



Application for Licence Amendment

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

Licence Number	L6465/1989/10
Licence Holder	Alcoa of Australia Limited
ACN	004 879 298
File Number	2010/007470-1
Premises	Willowdale Mine Part of Mineral Lease 1SA As defined by the premises maps attached to the issued licence L6465/1989/10
Date of Report	20 February 2024
Decision	Revised licence granted

**A/SENIOR MANAGER, RESOURCE INDUSTRIES
REGULATORY SERVICES**

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

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1. Decision summary

Licence L6465/1989/10 is held by Alcoa of Australia Limited (Licence Holder) for the Willowdale Mine (the Premises), located at Mineral Lease 1SA, Willowdale Road, Waroona WA 6215.

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 construction and operation of works at the Premises. As a result of this assessment, Revised Licence L6465/1989/10 has been granted.

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 Application summary

On 15 June 2023, the Licence Holder submitted an application to the department to amend Licence L6465/1989/10 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). This amendment is limited only to changes to activities related to Category 5 activities from the Existing Licence.

The Premises is an operational bauxite mine comprised of three main mining areas; Orion, Arundel and Larego (Figure 1). The Orion area is no longer being actively mined but has remaining infrastructure that is being progressively decommissioned. Active mining and ore processing activities occur at both Arundel and Larego mining areas.

Per- and poly-fluoroalkyl substances (PFAS) contamination was identified at the Premises in 2019 as a result of historical mobile equipment fire suppression systems that were used on site (now phased out of use). PFAS contamination has been identified at Orion and Arundel, in soils and stormwater currently stored in sumps and dams onsite.

The amendment applied for is to construct and operate a water treatment system at the Arundel mining area to treat up to 219 megalitres (ML) of contaminated water per year. The main contaminants of concern to be treated are PFAS and hydrocarbons within stormwater from Arundel and Orion mining areas. The Licence Holder is proposing the following:

Construction

- PFAS Treatment Unit (PTU) located at the Arundel area of the Premises
- New stormwater collection pond and oil/water separator at the Arundel workshops
- Pipelines transporting water containing PFAS from Arundel operational areas to the PTU
- Proposed Upgrade to Arundel Anpress Pre-treatment Sump (ASP) at Arundel
- Proposed construction of a new 1.5ML Anpress Pre-Treatment Sump (ASP3) at Arundel

Operation

- Treatment of PFAS and hydrocarbon-contaminated water from workshops at Arundel via oil/water separation units
- Collection of contaminated stormwater (including treated water from oil/water separation units) from Arundel for redirection to Arundel Pre-treatment Dams APTD-001 and APTD-002
- Transport of PFAS-contaminated water from Orion Sump 3 to Arundel Pre-treatment Dams APTD-001 and APTD-002 via public roads using licensed controlled waste

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- carriers (trucking route shown in Figure 1)
- Collection of PFAS contaminated water into the two Pre-treatment Dams
- Treatment of collected water in the two Pre-treatment Dams via a PTU
- Storage of treated water within Treated Water Dams 1, 2 and 3
- Discharge of treated water to McKnoes Brook discharge point

The proposed treatment process is depicted in Figure 2. The locations of the proposed PTU and treated water discharge point are shown in Figure 1.

Operations at the Larego mining area were risk assessed in 2019. As part of this amendment, conditions referring to the Larego infrastructure have been updated from construction conditions to operational conditions and outstanding controls relating to the management of noise emissions assessed under the 2019 assessment have been reviewed and updated (see section 2.3).

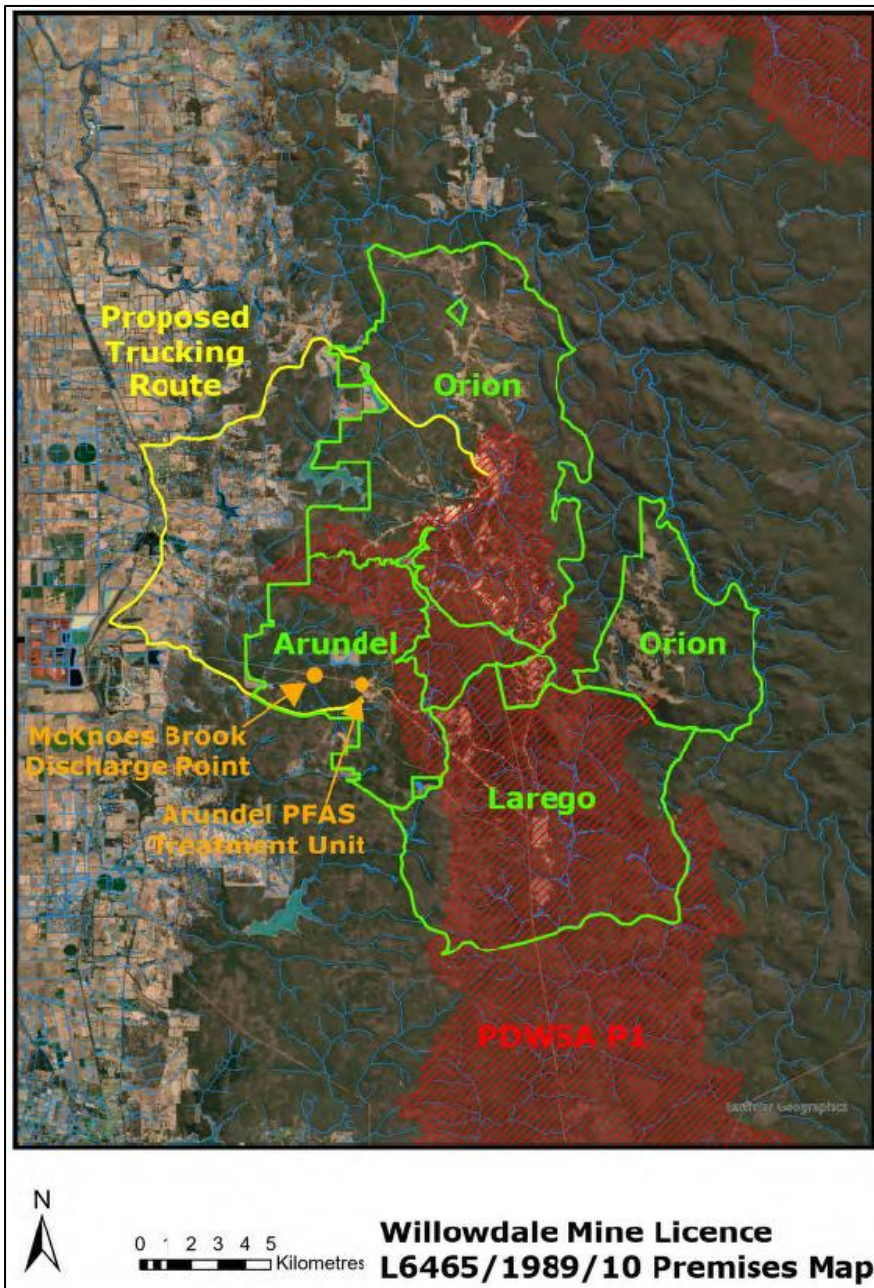


Figure 1: Arundel, Orion and Larego mining areas and proposed PFAS treatment plant and treated water discharge point

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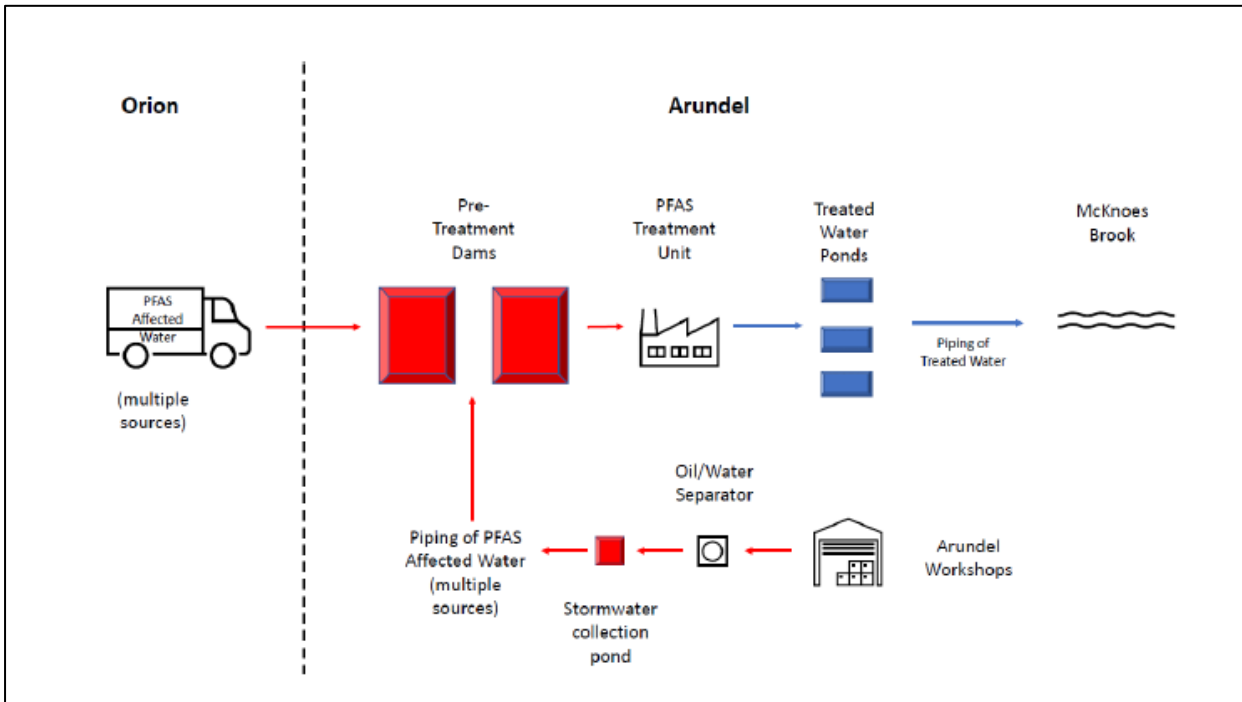


Figure 2: Overview of proposed PTU process

2.3 DWER initiated amendment

The Delegated Officer has taken the opportunity to review the existing conditions of licence L6465/1989/10 as part of this amendment, to remove redundant conditions and review outstanding compliance actions, such as Specified Actions that required noise investigations and actions to ensure ore processing operations can comply with the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations).

