Concentrator Pond #4 (capacity ~1 ML) (**Figure 3**), the applicant will install a pump to supply the feedstock to the Magnesium Salt Precipitation Demonstration Plant where feedstock will be stored within the plant area. Soda ash or caustic soda solution and precipitate Hydrated Magnesium

Carbonate (HMC) and Magnesium Hydroxide (MDH) is then added.

The precipitated HMC/MDH slurry will be filtered and washed in a horizontal plate pressure filter utilising desalinated water for the washing cycle. After filtering and extraction, the magnesium product is then dried in a kiln and packed into bags. The spent bitterns and wash liquor will be pumped back off-site to the spent bitterns evaporation pond (**Figure 3**) where partial evaporation of the liquor can take place. The waste storage pond forms part of the Prescribed Premises boundary for the project.

The magnesium recovery process consists of five main steps as detailed below and is depicted in Figure 4 to Figure 7. This process is conducted wholly at the Demonstration Plant.

Step 1: Reagent Preparation

The process uses sodium carbonate (Na_2CO_3) or sodium hydroxide (NaOH) to produce precipitated magnesium products. Na_2CO_3 will be supplied in technical grade powder form and NaOH as a solution. The Na_2CO_3 will be stored in a silo and is transferred by means of a weigh-belt feeder to process water with a mixer at target concentration.

Step 2: Precipitation Process

The precipitation reagent will be pumped into an agitated precipitator where it comes into contact with the feed bitterns. To improve the dewatering performance of the precipitated magnesium products, a source of seed crystal is provided in the precipitation tank. The precipitation process produces a magnesium slurry.

Step 3: Dewatering and Washing

The slurry from the precipitation tanks is then pumped to the dewatering circuit where centrifuges and/or filters are used to remove entrained solution. The filter cake is then washed with RO (reverse osmosis) water to remove impurities, followed by a further dewatering step to reduce the moisture content of the cake. The cake is then transferred to the drying stage.

Step 4: Drying and Packaging

The production of magnesium products requires drying to reduce the moisture contained in the filter cake to obtain the finished magnesium product at the desired purity. Drying will be undertaken in a gas-fired drier. Air exiting the kiln is passes through a baghouse filter, to remove any fine dust generated in the drying process.

The drying process generates the Hydrated Magnesium Carbonate (HMC) or Magnesium Di-Hydroxide (MDH) product which can be transferred to storage silos and then packed into bags. The product can also be directed to a high temperature kiln, where the product is heated up to 600°C , to convert the material to Caustic Calcined Magnesia (CCM). The hot product exits the kiln and is passed through a rotary cooler, to reduce its temperature before it is stored in silos. It is also packed into bags before being delivered to customers.

Step 5: Product Storage

Final bagged magnesium products will be palletised and/or containerised and temporarily stored on site before delivery to customers in Australia and overseas.

Currently, a third-party agreement to dispose of the concentrated waste brine from the storage pond has not been finalised during the time of assessment of this works approval application. Therefore, the disposal of the brine produced at the Demonstration Plant cannot be assessed and approved at this time. The applicant intends to apply for another works approval for the disposal of the concentrated brine at a later date once a third-party agreement has been finalised.

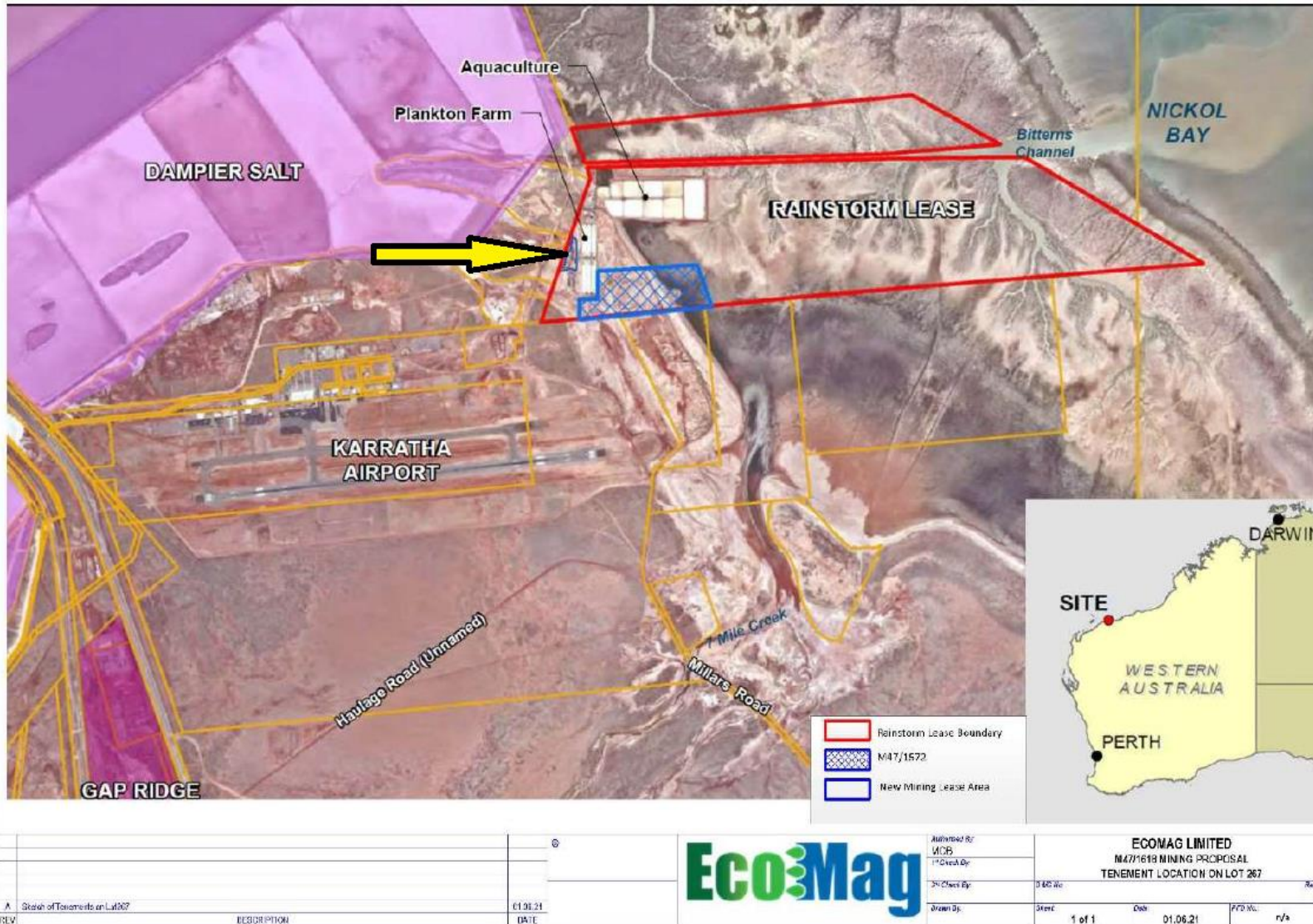


Figure 1: Location of the project site within the Rainstorm Lease.

Works Approval: W6711/2022/1

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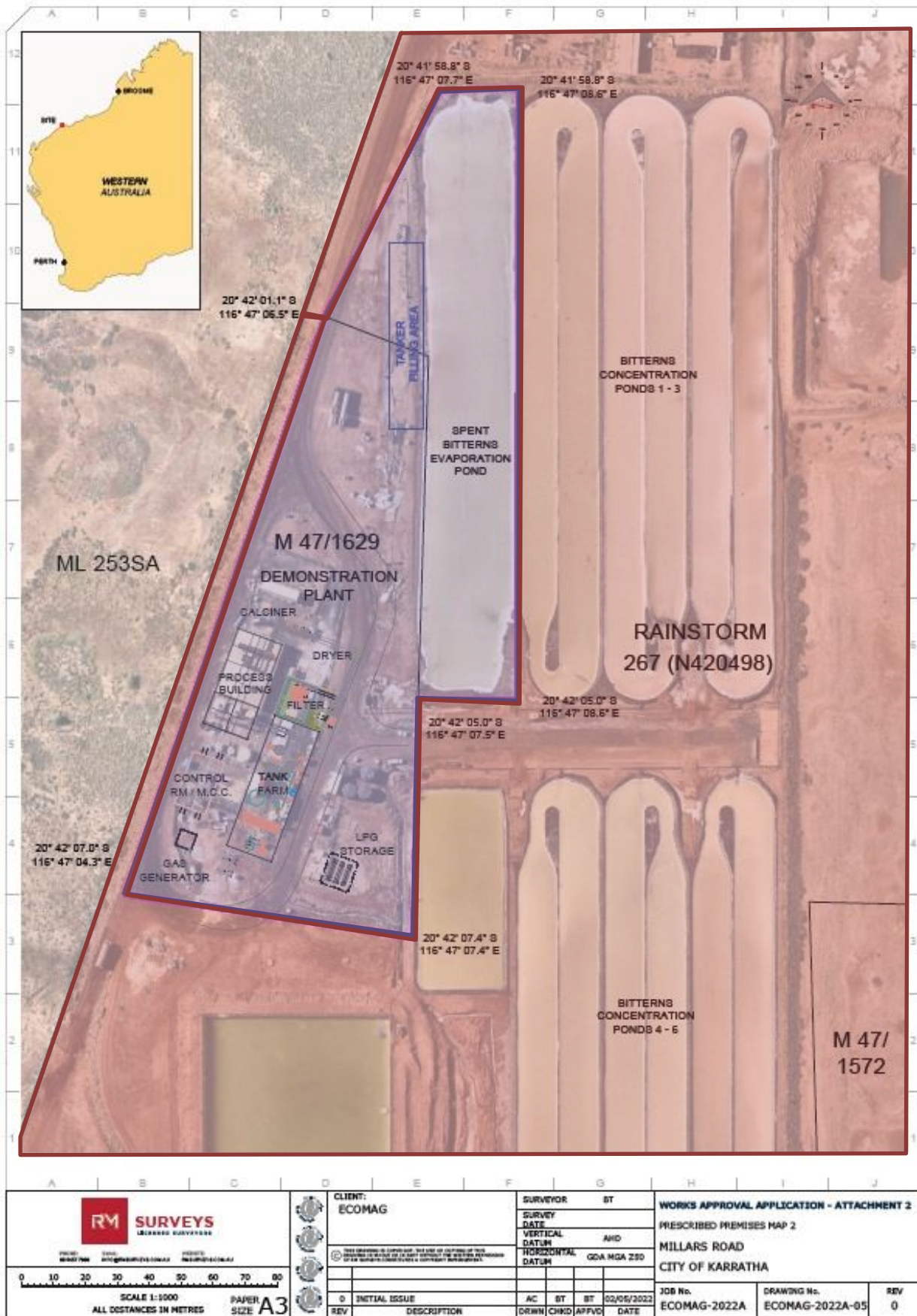