The amendment to L6465/1989/10 in May 2020 authorised the relocation of a rock (ore) crusher from the Orion mining area to the Larego mining area. A new overland ore conveyor from Larego to Arundel, and ore transfer station at Arundel was also approved. The Licence Holder has submitted noise monitoring data performed in March 2022, which found that noise emissions from the new conveyor and transfer station are exceeding the assigned nighttime noise levels in the Noise Regulations at the nearest residential receptor. As a result, noise attenuation controls are required to be implemented to achieve compliance and ensure protection of the receptor. The Licence Holder’s proposed controls to manage noise emissions from the conveyor and transfer station, as well as the new PTU, are further discussed in Table 2 (Controls) and Table 4 (Risk Assessment).

2.4 Background

The Licence Holder operates the Premises located in the Shire of Waroona, under prescribed premises licence L6465/1989/10.

The Orion mining area is located within the Samson Brook Priority 1 Public Drinking Water Source Area (PDWSA) as shown in Figure 1 and is connected to the Arundel mining area via an infrastructure corridor that traverses the Reservoir Protection Zone for the Samson Brook PDWSA. This corridor includes a causeway that crosses the southern section of the Lake Kabbamup (Sampson Dam) Reservoir.

The Orion mining area no longer produces ore and the crushing infrastructure that was established there has been transferred to the Larego area of the Premises. There are

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rehabilitation operations occurring within the Orion area and the stormwater, washdown bay and general surface runoff is still being collected in sumps OS1-OS3 as shown in Figure 3. OS4 is currently unlined and not in use due to the risks this would pose from seepage of PFAS-contaminated stormwater within the P1 PDWSA.

Active mining is occurring at the Arundel mining area, which is not located in the Samson Brook P1 PDWSA. Oily wastewater from the Arundel workshops, fuel bays and vehicle washdown facilities are currently collected and treated via a Dissolved Air Flotation (DAF) system to remove hydrocarbons to meet authorised limits specified in licence L6465/1989/10 prior to flowing through a series of dams and then discharging to McKnoes Brook.

The Licence Holder submitted a works approval application under Part V of the EP Act in March 2022 seeking approval to construct a PFAS water treatment unit (PTU), along with dams and pipelines, to treat PFAS-impacted water stored at Orion and Arundel mining areas and discharge that treated water to the environment.

The works approval application was withdrawn when it was found that Alcoa had constructed a significant amount of the infrastructure applied for and the transport of PFAS contaminated water across the Samson Brook Reservoir was inconsistent with the DWER's policy *Land use compatibility in public drinking water source areas* (August 2021).

The new application to amend licence L6465/1989/10 seeks approval to construct the remaining infrastructure associated with the PTU but has removed the proposal to pipe or truck PFAS contaminated water across the Samson Reservoir. The new application also proposes to construct a new oil/water separator and associated dams and sumps to service contaminated water generated from workshops and washdown facilities at the Arundel mining area.



Figure 3: Orion mining area – sumps OS1, OS2 and OS3 (sump OS4 is out of service)



Figure 4: Arundel mining area - sumps, pre-treatment dams and treated water ponds

2.5 Contaminated stormwater management

2.5.1 Current infrastructure

The Licence Holder has identified the following sources of contaminated water from active mining areas:

- Haulage road drains;
- Washdown bays (hydrocarbon treated first via oil/water separators); and
- General surface water runoff.

An assessment of these sources, as well as previous geochemical assessments of the ore at the Premises, has identified the following potential contaminants of concern:

- Heavy metals: chromium (Cr), copper (Cu) and zinc (Zn);
- Suspended solids;
- Oil and grease;
- Total Recoverable Hydrocarbons (TRH);
- Polycyclic Aromatic Hydrocarbons (PAH)
- Benzene, Toluene, Ethylbenzene, Xylene (BTEX); and
- PFAS.

The stormwater runoff is collected via drainage systems and sumps throughout the mining operations and contained within storage points at the Orion and Arundel sites. Larego is not believed to have been impacted by the PFAS contamination as the use of the firefighting foams containing PFAS was being phased out as Larego was being established.

The Orion sumps collect stormwater from the Orion operational area with the collected water flowing from OS1 to OS3. Sump OS4 intersects the groundwater when it rises due to rainwater. Due to risks posed by contaminants of concern, OS4 is no longer discharged to and will therefore be removed from the licence as a discharge point. OS1 and OS2 are not lined,

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however, OS3 is lined, and is the sump from which water will be pumped into trucks and transported for treatment at the PTU at Arundel. Currently water is pumped into trucks when required to maintain freeboard. This PFAS contaminated water is transported under the *Environmental Protection (Controlled Waste) Regulations 2004* to an offsite facility licensed to accept the waste for treatment.

Oily wastewater from the Arundel workshops, fuel bays and vehicle wash down facilities are collected in the Anpress Pre-treatment Sump and treated via a Dissolved Air Flotation (DAF) treatment system (the Anpress) to remove hydrocarbons to meet the limits stipulated in Licence L6465/1989/10. Treated water is piped to sump AP1 with the collected water flowing from AP1 through AP2 and AP3 to AP4 which are shown in Figure 4. The water in sump AP4 is pumped to the Arundel Pre-treatment Dams. Sump AP5 is no longer discharged to but intersects the groundwater when it rises due to rainwater, this sump will also be removed from the licence as a discharge point.

The Boneyard Sumps collect stormwater runoff from the Arundel facilities area, including the conveyor system and transfer station located to the north east. Water enters Boneyard Sump 1, once this sump reaches a certain level the overflow is conveyed to Boneyard Sump 2, water subsequently flows to Boneyard 3. In the event Boneyard Sump 3 reaches capacity, water will be transferred via water cart or pipeline to APTD-001 or APTD-002 for treatment.

2.5.2 Future infrastructure and operations

The DAF treatment system will remain in use alongside the new oil/water separator but both treatment plants will discharge to the new stormwater ponds and the old AP1-AP5 ponds will be decommissioned. All water that is treated by the DAF and the new oil/water separator will be further treated by the PTU.

Upgrades to the Anpress Pre-treatment sump (ASP2) are also proposed, due to concerns raised by the department about the capacity and integrity of the shotcrete liner. The Anpress pre-treatment sumps are located west of the Arundel workshops and consists of two sump cells:

- One 280 kL shotcrete (concrete sprayed at high pressure onto earthen walls) lined cell to the north (ASP2); and
- One 250 kL concrete lined cell to the south (ASP1)

The Licence Holder is proposing to re-line the 280kL shotcrete cell (ASP2) and construct a new 1,500 kL (1.5 ML) pond (ASP3), which will be a 1.5 mm high density polyethylene (HDPE) lined cell, providing a 1:100 year annual rainfall storage capacity and 1,000 mm freeboard. The location of the new Anpress Pre-treatment sump 3 will be confined to the Pre-treatment sump envelope as shown in Figure 5 below. The Licence Holder has advised clearing of native vegetation to facilitate the construction of the new sump will be undertaken in accordance with Section 3 of the *Environmental Protection (Alcoa – Huntly and Willowdale Mine Sites) Exemption Order 2004* and the Mining and Management Plan approved by the Minister for State Development. No clearing of native vegetation has been authorised as part of the assessment.



Figure 5: Location of new Anpress Pre-treatment sump (indicative location shown in red hatching)

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A new stormwater pond (Arundel Stormwater Pond 3 (ASW3)) and new oil/water separator is also proposed for construction under this amendment. This infrastructure will service a new building at the Arundel workshops to provide additional space for electrical, welding, boiler making and general maintenance activities, including washdown of equipment. Washdown water and spills collected in a channel drain to a concrete waste holding pit. The waste holding pit will feed into a pre-fabricated skid mounted oil/water separator system.

The oil/water separator system will be installed within a bunded area designed to hold 110% of the system capacity. The system will consist of a 1,000 L polyethylene solids interceptor tank which will allow solids to settle. The settled solids will be drained back to the waste holding pit for removal and disposal. The wastewater will then be gravity fed to the polyethylene oil/water separator to remove oils and grease. This hydrocarbon treated water will then be pumped to the Arundel stormwater drainage system and to the Arundel Pre-treatment Dams for PFAS removal via the PTU.

A water balance for the Arundel Pre-treatment Dams is provided in Figure 6 . This water balance assumes an earlier commencement date than has occurred but demonstrates the major inflow of water occurs during April – December each year with treatment over this period. The storage capacity of the dams is indicated as greater than the 1:100 Annual Exceedance Probability, 72 hour Storm Safety Margin.

Water monitoring and infrastructure across the Premises has been reviewed for the purpose of updating the infrastructure, treatment processes and monitoring conditions on licence L6465/1989/10.

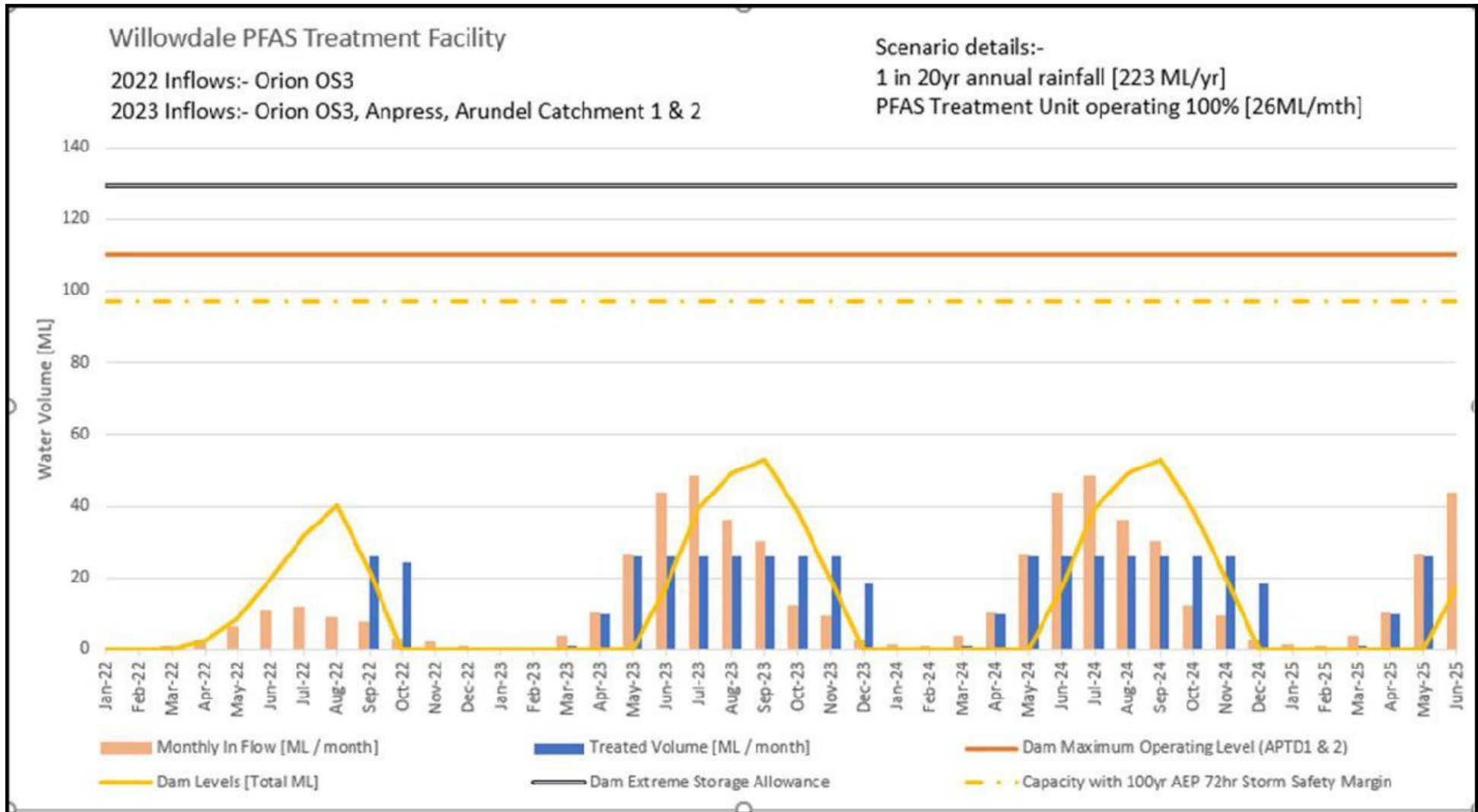


Figure 6: Water balance assuming if water treatment had commenced in September 2022

2.5.3 PFAS treatment process

Around 54 ML per year of PFAS-contaminated water will be trucked from the Orion mining area and around 165 ML per year will be piped from the Arundel mining area to the Arundel Pre-treatment Dams (shown in Figure 7). Approximately 1 km of new 100 mm HDPE pipeline will be installed within existing cleared or previously cleared areas at Arundel.

The treatment of PFAS-contaminated water via the PTU will incorporate:

- Pre-treatment filtration to remove large particles and sediments
- Granular Activated Carbon filtration to remove organic material and PFAS
- Ion Exchange to remove ionic substances (including ionic forms of PFAS)
- Post treatment polishing of treated water.

Water treatment will be continuous at 10 litres per second (L/s), with treated water discharged to one of three Treated Water Ponds. Each pond has a storage capacity of 4.5 ML or five days of treated water. Once a Treated Water Pond is at capacity, treated water will be sampled and sent to a NATA-accredited laboratory for analysis of contaminant levels, including PFAS compounds, TRH, metals and physico-chemical parameters.

Once analysis confirms the treated water quality meets authorised water quality discharge limits (as discussed in section 3.3), the treated water will be piped from the Treated Water Pond to the McKnoes Brook discharge point at a rate of 20 L/s over a 60-hour period, which is sufficient time to empty the Treated Water Pond. During this time, the treatment process will continue with treated water being discharged to one of the other Treated Water Ponds receiving treated water. Should the sampling and analysis results demonstrate that the treatment process has not achieved the authorised water quality discharge limits, water will be discharged back into the pre-treatment dams to be re-treated until discharge criteria for water quality has been demonstrated.

A 2 km 100 mm HDPE pipeline has been laid from the Treated Water Ponds to the proposed discharge point at McKnoes Brook (not yet connected or commissioned). The pipeline will transfer treated water in a 'batch' process after sampling and analysis confirms each treated batch meets approved discharge criteria. The pipeline can transfer up to 72 m³ per hour, which is around double the rate that the PTU can treat PFAS-contaminated water. At the discharge point, the pipeline has been laid in line with McKnoes Brook and will discharge over rock riffle to reduce discharge velocity and minimise erosion and turbidity within McKnoes Brook. A layout of the proposed PFAS water treatment system at Arundel, including the discharge point is shown in Figure 7 below.

A flow meter will be installed on the McKnoes Brook discharge pipeline to measure cumulative discharge volume and instantaneous flow rate.

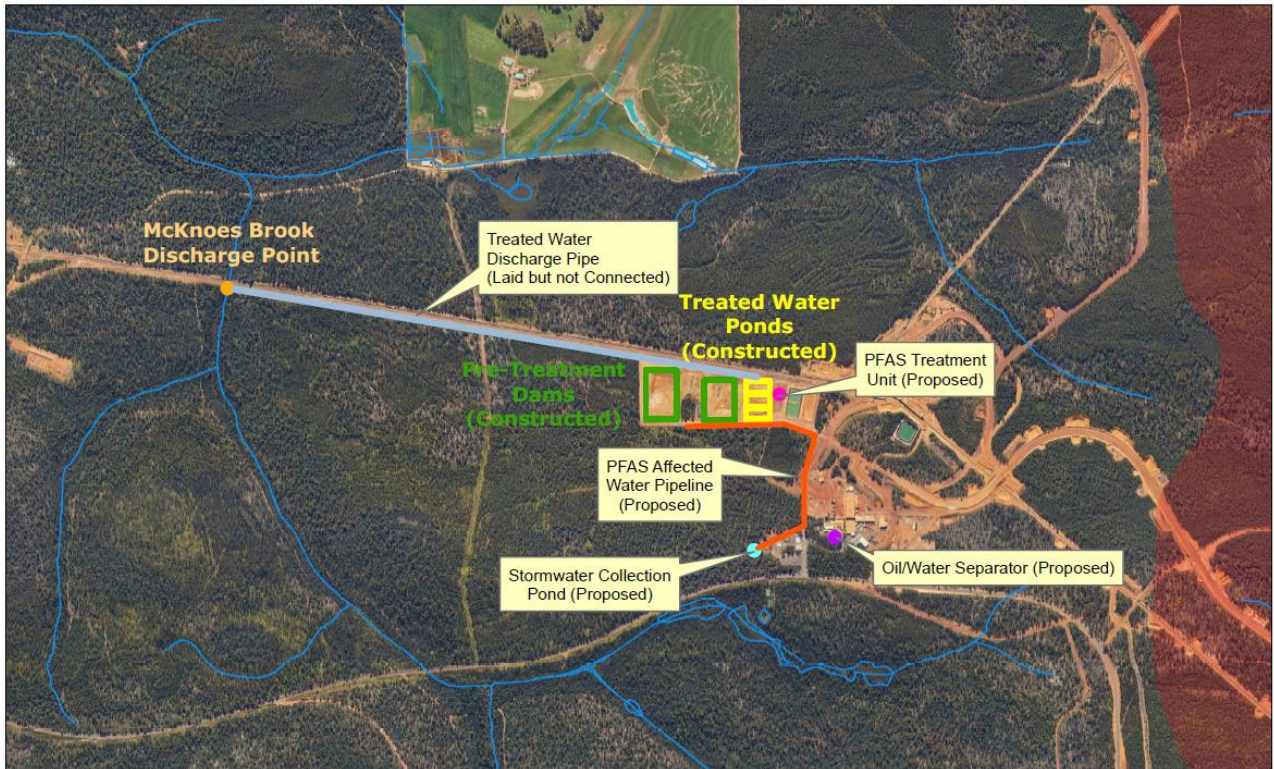


Figure 7: Layout of Arundel PFAS water treatment system and discharge point to McKnoes Brook