Figure 2: Site layout depicting the Demonstration Plant (the Project site) and Rainstorm's site.

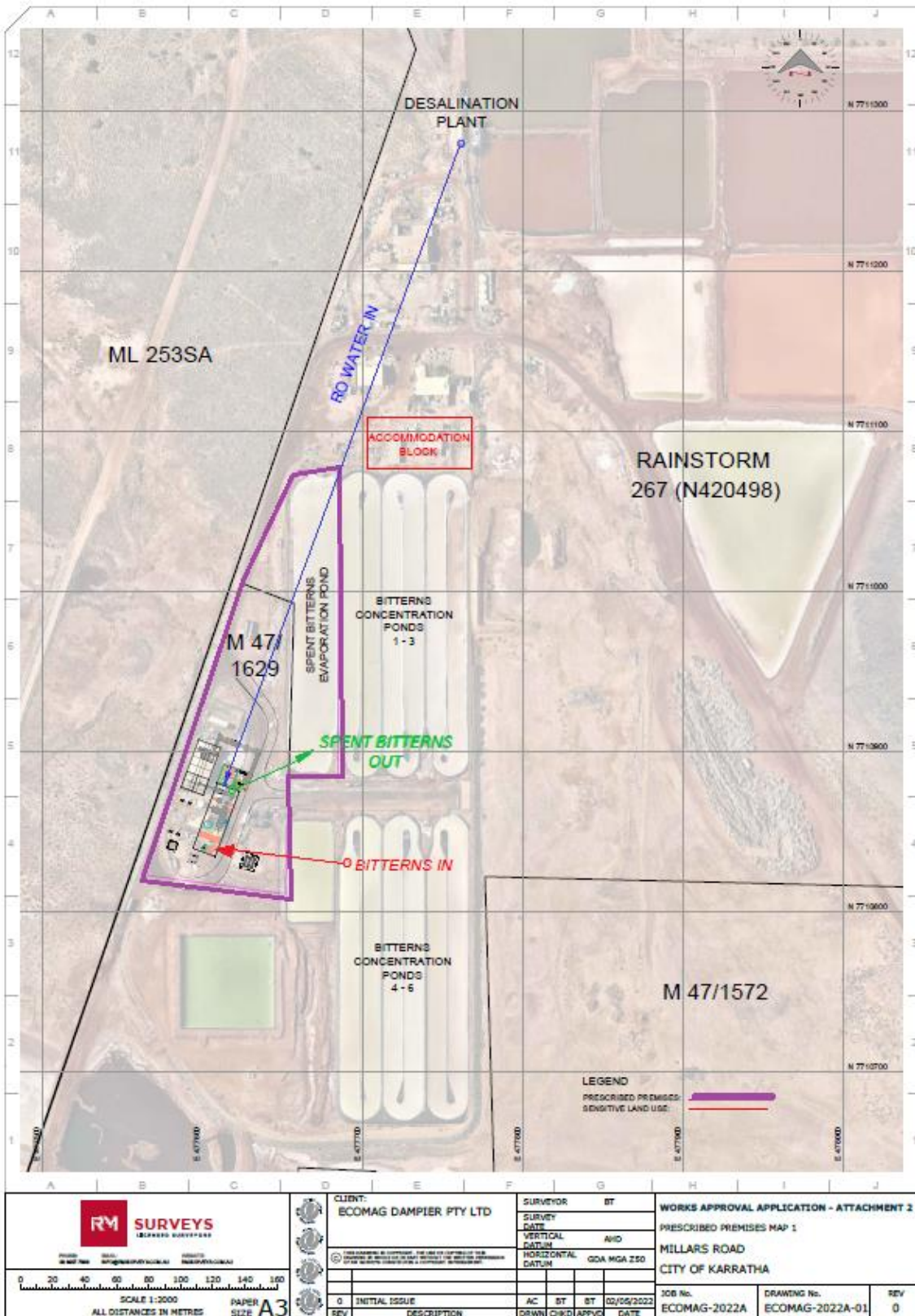


Figure 3: The ponds the bitterns are pumped in from and out to. Bitterns are pumped in from concentration pond #4 and spent bitterns are pumped out to the spent bitterns evaporation pond. Water from reverse osmosis (RO) is pumped in from the desalination plant.

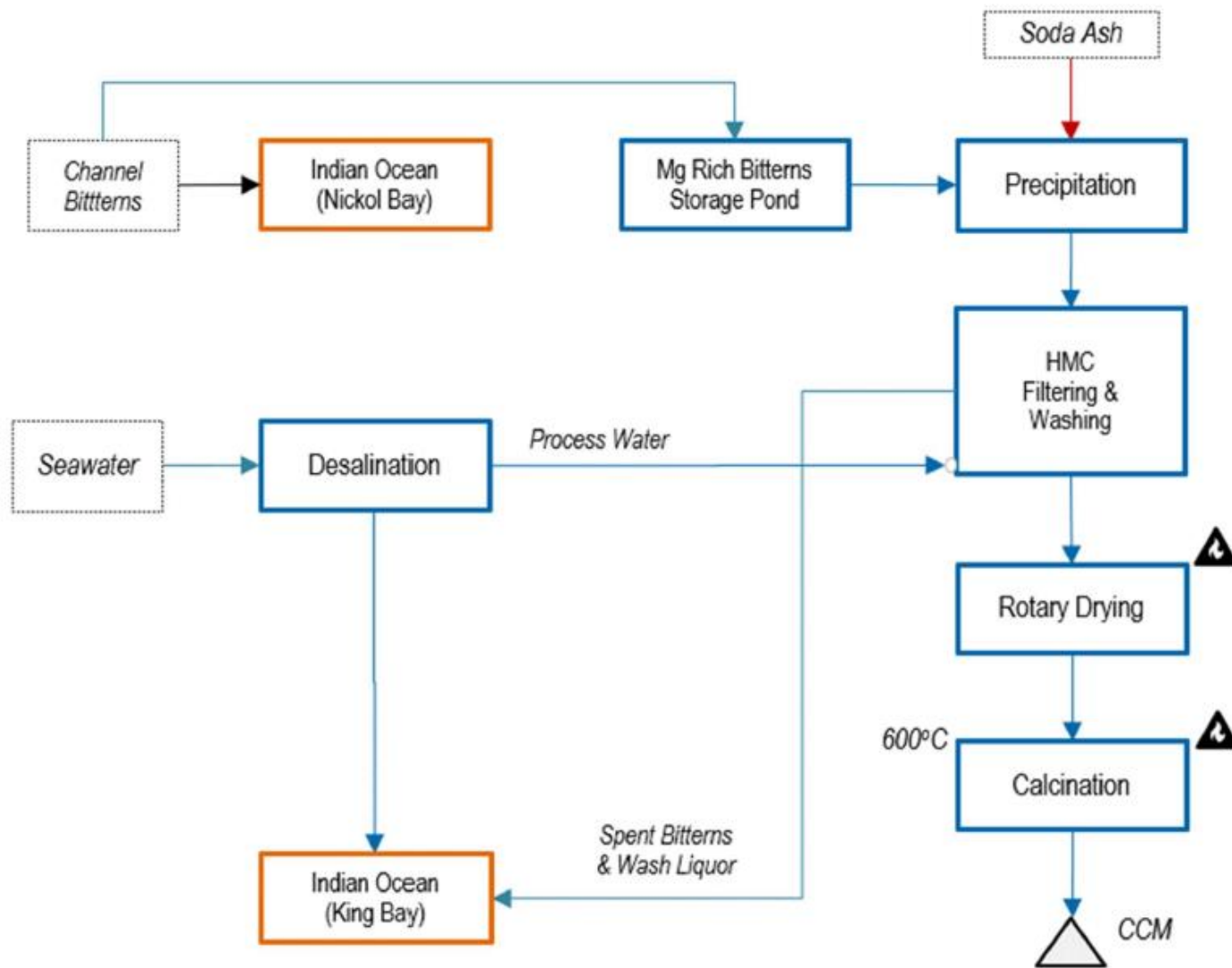


Figure 4 Simplified process flowchart.