2.5.4 Waste Outputs

The following wastes will be produced during operation of the PTU (volumes are approximate):

- 4m³ per year of zeolite
- 8 – 30m³ per year of granular activated carbon
- 6 – 15m³ per year of anionic exchange resin (PFAS-specific, single use)
- 40 tonnes per year of sludge from the PTU and pre-treatment dams.

All wastes will be removed off the Premises and disposed of to an appropriately classed disposal facility authorised to accept such waste.

2.6 Compliance

The previous works approval application included a pipeline to transport PFAS-contaminated water from Orion across the Samson Brook Reservoir to Arundel. This pipeline was constructed whilst the application was still under assessment. It was found to be inconsistent with the department's policy *Land use compatibility in public drinking water source areas* and had been constructed prior to any EP Act approval being granted.

The Licence Holder received two Prevention Notices (PN's) from the department, the first on 3 March 2023 (PN 202302) and the second on 5 May 2023 (PN 202304). Both PN's were issued to require specific actions in relation to transport, storage and discharge of PFAS-containing water within the Samson Brook Priority 1 PDWSA and catchment. Alcoa was directed to cease use of, and purge, the water pipeline from Orion to Arundel which traversed over a tributary connected to the Samson Brook Reservoir. The Licence Holder was also directed to remove PFAS-containing water from unlined dams at the Orion and Arundel sites into lined dams or to dispose of the water offsite via appropriately sealed tankers and in a direct route via specified

routes to a licensed liquid waste disposal premises. The PN also set out sampling requirements and limits for PFAS-contaminated water, and provisions for achieving specified freeboards for particular dams and sumps storing PFAS-contaminated water. All stormwater is currently collected within existing lined and unlined sumps, dams and ponds or disposed offsite via a licenced third-party contractor.

2.7 State Agreement Act

Alcoa of Australia Limited's mineral lease (ML1SA) was issued under a State Agreement framework, namely the *Alcoa Refinery (Wagerup) Agreement and Amendment Act 1978*. Under this framework Alcoa is required to submit a five-year Mining and Management Program (MMP) each year to the Minister for State Development, who consults with the Ministers for Water and Environment, and seeks advice from the Mining and Management Program Liaison Group (MMPLG) (chaired by the Department of Jobs, Tourism, Science and Innovation (JTSI)).

The MMP outlines Alcoa's planned clearing, mining, exploration and rehabilitation operations within ML1SA. The plans for 2022-2026 and 2023-2027 were referred by a third party in early 2023 to the Environmental Protection Authority (EPA) for assessment. This referral was open for public comment until 15 August 2023 on whether or not the EPA should assess the proposals and, if so, what level of assessment is considered appropriate.

The 2022-26 MMP was approved, subject to exclusions, through the State Agreement Act framework in September 2022, and this proposal is currently being implemented. The 2023-27 MMP has not yet been approved. Following the public comment period and consideration of any comments received, the EPA will decide, for each proposal, whether or not it requires environmental impact assessment and, if so, what level of assessment will be applied.

An extract regarding the clearing proposed in the last approved plan was provided by Alcoa as supporting documentation for this amendment to licence L6465/1989/10.

2.8 Part IV of the EP Act

Ministerial Statement (MS) 390 - Increase in alumina production to 3.3 million tonnes per annum at Wagerup Alumina Refinery and associated bauxite mining activities, was issued under Part IV of the EP Act on 11 August 1995 and amended by Ministerial Statement 564 in 2001.

The Ministerial Statement 728 - Wagerup Alumina Refinery - Production to a maximum capacity of 4.7 million tonnes per annum and associated bauxite mining was issued on 14 September 2006 and amended by Ministerial Statements 897 in 2012, 1069 in 2017 and 1157 in 2021.

The key matters regulated under the above Ministerial Statements include:

Environmental management commitments and MMPLG

MS 390 requires Alcoa to fulfil the commitments made in the Consultative Environmental Review provided they are not inconsistent with the procedures within this MS. These procedures include:

- the provision for the MMPLG to have carriage of the rehabilitation completion criteria programme.
- Buffer distances and amenity provisions to be developed by Alcoa and the MMPLG.
- The defining of the MMPLG composition as the representatives of State Government agencies whose areas of responsibility are affected by the mining operations of Alcoa. Also the setting of best Environmental Management Principles for the auditing of the Mining and Management Programme by the MMPLG.

Works to expand the Wagerup refinery:

MS 390 included a schedule of environmental management commitments to be met whilst completing the works to increase annual throughput of the refinery to 3.3 million tonnes. The commitments were updated in MS 728. MS 728 authorises the implementation of proposed works relating to the increased throughput of the Wagerup refinery to 4.7 million tonnes.

The statement contains conditions relating to the time limits of commencement, compliance reporting, performance reviews and decommissioning plans. Pollution control measures and air and noise monitoring provisions are included in the statement. The time limit for commencement of aspects of the proposal was extended in statements 897 and 1069. MS 1069 also clarified the requirement for a works approval before construction. MS 1691 included amendments to the air emission controls and monitoring plans and the noise management plan.

Mining of bauxite to supply the Wagerup refinery:

MS 728 included commitments by Alcoa related to mining activities. The later statements did not amend these commitments. They are summarised as follows:

- Mine planning and forest management:
 - The MMP will specify the areas proposed to mine, the method of mining, and the proposed methods of rehabilitation. Alcoa will consult closely with the State on the preparation of the programmes and will not implement them until agreement to them has been reached.
 - Plan and manage mining operations to minimise disturbance to biologically diverse areas fringing major rock outcrops and stream zones. Provide buffers between mine pit boundaries and biologically diverse areas. Construct crossings that may be removed and the stream rehabilitated after their removal unless as agreed with the MMPLG.
 - Continue biological surveys and support of activities that contribute to conservation of rare, endangered and priority species existing within the vicinity of its mining operations.
- Water resources
 - Mining will not take place in certain low rainfall areas until research shows that mining operations will not significantly increase the salinity of water resources. Results from trials and ongoing hydrology research and modelling will be the basis for future plans for mining in the intermediate rainfall zone.
- Forest conservation
 - Bauxite resources in jarrah forest conservation areas will be foregone as long as their conservation values remain.
 - Mining of bauxite resources in the facilities section of Lane Poole Reserve will be deferred indefinitely.
- Dieback management
 - Alcoa will implement a dieback management programme.
- Environmental research
 - Ongoing research into all aspects of its operation that have the potential to adversely affect the environment, and the environmental characteristics that could be adversely affected by its operations.
- Noise monitoring
 - Noise monitoring will be undertaken.
 - Noise levels will be monitored periodically and reported to Department of Mines, Industry Regulation and Safety.

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 operation which have been considered in this Amendment Report are detailed in Table 1 below. Table 1 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

Table 1: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Dust	Earthworks etc.	Air/windborne pathway	No Information provided
Noise	Earthworks etc.	Air/windborne pathway	<p>Noise modelling submitted for the construction of the PTU was the base model for the Larego crusher relocation project.</p> <p>The model does not include noise emissions from any sources other than those associated with the water treatment plant and Arundel conveying infrastructure.</p> <p>The majority of construction modelled has already occurred as the major earthworks proposed were the construction of the completed ponds and preparation of the ground for the PFAS plant.</p>
Commissioning and Operation			
Water containing PFAS	Historical PFAS contamination of infrastructure and soils	<p>Surface water runoff from soils and surfaces contaminated by PFAS</p> <p>Infiltration through soils to groundwater and / or surface water bodies</p>	<p>Stormwater collection in lined sumps:</p> <ul style="list-style-type: none"> New stormwater collection pond at Arundel workshops to have a clay and HDPE liner with permeability of less than 1×10^{-9} m/s Upgrade to Anpress pre-treatment sump 2 (current capacity 280kL) to lined cell with permeability of 2.27×10^{-17} m/s.
	Spills and leaks from pipelines, pumps and trucks transporting or		<p>Pipelines / Pumps</p> <ul style="list-style-type: none"> Regular (daily) inspection of pipelines.

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Emission	Sources	Potential pathways	Proposed controls
	transferring water		<p>Transportation via trucks</p> <ul style="list-style-type: none"> • all movement of PFAS-contaminated water via trucks will comply with the <i>Environmental Protection (Controlled Waste) Regulations 2004</i> and Controlled Waste Tracking System (CWTS). • Trucks will not cross Samson Reservoir, to reduce risks to P1 PDWSA. Trucks will use Nanga Brook Road. • Regular inspection and maintenance of water trucks.
	Overtopping of water containment ponds, sumps and dams		<ul style="list-style-type: none"> • Regular inspection of the dams and ponds. • Inspection of freeboards prior to large rainfall predictions. • Regular monitoring of freeboards. • Disposal of PFAS-contaminated water offsite should insufficient freeboard be maintained • Visual markers will be installed on the following lined dams and ponds: <ul style="list-style-type: none"> ➤ Larego Water Storage Reservoir; ➤ Arundel Pre-Treatment Dams APTD-001 and APTD-002; ➤ Arundal PTU Treated Water Ponds ATWP-001, ATWP-002 and ATWP-003; and ➤ Orion Sump 3. <p>Arundel Pre-treatment Dams APTD-001 and APTD-002</p> <ul style="list-style-type: none"> • Designed to allow Extreme Storage Allowance – 1 000 mm to base of spillway and Depth from Crest to maximum operating level – 1 500 mm (attenuated depth due to Probable Maximum Point rainfall event) (Refer Figure 8) • Designed to ANCOLD standards (1:100 annual rainfall). • 500 mm freeboard above the 1:100 annual requirement. • constructed with a clay and HDPE liner with permeability of less than 1×10^{-9} m/s • Spillway incorporated into design. <p>Treated Water Dams 1, 2 and 3</p> <ul style="list-style-type: none"> • constructed with a clay and HDPE liner with permeability of less than 1×10^{-9} m/s

Emission	Sources	Potential pathways	Proposed controls
	Seepage from ponds, sumps and dams.		<ul style="list-style-type: none"> Regular inspection of the dams and ponds, including the condition of HDPE liners. 10-year design life for the HDPE liners Groundwater monitoring program.
	Loss of containment within PTU	Direct discharge to land	Secondary containment with a sump discharging back to the pre-treatment dams.
	Processing failure of PTU	Discharge to McKnoes Brook via discharge point	<ul style="list-style-type: none"> Water only discharged on passing QA/QC and meeting the discharge criteria (batch discharge process). Treated water can be re-treated as necessary. Periodic field survey of vegetation and comparison to baseline survey.
Solid waste from PFAS treatment facility	Sludge from pre-treatment dams	Direct discharge to land	<ul style="list-style-type: none"> Water will be returned to the pre-treatment dams. Waste will be tested for PFAS. It will be disposed of on site or to an appropriately classified disposal facility following testing.
	Solids removed from the source water combined with flocculating chemicals in PTU.		It is anticipated that the PFAS concentrations within the sludge will be below the 99% species freshwater protection – PFOS (<0.0002 µg/L) and PFOA (0.0012 µg/L). These concentrations would allow sludge to be disposed of at a Class II landfill.
	Anionic Exchange Resin (PFAS specific, single use)		Removed offsite by waste carrier to licensed waste management facility.
	Zeolite and granular activated carbon		Disposal to appropriately classified landfill that can accept Special Waste Type 3.
Water discharging causing scouring of bed and banks.	Discharge of water to McKnoes Brook	Direct discharge to land	<ul style="list-style-type: none"> Regular inspection of discharge point. Armouring of discharge point with energy dissipation structure.
Noise	Operation of PTU (in combination)	Air/windborne pathway	The modelling of the operational noise prior to the completion of the Larego infrastructure was

Emission	Sources	Potential pathways	Proposed controls
	with existing infrastructure at Arundel mining area)		<p>summarised as follows:</p> <p><i>The modelling scenario for the water treatment plant operating alongside the future Larego infrastructure predicts an increase of +0.06 dB during both daytime and evening/night periods at the R1 receiver (see Figure 9) when compared to the future Larego infrastructure scenario alone. Despite the marginal increase, the future Larego infrastructure alongside the operational water treatment plant is still predicted to be -0.1 dB quieter than the existing Larego infrastructure during both daytime and evening/night periods.</i></p> <p>Figure 10 shows the predicted operational noise levels of the PTU (water treatment plant) in addition to the Conveyor infrastructure operating at Arundel.</p> <p>The model shows the noise from the combined Conveyor infrastructure and the operating PTU will exceed the LA10 limits in the Noise Regulations between</p> <ul style="list-style-type: none"> • 0900 to 1900 hours Sunday and public holidays; • 1900 to 2200 hours all days; and • 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays. <p>The Licence Holder has submitted a Noise Management Plan (Alcoa, 2021) outlining proposed additional controls and monitoring timeframes that will be implemented to effect compliance with the Noise Regulations.</p> <p>The Licence Holder has completed installation of noise attenuation treatments and the Arundel Conveyor Transfer station and has commenced installation of an enclosure around Conveyor 371 to reduce noise levels experienced at the affected residential receptor. The full extent of the Conveyor enclosure proposed is 2.5km. However, the final length will be subject to achieving compliance with the Noise Regulations. Further noise monitoring will be conducted to determine noise levels after the 2.5km enclosure has been installed.</p>

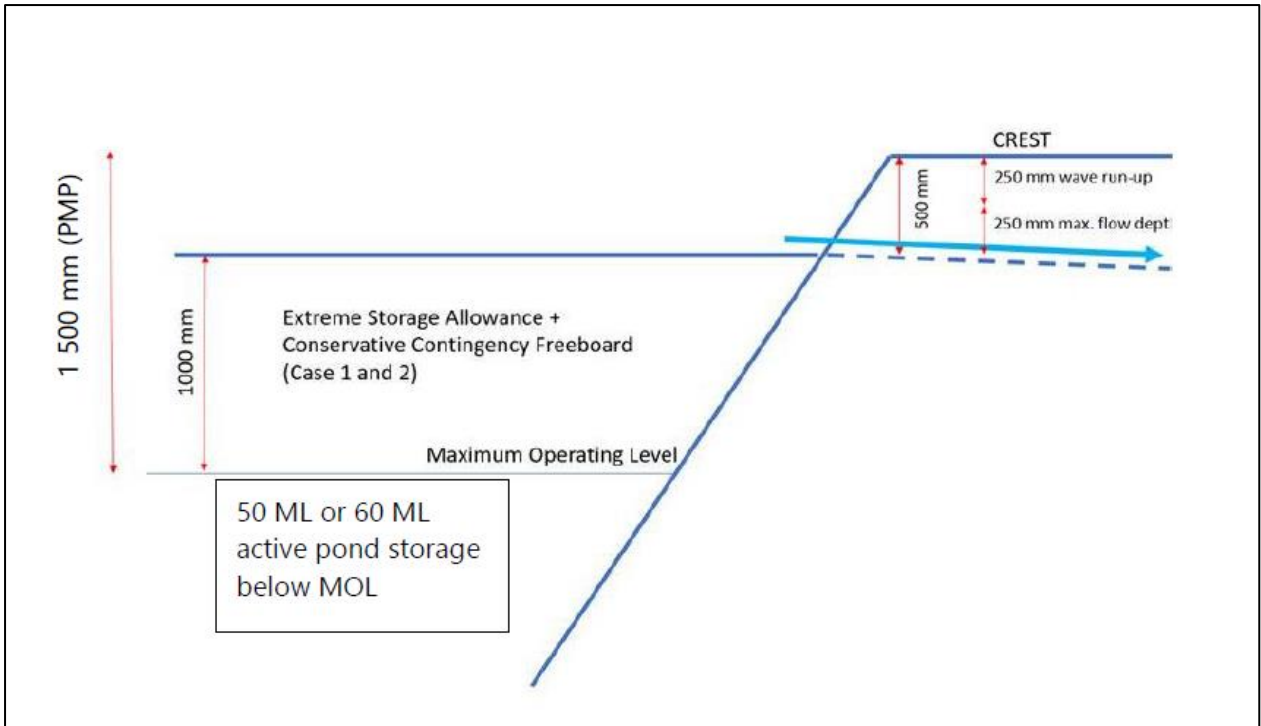


Figure 8: Freeboard of Arundel Pre-treatment Dams APTD-001 and APTD-002



Figure 9: Position of nearest receptor in relation to the PFAS treatment unit area for the purpose of noise modelling

Scenario	Noise Level dB(A)	
	Daytime	Evening/Night
Future Conveyor Infrastructure	41.3	41.5
Future Conveyor Infrastructure & Water Treatment Plant	41.3	41.6
Water Treatment Plant Noise Emergence	+0.06	+0.06
Overall Difference from Existing	-0.1	-0.1

Figure 10: Water Treatment Plant Operational Noise Levels Predicted at Nearby Residential Receiver (R1)