Works Approval: W6711/2022/1

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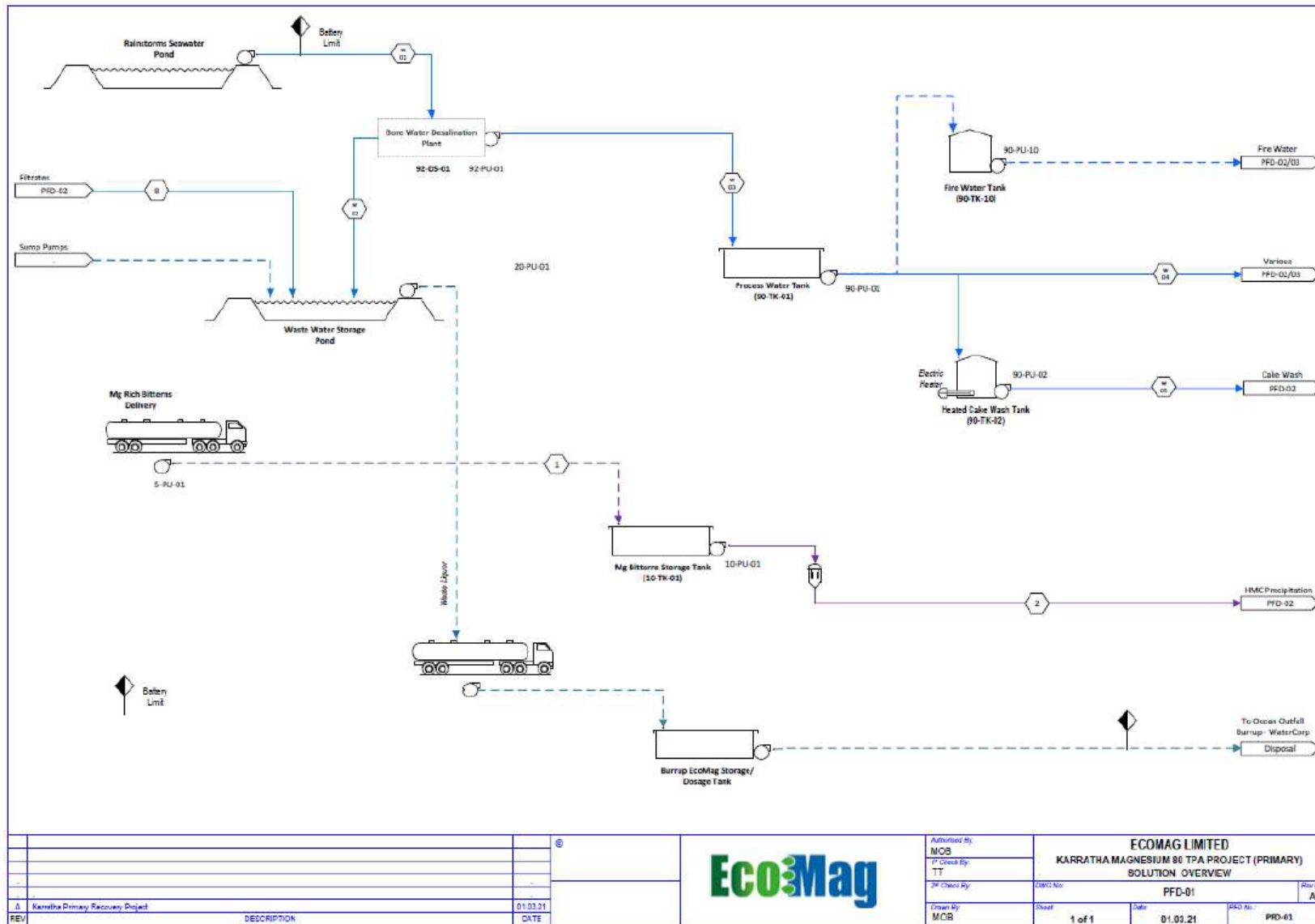


Figure 5: Magnesium Recovery Process Flowsheet 1 of 3

Works Approval: W6711/2022/1

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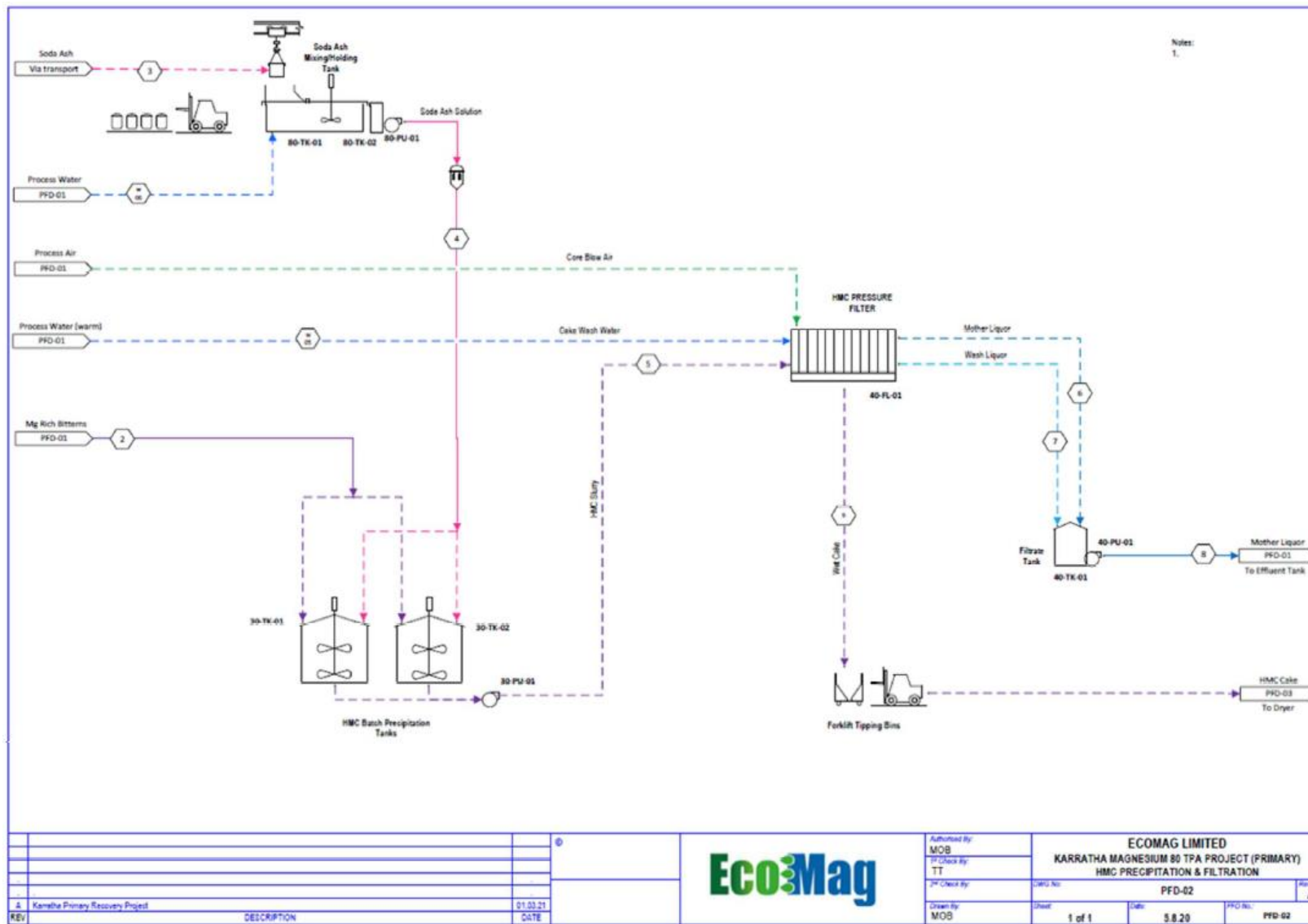