3.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors and contractors of the Licence Holder’s 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's 11, 12 and 13 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	Distance from activity / prescribed premises
Residential Premises – Farm building 1	1 km north of the PFAS water treatment plant and 1.5 km northeast of the discharge point at McKnoes Brook.
Waterous Scout Camp	800m north of McKnoes Brook discharge point and 2 km from PFAS water treatment plant
Agricultural land users and Waroona Irrigation District	The nearest agricultural landuser downstream along McKnoes Brook is approximately 4.5 km from the discharge point. Waroona Irrigation District border is approximately within the same distance from the discharge point.
Environmental receptors	Distance from activity / prescribed premises
Public Drinking Water Source Area (PDWSA): Samson Brook Reservoir and surrounding Priority 1 PDWSA with creeks feeding into the reservoir.	Samson Brook Reservoir is a reservoir that contributes to the metropolitan drinking water supply. The premises is situated within the PDWSA as depicted in Figure 1 above. The crossing of the reservoir causeway is no longer to be used but traffic carrying PFAS-contaminated water will travel along Nanga Brook Road. Depth to groundwater at the Arundel area ranges from 14 - 18 mbgl

<p>Surface water: McKnoes Brook and Samson Brook south of Samson Brook Reservoir</p>	<p>McKnoes Brook flows into Samson Brook approximately 8.5 km downstream from the discharge point (approximately 7.5 km northwest measured 'as crow flies').</p> <p>McKnoes Brook is used for recreation and is valued as an important fishing site, particularly for trout. McKnoes Brook is stocked with around 2000 trout fry annually into the upper reaches around Scarp Road, and further stocking of the waters has been carried out by the Pemberton Freshwater Research Centre in 2023.</p> <p>The Department of Primary Industries and Regional Development's Freshwater Fish Database, which contains the records of fish sampling, shows little sampling has been undertaken in McKnoes Brook, however, the Samson Brook has been relatively well sampled and contains the recreationally important marron and trout and the minor recreational fish, native freshwater cobbler, which are all used for human consumption. The brook also contains many of the other native fish species of the southwest, some of which are important in mosquito control.</p>
<p>Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region</p>	<p>Approximately 7km downstream of discharge point in McKnoes Brook. Approximately 6.5 km northwest of discharge point (measured 'as crow flies')</p>
<p>State forest</p>	<p>State forest is present as the underlying land tenure within the State Agreement area that Alcoa operates within.</p>
<p>Priority and threatened fauna</p>	<p>Quenda (<i>Isoodon fusciventer</i>) and chuditch (<i>Dasyurus geoffroi</i>) have been recorded along the McKnoes Brook including quenda sighted in proximity to the discharge point in the past.</p> <p>Carter's freshwater mussel has been recorded downstream of the McKnoes Brook and Samson Brook confluence approximately 8km downstream of the discharge point.</p>