Figure 6: Magnesium Recovery Process Flowsheet 2 of 3

Works Approval: W6711/2022/1

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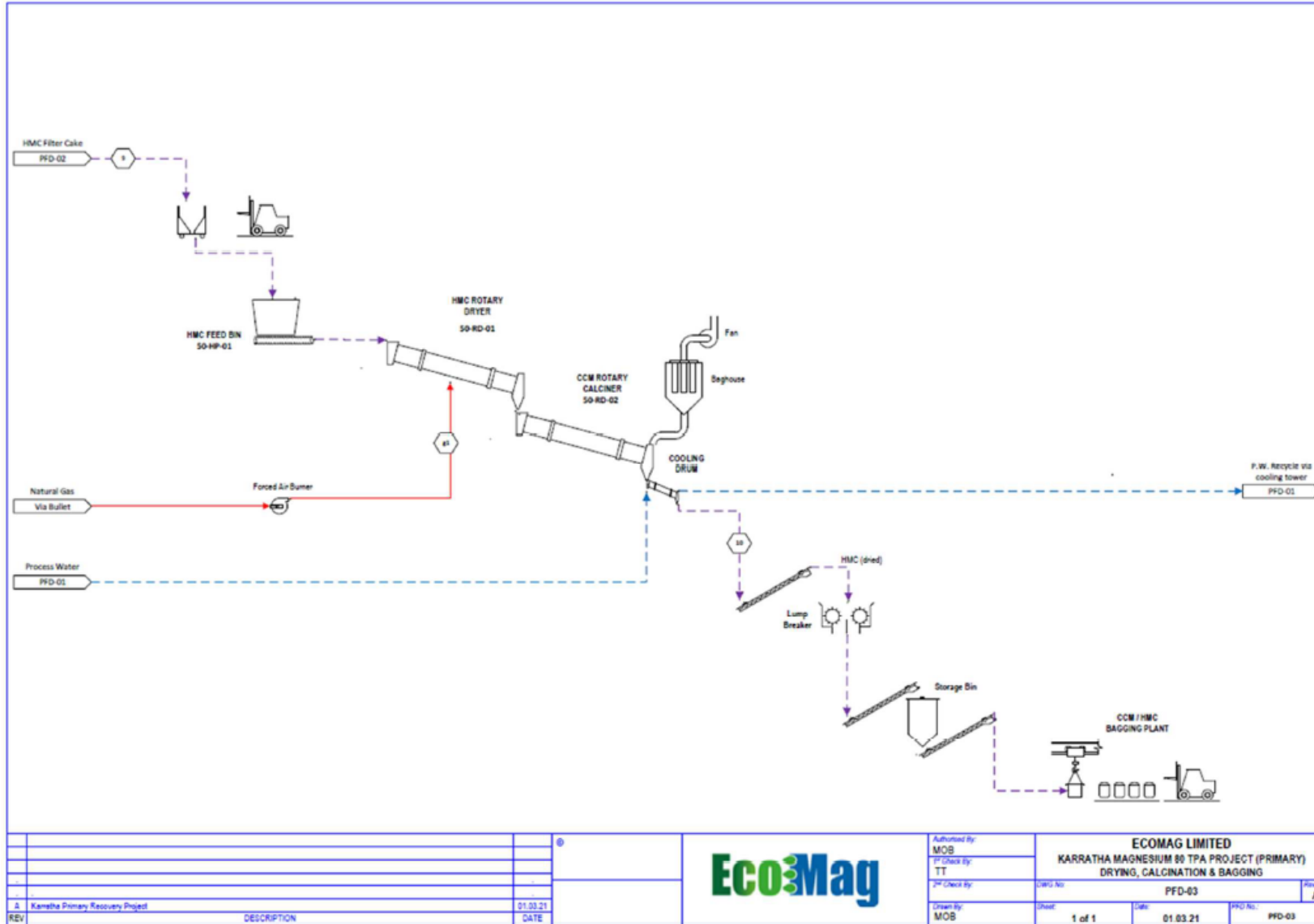


Figure 7: Magnesium Recovery Process Flowsheet 3 of 3

Works Approval: W6711/2022/1

Infrastructure requirements

The infrastructure requirements of the premises will be provided through a mixture or reuse of existing infrastructure on and off the premises and new infrastructure to be constructed on the premises.

Existing infrastructure located on the Leasehold and will be repurposed for the project include the following:

- 30 m x 20 m steel framed shed
- 3 x 22,500 L solution storage tanks
- 2 x 3,000 L solution storage tanks
- Concrete pads
- 1 x 40 ft Portable Office
- 1 x 20 ft Ablution portable.

Photographs of the storage tanks, a steel framed shed and office block to be repurposed are shown in Figure 8 below.



Figure 8: Storage tanks, a steel framed shed and office block to be repurposed.

Other existing infrastructure utilised as part of the project owned and maintained by Rainstorm and are not located on the Prescribed Premises include the following:

- Rainstorm’s reverse osmosis plant,
 - Spent Bitterns Concentration Ponds which will hold water before it is transferred to the Demonstration Plant (not regulated under works approval W6711/2022/1); and
- Access roads.

Infrastructure to be constructed or installed on the premises include:

- An enclosed chemical storage building on concrete with a bunded concrete slab on grade. The building will be designed with bunding to capture accidental release in a manner that mitigates any release to the environment;
- The Rotary dryer/Kiln and CCM calciner and associated generators
- Bitterns holding tank (27,500 L polyethylene heavy duty tank). Level sensor to prevent overflowing. Overflow pipe to concrete sloped floor
- Soda ash preparation (6,000 L carbon steel tank)
- Precipitation x 3 (3,000 L polyethylene heavy duty tank)
- Filtrate tanks x 2 (6,000 L polyethylene heavy duty tank)
- Waste liquor holding tank (27,500 L polyethylene heavy duty tank)
- Other tanks will hold seawater, process water and fire water and will be positioned on concrete ring beams, with an internal sand base. These are 500,000 L lined panel tanks.

Modification of existing infrastructure includes modifying the spent bitterns’ evaporation pond so overflow is directed to an adjacent bitterns concentration pond.

Other categories

The premises relates to category 61 and assessed production capacity under Schedule 1 of the Environmental Protection Regulations 1987 (EP Regulations) which are defined in works approval W6711/2022/1. Other categories were considered but were determined not to meet the definitions or trigger.

Category 31 – Chemical Manufacturing: premises (other than premises within category 32), was determined by DWER to not be applicable to the proposal. High purity magnesium product is extracted from waste bitterns discharged by Dampier Salt Limited through refinement and heating rather than by chemical reaction of unrelated starting chemicals.

Category 85 – Sewage facility. The applicant determined the expected production throughputs will not exceed the trigger for a sewage facility and domestic wastewater will be treated and disposed of on-site.

The infrastructure and equipment relating to the premises category and any associated activities which the department has considered in line with *Guideline: Risk Assessments* (DWER 2020) are outlined in works approval W6711/2022/1.

2.2.1 Part IV Ministerial Statements and assessments

The Leasehold was previously subject to Ministerial Statement 950 (MS 950). MS 950 was issued for Aurora Algae Pty Ltd for their algae farm and processing facilities in Karratha, which no longer operates. MS 950 contained conditions to protect the ecological and social values associated with groundwater in the local area. The applicant has proposed controls such as bunding and a lined evaporation pond to contain hazardous material and protect the local soils, vegetation, and groundwater from contamination.

The applicant is in discussions with Water Corporation to determine whether the concentrated waste brine product may be disposed of via Water Corporation’s Multi-User Brine Return Line

(MUBRL). Water Corporation's prescribed premises is regulated under Ministerial Statement 000594 (MS 594) (amendment to MS 567), Operational Marine Environmental Management Plan (OMEMP), and their delegated environmental authority. Ministerial Statements 567 and MS 594 regulate various environmental risks at Water Corporation's desalinated water and seawater supply operations at the Burrup Peninsula.

As of 7 October 2022, Water Corporation is continuing to work with the applicant to understand the implications of the proposal in context of the requirements of the Ministerial Statements.

Due to the applicant not having a finalised agreement with a third-party to dispose of the concentrated brine, the department will not consider disposal risks in this application and assessment. Disposal of waste brine product to the environment is therefore not authorised at this time.

2.2.2 EcoMag and WRS Bioproducts Wildlife Hazard Risk Assessment

Biodiversity Australia was commissioned by the applicant to undertake a wildlife hazard risk assessment for the premises to identify and quantify the wildlife related risks of airstrike relative to Karratha Airport (KTA) that may arise as a result of the project's development and operations. The report also provides recommendations that will ensure the premises operations maintains compliance with relevant aerodrome wildlife hazard management legislation and guidelines.

Infrastructure related to the applicants' operations surveyed in this risk assessment include Water Corporation's wastewater treatment plant (K2 ponds). The K2 ponds attract a relatively high variety of species for what appears to be for roosting purposes. These species are presented in order of aviation risk: common wallaroo (extreme), Pacific black duck (extreme), Radjah shelduck (very high), the Gull-billed tern (high) and Spinifex pigeon (medium). Due to the high attract of species, this site is considered a hazard to aircraft and is regularly monitored.

Numerous recommendations have been proposed in the report to manage animal numbers from increasing including:

- Minimising pond surface water area and increasing pond depth;
- Ensuring seawater pumps do not allow fish ingress;
- Undertaking pre-construction monitoring and collaborate with KTA;
- applying insecticides to pond water to eliminate food sources;
- communicating with KTA with monitoring observations and earthworks events;
- minimising additional landscaping which may attract wildlife;
- maintaining high salinity levels following rainfall and flooding events;
- maintaining PVC covers on bitterns;
- removing fish and crustaceans from ponds; and
- provision of bird spike on new ancillary infrastructure.

2.2.3 Contaminated Sites Act 2003 Basic Summary of Records Search Response

The site the applicant is leasing; Lot 267 on plan 93179; is considered 'Possibly contaminated, investigation required' under the *Contaminated Sites Act 2003* (Figure 9). From investigations carried out between April 2009 and February 2015 over 30 areas, hydrocarbons of diesel and petrol were often detected in localised spills in the soil. Staining from oil and fuel spills were observed outside of bunding at four areas.

Groundwater contaminated from diesel hydrocarbons, pure diesel, and metals (lead, copper, nickel and zinc) were detected at seven areas. In six of those areas, groundwater abstraction is

not permitted. Three contaminated groundwater areas appeared to show a decline in 2014. Three other areas did not find groundwater contamination. For the rest of the areas, groundwater was not sampled.

There was one tested occurrence of volatile hydrocarbons.

Surface water investigations carried out in 2010 did not identify evidence of contamination. No sediment sampling has been carried out therefore sediment quality is not known.

Concentration of contaminants have been found to exceed adopted assessment levels; however further investigation is required.

The area appears suitable for continued commercial and industrial use. As there are grounds to indicate possible contamination of the site and surface water, sediment and groundwater has not been fully investigated, the site is classified as 'possibly contaminated – investigation required'. Further investigation should be carried out in unsampled areas.