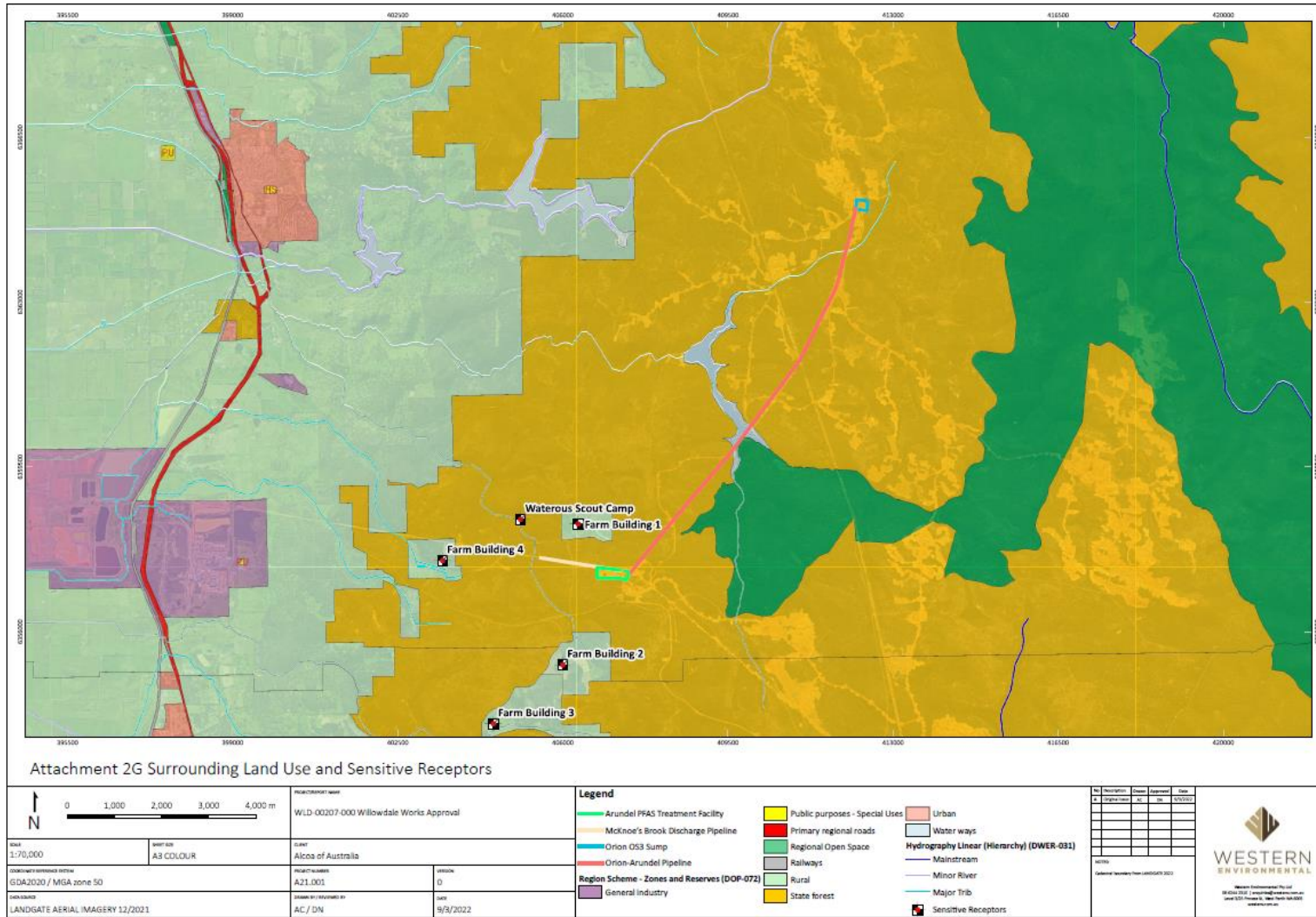


Figure 11: Distance to sensitive receptors

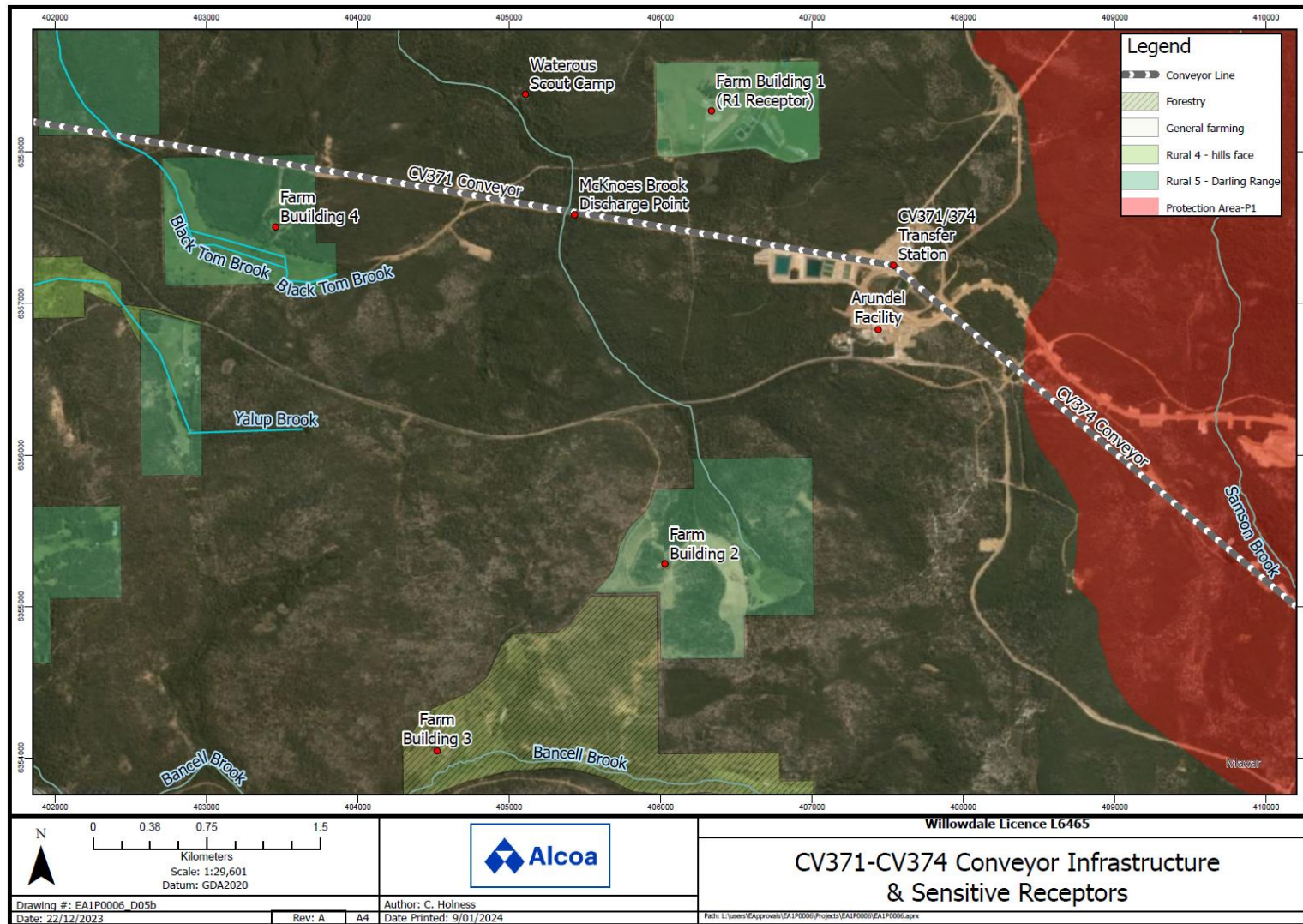


Figure 12: Distance to sensitive receptors

Licence: L6465/1989/10

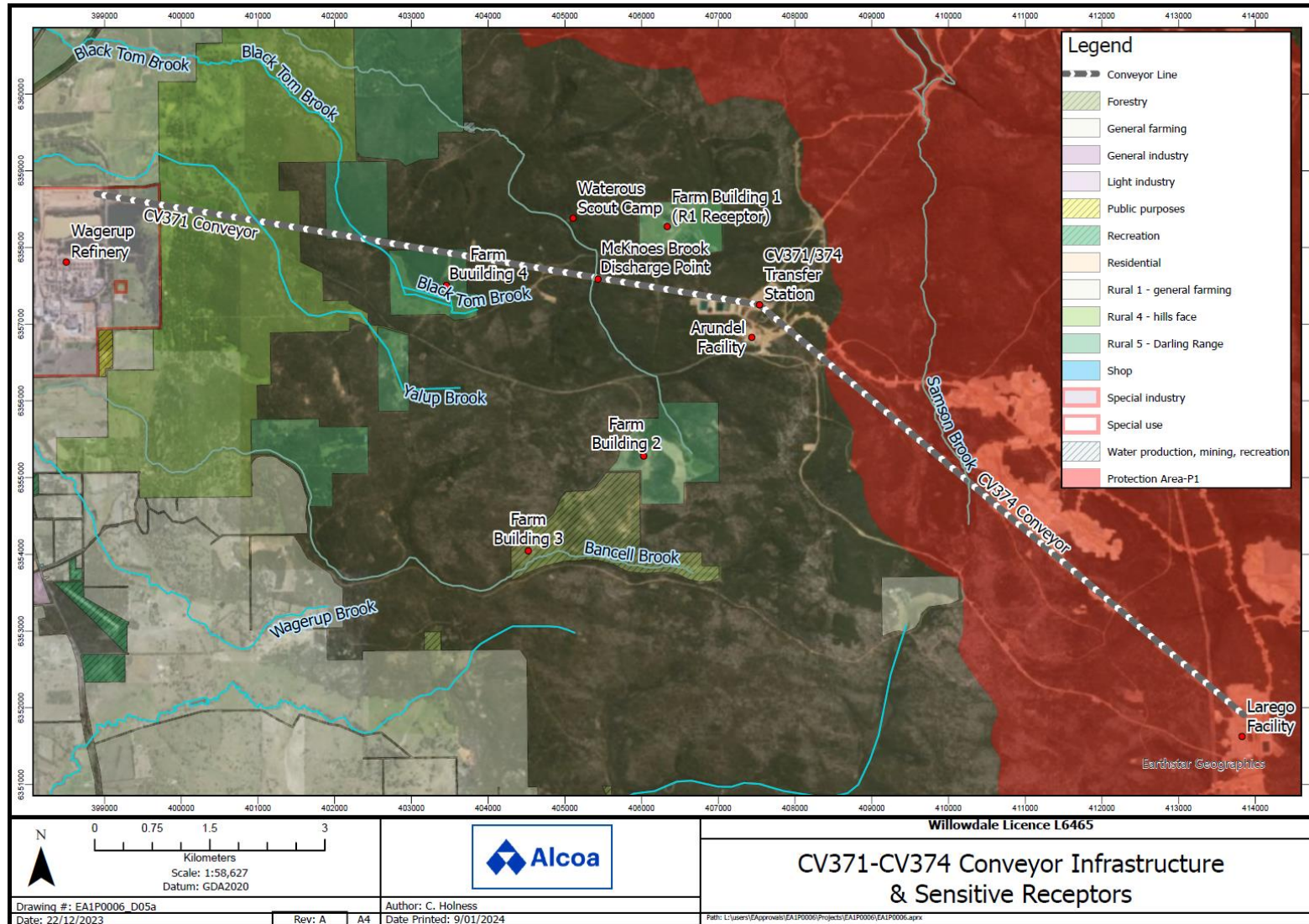


Figure 13: Distance to sensitive receptors

Licence: L6465/1989/10

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) 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 in-complete 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 3.

The Revised Licence L6465/1989/10 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e. treatment of water related to category 5 activities.

The conditions in the Revised Licence 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, commissioning and operation

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
Construction								
Construction of stormwater pond (ASW3), pre-treatment sump (ASP3 and upgrade to ASP2) and oil/water separation unit with associated drains and pipelines. Construction of tanks and pipework associated with the PTU (package plant).	Dust	Air/windborne pathway causing impacts to health and amenity	Surface water contaminated by dust	Refer to Section 3.1	C = Minor L = Rare Low Risk	N/A	Minimal dust is expected to be generated from construction activities as the majority of significant earthworks for ponds and hardstands is complete. The Delegated Officer considers the risk of dust to receptors during the construction phase is low and therefore no regulatory controls have been placed on the licence. General provisions of the EP Act apply.	N/A
			Native vegetation		C = Minor L = Rare Low Risk	N/A		
	Noise		Residence, 1 km north of the PFAS water treatment plant		C = Minor L = Rare Low Risk	N/A	The Delegated Officer notes the majority of infrastructure associated with the PTU has already been constructed, including major earthworks for the Arundel Pre-treatment Dams and preparation of the ground and pad for the modular PTU. The remaining construction works are limited in nature and will not be appreciably different to noise emissions from existing activities at Arundel. No regulatory controls have been placed on the licence. The provisions of the <i>Environmental Protection (Noise) Regulations 1997</i> apply.	N/A
Commissioning and operation								
Transporting of water containing PFAS from Orion via controlled waste carriers	PFAS contaminated water	Loss of containment from truck due to leaks and spills or traffic incidents.	Environment and residences along the transport route. Environment along the route within the premises boundary.	Refer to Section 3.1	C = Minor L = Rare Low Risk	Y	Transportation of PFAS-contaminated water from Orion to the PTU at Arundel will be conducted by a third party licensed controlled waste carrier in a licensed bulk-controlled waste vehicle (estimated capacity of trucks will be up to 23,000L). The trucking route will not traverse the Samson Dam P1 PDWSA, rather, will be via Nanga Brook Road (outside of P1). In the event of loss of containment of water from trucks, the Licence Holder will enact the Premises emergency spill response procedures for containment, clean up and reporting. Licence Condition 10 lists the controlled waste code that can be accepted at the PTU for treatment, to enable acceptance of PFAS-contaminated water at the premises under the Controlled Waste Regulations. Acceptance specifications in relation to the transport route have been included to prohibit transportation across the Reservoir Protection Zone for the Samson Brook Drinking Water Catchment.	Transport of the material beyond the premises boundary is controlled under the <i>Environmental Protection (Controlled Waste) Regulation 2004</i> . The Licence Holder also has a duty under section 72 of the EP Act to notify the CEO of DWER of any discharges of waste to the environment that may result in pollution or environmental harm.
Commissioning and operation of PTU	PFAS contaminated water	Loss of containment from pre-treatment dams and tanks associated with PTU resulting in discharge to soils, seepage / overland runoff	Surface water bodies (McKnoes Brook) located 800m north and 1km north Native fauna, particularly aquatic and riparian fauna.	Refer to Section 3.1	C = Major L = Unlikely Medium Risk	Y	To manage loss of containment risks, the Licence Holder's proposed controls have been conditioned on the licence. Condition 1 specifies design and construction requirements for the PTU and stormwater infrastructure at Arundel. Conditions 2 and 3 specify construction compliance and reporting requirements. Conditions 4 and 5 specify infrastructure and sampling requirements for commissioning and condition 12 specifies operational controls for the Arundel Pre-	In accordance with DWER's <i>Guidance Statement: Risk Assessments (2017)</i> , the Licence Holder's proposed controls will be conditioned.