2.2.4 Exemption of planning and development approval

The applicant engaged the City of Karratha to seek exemption from planning and development approval. The applicant commissioned legal advice which confirmed their proposal, meets clause 1.2 (c) (iii) section 8 of the *Mining Act 1978* which clearly states that extraction of minerals from the sea or natural waters is defined as Mining Operations and requires a mining lease.

The processing plant is located on Mining Lease tenure and the storage pond is on aquaculture tenure. Both of these tenures are exempt from planning and development requirements. Building licences will be required before construction commences, however.

The City of Karratha recognises the applicant's operations and states once the mining lease has been granted by the mining warden then the applicant is exempt from the need for development approval under the City's Local Planning Scheme No. 8.

Development approval would only be required for the installation of utilities, access ways and signage etc., outside the premises boundary.

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 Guideline: Risk Assessments (DWER 2020).

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 construction and commissioning which have been considered in this decision report are detailed in Table 1 below.

Table 1 also details the control measures the applicant has proposed to assist in controlling these emissions, where necessary.

Table 1: Proposed applicant controls

Sources	Emission	Potential pathways	Proposed controls
Construction			
Earthworks and construction of demonstration plant	Dust	Air / windborne pathway	Apply Dustmag suppressant.
	Noise		Equipment design for noise reduction.
Commissioning			
Vehicle movements	Dust	Air / windborne pathway	Apply Dustmag suppressant.
Vehicle movements	Noise	Air / windborne pathway	Equipment design for noise reduction.
Processing of bitters into concentrated magnesium products at the Demonstration Plant.	Flue gas and combustion products from rotary kiln/dryer, kiln, generator and CCM calciner (Figure 10) containing a net of CO ₂ . Mass of flue discharge from rotary kiln/drying calciner 612 kg/h and from CCM calciner 304 kg/h.	Air / windborne pathway	<ul style="list-style-type: none"> No controls provided. CO₂ production unlikely to exceed 100,000 tonnes of CO₂ per year.
	Spill of soda ash, acids and other chemicals	Direct spill to land, causing pH changes	<ul style="list-style-type: none"> Sodium carbonate in powder form that will be transported in bulk bags by trucks to the facility and stored in storage shed. Sodium carbonate required for plant operation will be loaded into a storage silo. Caustic soda solution will be trucked to site and stored in bunded storage tanks. Citric acid, Fumaric acid, and Glycine will come to site in bagged powder form to be mixed with process water for precipitation of organic magnesium compounds. Lactic acid will arrive as a solution in 1000L bulk

			<p>containers.</p> <ul style="list-style-type: none"> • Hydrochloric acid solution that will be transported in bulk containers by truck to the facility and stored in the chemical storage shed. • Desalination unit chemicals will be kept in the chemical storage shed. These chemicals will include membrane cleaners and detergents, scale inhibitors and anti-scalants, corrosion inhibitors, de-chlorinators, and flocculants. • An enclosed chemical storage building will be constructed on concrete with a bunded slab on grade. The building will be designed with bunding to capture accidental release in a manner that mitigates any release to the environment.
	Spill of saline process materials or spent liquor (saline; alkaline)	Direct discharge to land	<p>Storage solution tanks (3 x 22,500 L and 2 x 3,000 L) are on concrete pads, will be bunded and sumps included. Sump pumps will return solution to its source or to the spent bitterns evaporation pond.</p> <p>Tanks include:</p> <ul style="list-style-type: none"> • Bitterns holding tank (27,500 L polyethylene heavy duty tank). Level sensor to prevent overflowing. Overflow pipe to concrete sloped floor. • Soda ash preparation (6,000 L carbon steel tank). Level sensor. Overflow outlet. • Precipitation x 3 (3,000 L polyethylene heavy duty tank). Overflow outlet. • Filtrate tanks x 2 (6,000 L polyethylene heavy duty tank). Overflow outlet. • Waste liquor holding tank (27,500 L polyethylene heavy duty tank). • 500,000 L lined panel tanks for holding seawater, process water and fire water. Positioned on concrete ring beams, with an internal sand base. Level sensors will be installed to prevent overflowing.
	Disposal of spent Bitterns/liquor to Spent Bitterns' Evaporation Pond	Overflow to land	The overflow of the pond will be modified during construction so that overflowing solution will report to Rainstorms adjacent HDPE lined bitterns concentration pond.
		Seepage to land	The evaporation pond is earthen lined with a graded mixture of sand, silt and clayey fines. Permeability is expected to be up to $1.0 \times 10^{-9} \text{ m.s}^{-1}$.
	Dust	Air/windborne pathway	Utilisation of a dust collection and baghouse filter that remove particles down to 2 microns. The filters incorporate an automatic process air dump cycle.
	Discharge of contaminated stormwater	Discharge to land	Surface water and stormwater drainage systems will be appropriately designed to prevent contaminated stormwater from mixing with uncontaminated stormwater. Uncontaminated stormwater will be directed away from the processing areas, while contaminated stormwater will be collected and drained to the spent bitterns evaporation pond. This pond will act as an event pond. A drainage plan will be available at the end of the detailed design process.
	Noise	Air / windborne pathway	Equipment design for noise reduction.

	Odour	Air / windborne pathway	<ul style="list-style-type: none"> • Sodium carbonate in powder form that will be transported in bulk bags by trucks to the facility and stored in storage shed. Sodium carbonate required for plant operation will be loaded into a storage silo; • Caustic soda solution will be trucked to site and stored in bunded storage tanks; • All tanks will be constructed as per Australian design standards and relevant dangerous goods legislation. • Citric acid, Fumaric acid, and Glycine will come to site in bagged powder form to be mixed with process water for precipitation of organic magnesium compounds; • Lactic acid will arrive as a solution in 1000L bulk containers; • Hydrochloric acid solution that will be transported in bulk containers by truck to the facility and stored in the chemical storage shed; • Desalination unit chemicals will be kept in the chemical storage shed. These chemicals will include membrane cleaners and detergents, scale inhibitors and anti-scalants, corrosion inhibitors, de-chlorinators, and flocculants; and • An enclosed chemical storage building will be constructed on concrete with a bunded slab on grade. • At the lowest point of the plant a sump will be built. This will gravity drain to the Spent Bitterns evaporation pond. <p>The building will be designed with bunding to capture accidental release in a manner that mitigates any release to the environment.</p>
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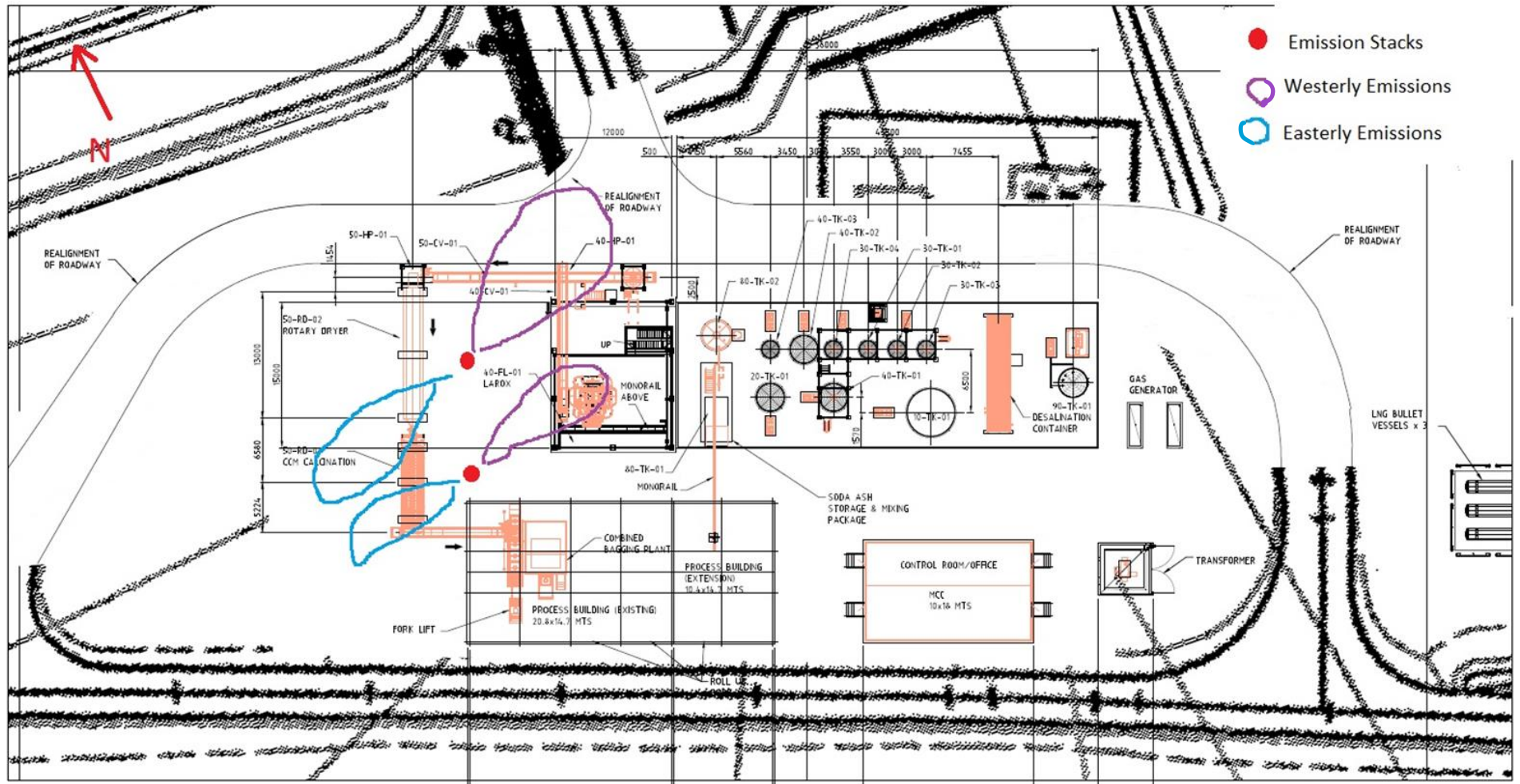


Figure 10: Point source emission locations from the Rotary Dryer/Kiln and the CCM Calciner.

3.1.2 Receptors

In accordance with the Guideline: Risk Assessment (DWER 2020), the Delegated Officer has excluded the applicant's employees, visitors, and contractors from its assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation.

Table 2 and **Figure 11** below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises (Guideline: Environmental Siting (DWER 2020)).

Table 2: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors ¹	Distance from prescribed activity
Accommodation facility for Rainstorm Dust Control facility (typically accommodates up to 5 people)	>300 m from proposed EcoMag plant
Environmental receptors ²	Distance from prescribed activity
Remnant native vegetation	Adjacent to premises

Note 1: The Karratha Airport infrastructure is largely outside of the 1 km radius from the processing plant (Figure 12). The solar plant is located within the 1 km buffer at 970 m to the southwest.

Note 2: Groundwater is saline and tidally influenced, therefore of similar composition to the process materials. Surface water flow has been heavily modified by existing Dampier Salt operations, and the nearest surface water feature is the Bitterns channel. There is no planned discharge to surface water. Soils on site are known to be contaminated. UDRs apply.

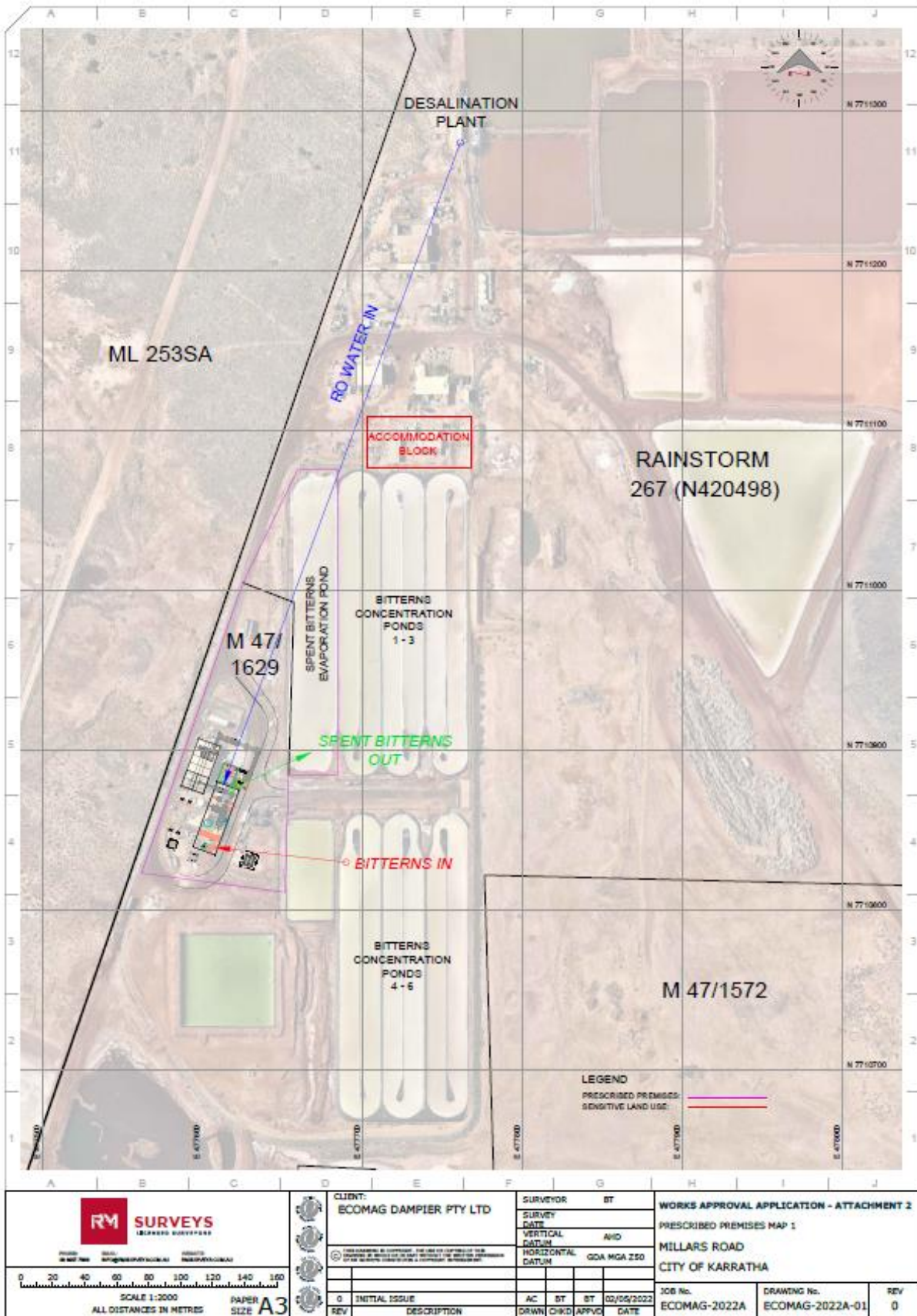


Figure 11: Distance to residential receptor

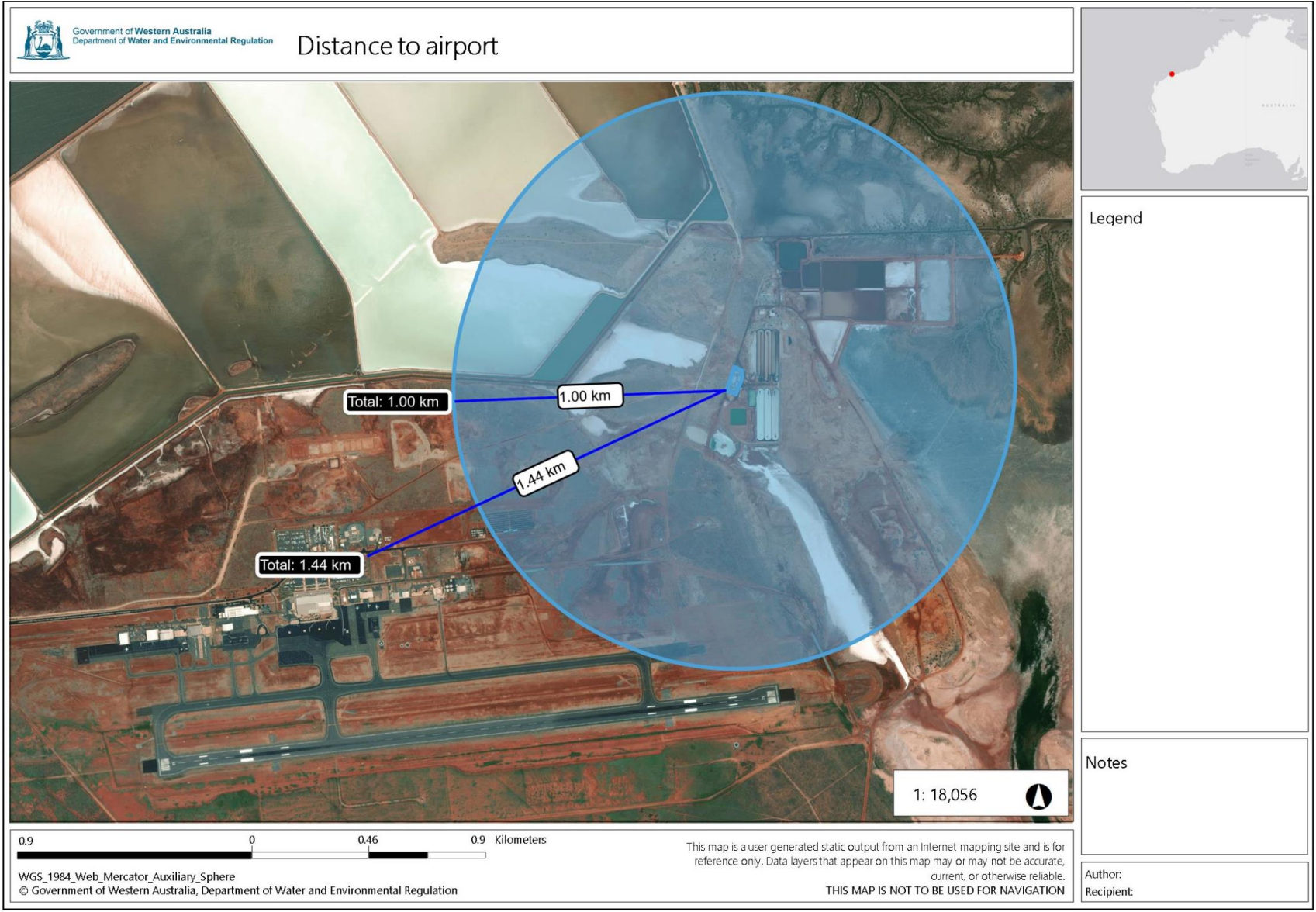


Figure 12: Distance to Karratha airport

Works Approval: W6711/2022/1

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3.2 Risk ratings

Risk ratings have been assessed in accordance with the Guideline: Risk Assessments (DWER 2020) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the applicant 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 applicant's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the works approval as regulatory controls.

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 3.

Works approval W67112022/1 that accompanies this decision report authorises construction and commissioning. The conditions in the issued works approval, as outlined in Table 3 have been determined in accordance with Guidance Statement: Setting Conditions (DER 2015).

Table 3: Risk assessment of potential emissions and discharges from the premises during construction and commissioning.

Risk events					Risk rating ¹ C = consequence L = likelihood	Applicant controls sufficient?	Conditions ² of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
Construction								
Earthworks and construction of demonstration plant	Dust	Air / windborne pathway causing impacts to health and amenity	Accommodation facility for Rainstorm Dust Control facility (>300 m)	Refer to Section 3.1	C = Minor L = Unlikely Medium Risk	Y	Condition 1 – dust management.	Condition 1(c): Strong wind conditions may reduce the effectiveness of suppressants and dust collection methods.
	Noise			Refer to Section 3.1	C = Minor L = Rare Medium Risk	Y	N/A	N/A
Commissioning								
Vehicle movements	Dust	Air / windborne pathway causing impacts to health and amenity	Accommodation facility for Rainstorm Dust Control facility (>300 m)	Refer to Section 3.1	C = Minor L = Unlikely Medium Risk	Y	Condition 1 – dust management.	Condition 1(c): Strong wind conditions may reduce the effectiveness of suppressants and dust collection methods.
Processing of bitters into concentrated magnesium products	Flue gas and combustion products (18 kg/h or 3% CO ₂ and 593 kg/h or 97% H ₂ O) from rotary kiln and kiln generator.	Air / windborne pathway contributing to the greenhouse gas effect.	Remnant native vegetation Accommodation facility for Rainstorm Dust Control facility (>300 m)	Refer to Section 3.1	C = Slight L = Rare Low Risk	Y	Conditions 6 & 7 - commissioning requirements Condition 8 – authorised emission point from rotary kiln/dryer and kiln generator.	N/A, CO ₂ production unlikely to exceed 100,000 tonnes of CO ₂ per year.
	Flue gas and combustion products (192 kg/h or 63% CO ₂ and 111 kg/h or 37% H ₂ O) from the calciner.				C = Slight L = Rare Low Risk			
	Spill of soda ash, acids and other chemicals	Direct spill to land, causing pH changes	Remnant native vegetation	Refer to Section 3.1	C = Slight L = Rare	Y	Condition 3 – design and construction requirements for	<i>Spills / leaks of chemicals also regulated by the</i>

Works Approval: W6711/2022/1

					Low Risk		chemical storage building and waste bitterns evaporation ponds.	<i>Unauthorised Discharge Regulations (2004)</i>
Spill of saline process materials or spent liquor (saline; alkaline)	Direct discharge to land soaking into the root zone of vegetation, causing degradation.	Remnant native vegetation	Refer to Section 3.1	C = Slight L = Rare	Low Risk	Y	Conditions 6 & 7 - commissioning requirements	
Discharge of spent bitterns to evaporation pond.	Overflow to land soaking into the root zone of vegetation, causing degradation.	Remnant native vegetation	Refer to Section 3.1	C = Slight L = Unlikely	Low Risk	Y	Conditions 8, 9 and 10 – monitoring during environmental commissioning	
	Seepage to land soaking into the root zone of vegetation, causing degradation.	Remnant native vegetation	Refer to Section 3.1	C = Minor L = Unlikely	Medium Risk	Y	Conditions 4 & 5, 11 – 15 – compliance and commissioning recording and reporting requirements	
Dust	Air/windborne pathway causing impacts to health or amenity	Accommodation facility for Rainstorm Dust Control facility (>300 m)	Refer to Section 3.1	C = Slight L = Rare	Low Risk	Y	Condition <u>1</u>	Condition 1: Inclusion of dust suppression and collection controls provided by the applicant.
Discharge of contaminated stormwater	Discharge to land soaking into the root zone of vegetation, causing degradation.	Remnant native vegetation Accommodation facility for Rainstorm Dust Control facility (>300 m)	Refer to Section 3.1	C = Minor L = Unlikely	Medium Risk	Y	Condition 2	<u>Condition 2:</u> Inclusion of stormwater condition equivalent to applicant's controls.
Noise	Air/windborne pathway causing impacts to health or amenity	Accommodation facility for Rainstorm Dust Control facility (>300 m)	Refer to Section 3.1	C = Minor L = Unlikely	Medium Risk	Y	N/A	N/A
Odour	Air/windborne pathway causing impacts to health or amenity	Accommodation facility for Rainstorm Dust Control facility (>300 m)	Refer to Section 3.1	C = Slight L = Rare	Low Risk	Y	N/A	N/A

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the Guideline: Risk Assessments (DWER 2020).

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

4. Consultation

Table 4 provides a summary of the consultation undertaken by the department.

Table 4: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 9 August 2022.	None received.	N/A
City of Karratha was advised of proposal on 10 August 2022.	On 9 September 2022, the City of Karratha advised the department a development approval is required on Lot 267 unless they are granted a Mining Lease from DMIRS, in accordance with the City's Local Planning Scheme No.8. The applicant has an application pending with DMIRS for Mining Lease M47/1629. Until the Mining Lease is granted or if the Mining Lease is not granted, then any use and/or works at the site are likely to require development approval in accordance with the Scheme.	Noted.
Water Corporation was advised of proposal on 23 September 2022.	On 7 October 2022, Water Corporation advised the department, they are continuing to work with the applicant to understand the implications of the proposal in the context of the requirements established by Ministerial Statements 567 and 594. As such, Water Corporation is not able to comment on whether the proposal is consistent with Ministerial Statements 567 and 594 at this time. Water Corporation is anticipating on developing a better understanding of the implications of the proposed brine disposal in the coming months.	Noted.
Applicant was consulted with options to proceed with application on 10 October 2022.	On 10 October 2022, the applicant considered the possibility of withdrawing the application until a third-party agreement for concentrated brine disposal has been finalised, compared to continuing the application with a reduced scope which omits any proposal to dispose of brine waste to the environment. The applicant chose to continue with the application with a reduced scope to allow construction of assets and commissioning only.	Noted. DWER advises that further applications / approvals will be required for any proposal to discharge brine waste from the premises to the environment.
Applicant was provided with draft documents on 27 October 2022.	On 7 November 2022 the applicant provided comment on the draft documents. Details of the comments are in Appendix 1: Summary of applicant's comments on risk assessment and draft conditions.	DWER updated the draft documents based on the comments provided. Please refer to Appendix 1: Summary of applicant's comments on risk

		assessment and draft conditions.
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5. Conclusion

Based on the assessment in this decision report, the delegated officer has determined that a works approval will be partially granted to allow construction and commissioning phases only, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

References

1. ABC News 2013, Aurora Algae casts doubt over multi-million dollar farm in Pilbara.
2. Department of Environment Regulation (DER) 2015, Guidance Statement: Setting Conditions, Perth, Western Australia.
3. Department of Water and Environmental Regulation (DWER) 2020, Guideline: Environmental Siting, Perth, Western Australia.
4. DWER 2020, Guideline: Risk Assessments, Perth, Western Australia.
5. O2 Environment 2021, EcoMag Bitterns Assessment.
6. O2 Marine 2021, Bitterns Ecotoxicity Assessment for EcoMag Limited.
7. Biodiversity Australia 2019, EcoMag and WRS Bioproducts wildlife hazard risk assessment. Karratha WA.

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

Condition	Summary of applicant's comment	Department's response
3, table 1, item 1.	<p><i>Is there a sump? Where does everything drain to?</i></p> <p>A sump will be positioned in the corner of the chemical storage building, and floor drains will be report here. Any spillages will be either pumped to a process tank or to the waste liquor evaporation pond. In the event of power failures or heavy rain, excess solution will overflow to another sump at the lowest point on the plant layout. This will then gravity drain to the waste liquor pond via a pipe and/or concrete channel.</p>	Sump details included.
3, table 1, item 2.	<p><i>Applicant to address whether pumps are connected to pipelines?</i></p> <p>A tanker filling pump will draw solution from the waste liquor pond, and delivery it to a tanker via quick connect flexible rubber hoses. This pump will not be connected to any pipelines.</p> <p><i>What type of liner exists in the pond?</i></p> <p>The pond floor and embankments are made up of a well graded mixture of sand, silt and clayey fines. Up to recently, the pond has been used for the storage of bitterns over many years. No leakage has been detected during this use. The permeability of the earthen liner is expected to be $<1.0 \times 10^{-9} \text{ m.s}^{-1}$.</p> <p><i>Design / operational freeboard?</i></p> <p>A 100 mm freeboard, with overflow to Rainstorms HDPE lined bitterns pond will be incorporated into the design.</p>	Pumping, liner specifications and freeboard details included.
7, table 2, item 1.	<p><i>Re: Have the dryer and kiln have been constructed?</i></p> <p>No, these will be constructed as part of the plant per this Works Approval when approved.</p>	Table 1 updated to include dryer and calciner as item 3.
7, table 2, item 3	<p><i>Verify transport systems?</i></p> <p>The reagents will arrive to site in either bulk bags or via tanker trailers. The bulk bags will be stored in the chemical shed. If the reagents arrive via tankers, the material will be stored in dedicated silos that incorporate dust filters. The reagents are dissolved in process water before being used in the recovery process. The magnesium products will be stored in silos before being packaged in bulk bags or smaller 20 kg bags.</p>	<p>Bulk handling details included.</p> <p>Condition 13(c)(iii) updated.</p>
9, table 4	<p>The discharge target for the spent bitterns shown in Table 4 of the Works Approval draft, are inconsistent with the processing characteristics of the plant discharge. The correct figures for the pH and conductivity are listed below.</p>	Target values for pH and conductivity updated.

Condition	Summary of applicant's comment			Department's response
	Parameter	Target	Units	
	pH	<10.5		
	Conductivity	135	µS/cm	
Decision Report Page 1 – 2, 5	<p><i>Applicant please clarify the input and output ponds offsite using the terms 'Bitterns Concentrator Pond' (and which number) and whether the 'Spent Bitterns Evaporation Pond' as per Figure 2 below, is used at all. The application sounds like only "off-site" ponds are used and the "on-site" pond is not. A figure showing the pumps connecting the ponds and the demonstration plant would also be useful.</i></p> <p>The plant feed bitterns (BITTERNS IN) are pumped from Bitterns Concentration Pond # 4 (off-site) to the processing plant. Waste liquor from the processing plant is pumped to the Spent Bitterns Evaporation Pond (on-site). Refer to Figure A for solution flow outline.</p>			Text updated with clarifications. Inclusion of Figure 3.
Note 1 Table 1, Page 15	<p><i>Ecomag to provide details of flue gas species composition / concentrations and provide a map showing point source emission to air locations (stacks).</i></p> <p>The flue gas compositions are displayed in Table A.</p> <p>A map showing the approximate locations of the stacks and emissions directions during predominant wind directions are displayed in Figure B.</p>			Text updated to include flue composition and figure 10 (pg 18).
Note 2, Table 1, Page 16	<p><i>Spill of saline ... liquor. Are the tanks stored on the concrete pad? What type of tanks? Size? Design details? Control to prevent overflows / spills / leaks etc?</i></p> <p>All process tanks containing bitterns, spent bitterns or soda ash solution, will be positioned on concreted pads located within bunded areas that have sumps to collect spillages, from where sump pumps will return the solution to its source or direct to the spent bitterns evaporation pond.</p> <p>List of tanks:</p> <ul style="list-style-type: none"> • Bitterns holding tank (27,500 L polyethylene heavy duty tank). Level sensor to prevent overfilling. Overflow pipe to concrete sloped floor. • Soda ash preparation (6,000 L carbon steel tank). Level sensor. Overflow outlet. • Precipitation x 3(3,000 L polyethylene heavy duty tank). Overflow outlet • Filtrate tanks x 2 (6,000 L polyethylene heavy duty tank). Overflow outlet • Waste liquor holding tank (27,500 L polyethylene heavy duty tank). <p>Other tanks will hold seawater, process water and fire water and will be positioned on concrete ring beams, with an internal sand base. These are 500,000 L lined panel tanks. A level sensor will be installed to prevent overfilling.</p>			Text updated to include bunding, sump, tank and evaporation pond overflow details. Updated Works Approval condition 3, Table 1 as item 4.

Condition	Summary of applicant's comment	Department's response
<p>Note 3 Table 1, Page 16</p>	<p><i>Disposal of spent Bitterns/liquor to Spent Bitterns' Evaporation Pond.</i></p> <p>Confirming that spent bitterns evaporation pond is the correct name.</p> <p>The overflow of the pond will be modified during construction so that overflowing solution will report to Rainstorms adjacent HDPE lined bitterns concentration pond.</p> <p>The pond floor and embankments are made up of a well graded mixture of sand, silt and clayey fines. Up to recently, the pond has been used for the storage of bitterns over many years. No leakage has been detected during this use. The permeability of the earthen liner is expected to be $<1.0 \times 10^{-9} \text{ m.s}^{-1}$.</p>	<p>Text updated to include Spent Bitterns' Evaporation Pond details.</p>
<p>Note 4 Table 1, Page 16</p>	<p><i>Dust. Applicant to confirm type of filter? What size particulates will it remove?</i></p> <p>The baghouse will include filter elements that remove particles down to 2 microns. The filters incorporate an automatic process air dump cycle.</p>	<p>Text updated to include dust filter details.</p>
<p>Note 5 Table 1, Page 17</p>	<p><i>Discharge of contaminate stormwater. Applicant to provide further details on drainage design including drainage plan for the site.</i></p> <p>The design intent will be to prevent contaminated stormwater from mixing with uncontaminated stormwater. Uncontaminated stormwater will be directed away from the processing areas, while contaminated stormwater will be collected and drained to the spent bitterns evaporation pond. This pond will act as an event pond.</p> <p>A drainage plan will only be available at the end of the detailed design process.</p>	<p>Text updated to include drainage details of contaminated stormwater. We note that a drainage plan will be submitted prior to construction and has been inc.</p>
<p>Note 6 Table 1, Page 17</p>	<p><i>Please confirm if storage tanks constructed as per the Dangerous Goods legislation or other design standards (e.g. Australian Standards)? Please confirm where grade drains to. Is there a sump / collection point?</i></p> <p>All tanks will be constructed as per Australian design standards and relevant dangerous goods legislation.</p> <p>At the lowest point of the plant a sump will be built. This will gravity drain to the Spent Bitterns evaporation pond.</p>	<p>Text updated to include construction standards and sump details.</p>

Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)	
Application type	
Works approval	<input checked="" type="checkbox"/>
Date application received	17/05/22
Applicant and premises details	
Applicant name/s (full legal name/s)	EcoMag Dampier Pty Ltd (106 MADDINGTON ROAD, MADDINGTON WA 6109) (ACN on application form different to ASIC extract – RFI confirmed correct ACN is 622 727 208)
Premises name	N/A
Premises location	Part of Lot 267 on deposited plan 93179. Shape file provided.
Local Government Authority	City of Karratha
Application documents	
HPCM file reference number:	DER2022/000212
Key application documents (additional to application form):	<ul style="list-style-type: none"> Evidence of legal occupation - Ancillary Land-Use and Compensation Agreement (but only covers part of the Prescribed Premises) Proposed activities (Attachment 3B) Waste details (Attachment 6A and 6B)
Scope of application/assessment	
Summary of proposed activities or changes to existing operations.	<p>Works approval</p> <p><u>Construction</u> of a 'demonstration magnesium recovery plant' to process bitters (waste product from nearby Dampier Salt Limited operations) into a high purity magnesium products, for export. Liquid waste product will be trucked off site and disposed of via the Water Corporation Multi User Brine Return Line in King Bay.</p> <p><u>Commissioning</u> of the above</p> <ul style="list-style-type: none"> - Pre-commissioning inspections. - Dry commissioning (powered but not material flow). - Water commissioning – check for leaks and flow rates. - Wet Product commissioning – plant operating with feed. <p><u>Operations under time limited operations</u></p>

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)

Category number/s (activities that cause the premises to become prescribed premises)

Table 1: Prescribed premises categories

Prescribed premises category and description	Proposed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 31 Chemical Manufacturing: premises (other than premises within category 32) on which chemical products are manufactured by a chemical process.	7000 tonnes per year (of Magnesium Compounds; based on 1000 tonnes of contained Magnesium).	[Cat. 31] Applied for. But I suggest this is not required as per email: "Chemical manufacturing is the manufacture of completely different chemicals, and it should have a chemical reaction. I do not think this is applicable here. Seems to be more of a refining process."
Category 61 Liquid Waste facility: premises on which liquid waste produced on other premises (other than sewerage waste) is stored, reprocessed, treated or irrigated.	34,000 tonnes per year (Liquid Brine Feed)	

Legislative context and other approvals

Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referral decision No: Managed under Part V <input type="checkbox"/> Assessed under Part IV <input type="checkbox"/>
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Ministerial statement No: EPA Report No:
Has the proposal been referred and/or assessed under the EPBC Act?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Reference No:
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	'Ancillary Land Use and Compensation Agreement', and details of Rainstorm lease provided. Schedule 1 defines an area that does not appear to cover all of the premises. Proof of occupier status required for the remaining area – Rainstorm evaporation pond. Or alternatively, this area could be excluded (if source area only, and no processing activities occur here) No expiry date: expiry is dependent on other approvals – clause 7.1 of 'Ancillary Land Use and Compensation Agreement' Proof of access provided in

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)		
		response to RFI – DWERDT633617
Has the applicant obtained all relevant planning approvals?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>	Approval: Expiry date: If N/A explain why? Mining tenure. LGA advice that planning permission is not required provided in attachment.
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	CPS No: N/A No clearing is proposed.
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Application reference No: N/A Licence/permit No: N/A No clearing is proposed.
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Application reference No: Licence/permit No: Licence / permit not required.
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Waste brine to be trucked off site and discharged into King Bay via the Water Corporation's multi user brine disposal line. An assessment is provided in Attachment 6A. LO will need to check that risks are adequately covered by Ministerial Statements 567 and 594.
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Name: N/A Priority: N/A Are the proposed activities/ landuse compatible with the PDWSA (refer to WQPN 25)? Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>
Is the Premises subject to any other Acts or subsidiary regulations (e.g. Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxxx)	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Mining Act 1978
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Is the Premises subject to any EPP requirements?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)

Is the Premises a known or suspected contaminated site under the Contaminated Sites Act 2003?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Classification: possibly contaminated – investigation required (PC–IR) Date of classification: 16/9/2015
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