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
			Soil Groundwater (~14 – 18 mbgl)				treatment Dams, Treated Water Dams and associated infrastructure. Refer to section 3.4 for detailed risk assessment on loss of containment and controls imposed during commissioning of PTU.	
		Spills or leaks from overland pipelines carrying contaminated water.		Refer to Section 3.1	C = Moderate L = Possible Medium Risk	Y	To manage the risk of spills / leaks from pipelines, the Licence Holder's proposed controls have been conditioned on the licence. Condition 1 (design and construction requirements) requires: <ul style="list-style-type: none"> all new pipelines to be installed above ground, and have flow meters and leak detection systems installed; and Condition 12 (pipeline operational controls) <ul style="list-style-type: none"> all pipelines conveying PFAS-contaminated water must be double skinned with leak detection and flowmeters, and must be maintained during operations Condition 13 – pipeline inspections <ul style="list-style-type: none"> Licence Holder to perform daily inspections of pipelines connected to PTU and DAF water treatment facility to confirm integrity of pipes and no leaks present Conditions 14 – 16 have also been imposed to require appropriate management of spills / leaks of hazardous materials and stormwater on the Premises.	
	Solid waste (sludge, filters and activated carbon, anionic exchange resin)	Direct discharge to land during removal from dams or PTU	Soil Stormwater from contact with contaminated soil	Refer to Section 3.1	C = Minor L = Rare Low Risk	Y	Condition 11 specifies processes and specifications for all waste materials generated from operation of the PTU, including: <ul style="list-style-type: none"> Dewatering and analytical requirements Must be stored in impervious containers prior to being disposed of to an appropriately classed waste facility Any leachate generated must be returned APTD-001 or APTD-002 	
Noise (from operation of PTU combined with new overland ore conveyor (371) from Larego to Arundel and 371/374 ore transfer station)	Air/windborne pathway causing impacts to health and amenity	Residence, 1 km north of the PFAS water treatment plant	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	Y	To reduce unreasonable noise emissions and effect compliance with the Noise Regulations, the Licence Holder has proposed several controls via a Noise Management Plan, including: <ul style="list-style-type: none"> Installing a 2.5km enclosure around Conveyor 371 to reduce noise levels experienced at the nearest residential receptor. Sealing of gaps between acoustic panels on the upper floor of the Arundel 371/374 transfer station. Further noise monitoring to determine noise levels after the enclosure has been installed. Timeframe for completion of noise controls and further noise monitoring (end 2025). 	The provisions of the <i>Environmental Protection (Noise) Regulations 1997</i> apply. Noise monitoring has confirmed exceedance of assigned noise levels at sensitive receptors as a result of operation of the new conveyor and transfer station, which is also in the vicinity of the PTU. The Licence Holders controls have been conditioned to	

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
							The above controls have been conditioned via Conditions 1 – 3 and 6 - 9	ensure noise mitigation works are installed in a timely manner, and monitoring performed to confirm compliance with assigned noise levels.
Discharge of treated water to McKnoes Brook (up to 219 ML per year)	Water treated for PFAS and hydrocarbon compounds	Direct discharge to McKnoes Brook	Native fauna, particularly aquatic and riparian fauna. Riparian vegetation along McKnoes Brook Agricultural and irrigation areas approximately 4.5 km downstream of discharge point. Public recreational users (water sports activities, fishing activities)	Refer to Section 3.1	C = Major L = Possible High Risk	N	Refer to section 3.3 for detailed risk assessment of discharge of treated water to McKnoes Brook during commissioning and operation phases.	Additional regulatory controls have been imposed as outlined in section 3.3.8
		Loss of containment from Arundel Treated Water Ponds 1, 2 and 3	Surface water bodies located 800m north and 1km north	Refer to Section 3.1	C = Minor L = Possible Medium Risk	Y	During commissioning and operation of the PTU the Treated Water Ponds will be used for storing treated water in a "batch" process. Relevant commissioning and operational controls specified in conditions 4, 5, 12, 13, 20 and 25 include: <ul style="list-style-type: none"> Timeframe for commissioning process Specifications of liner and freeboard requirements Daily inspection of PTU and Treated Water Ponds to ensure integrity and freeboards maintained Discharge criteria limits imposed; and Sampling and analysis of treated water to ensure it complies with approved discharge criteria 	N/A
		Spills or leaks from overland pipelines carrying treated water.	Soil Groundwater (~14 – 18 mbgl)		C = Minor L = Possible Medium Risk	Y	To manage the risk of spills / leaks from pipelines, the Licence Holder's proposed controls have been conditioned on the licence. Condition 1 specifies approved design features Including: <ul style="list-style-type: none"> Capacity of 72m³/hour 125 mm diameter HDPE pipeline to be installed above ground, and have leak detection systems installed to be laid in existing easements Condition 12 specifies operational requirements for pipelines, including: <ul style="list-style-type: none"> Pipelines for conveying PFAS-contaminated water must be double skinned and have leak detection systems installed and maintained during operations Discharge point to McKnoes Brook to be maintained 	N/A

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
							over existing rock dominated channel at a discharge rate of not more than 10 L per second • Flowmeter(s) to be maintained to enable discharge rates to be recorded	
		Scouring / erosion / sedimentation at McKnoes Brook discharge point	Native fauna, particularly aquatic and riparian fauna. Riparian vegetation along McKnoes Brook	Refer to section 3.1	C = Minor L = Unlikely Medium Risk	Y	Condition 1 specifies installation of pipeline at discharge point must be over existing rock dominated channel to control erosion and sedimentation to prevent damage to bed and banks. Condition 13 requires weekly inspection to confirm integrity of discharge point and rock riffle surface at the discharge point to confirm no sedimentation, erosion or scouring	N/A

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

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

3.3 Detailed risk assessment for discharge of treated water to McKnoes Brook

3.3.1 Overview of risk event

The risk event assessed is the discharge of treated water to McKnoes Brook, resulting in releases of low level PFAS, heavy metals and hydrocarbons to surface water, which may adversely impact the health of humans, who fish and recreate in McKnoes Brook, as well as impacts to flora and fauna in and around McKnoes Brook, which provides important ecosystem services (habitat, foraging, water source) to a range of biota.

PFAS chemicals are very resistant to heat and degradation in the environment, and they persist for quite long periods in the human body. They have been manufactured since the 1950s and used in a variety of consumer products such as non-stick cookware, water-proof clothing, and fabric stain protection. PFAS were also an ingredient in Aqueous Film-Forming Foam (AFFF) used for firefighting activities (ANU, 2023).

The PFAS compounds of most concern are perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). Perfluorohexane sulfonate (PFHxS) is another chemical of the PFAS group and is present in some fire-fighting foams for which an Australian health reference value has been set (DoH, 2023). These three PFAS are part of a broader group of PFAS known as PFAAs, which resist physical, chemical and biological degradation, and are very stable. This stability creates a problem as these PFAS last for a long time (NEMP, 2020).

The persistence of PFOS and PFOA have led to them being listed under the Stockholm Convention as Persistent Organic Pollutants (POPs), which are defined as chemicals that are very persistent, very bioaccumulative, toxic, and have potential to undergo long-range transport. The Stockholm Convention, of which Australia is party to, identifies POPs and aims to reduce or eliminate their release into the environment. PFHxS, its salts, and PFHxS-related compounds were nominated for listing on the Stockholm Convention in 2017 (yet to be ratified).

The high solubility of many PFAS in water means that PFAS may readily leach from soil and sediments into surface water and groundwater, where they can move long distances to enter creeks, rivers and lakes, estuaries, and marine ecosystems and become part of the food chain, being transferred from organism to organism as they accumulate, potentially posing a risk of causing adverse effects to human and environmental health, even at low concentrations.

PFOS may also biomagnify through the food chain resulting in very high internal concentrations in biota, especially in top predators. Importantly, it is difficult or impossible to reverse the adverse effects of persistent, bioaccumulative and toxic (PBT) chemicals once they have been released to the environment. As a result, these chemicals are of high concern for the environment (NICNAS, 2023).

PFOA is highly resistant to degradation in the environment and has the potential to biomagnify in marine and terrestrial mammals. PFOA is expected to have long-term toxic effects in aquatic and terrestrial organisms. PFOA has been assessed as having the potential to give rise to adverse outcomes for the environment (NICNAS, 2023).

PFHxS is environmentally extremely persistent, exhibits long-range transport, it is more bioaccumulative and hazardous in humans than PFOS and is present in both the general population and in occupationally exposed groups, as well as having an unacceptable PBT profile like PFOS and PFOA; two substances already listed in the Stockholm Convention.

In comparison to PFOS or PFOA, PFHxS is more water-soluble, more environmentally mobile, less adsorbable to soils and sediments, and has a far longer elimination half-life in humans, about double that of PFOS. Because of the physicochemical properties of PFHxS, its mobility and therefore the extent of its contamination plumes are generally greater than for its close relative, PFOS. Sites polluted by PFAS waste containing perfluoroalkyl sulfonic acids, e.g., PFOS, PFHxS, PFBS, etc., from firefighting foams, manufacturing processes, or PFAS textile

treatment, give rise to contamination of groundwater and drinking water mainly by infiltration through the soils. This is especially the case for PFHxS through its greater mobility and the mechanisms of hydrogeological fractionation, plus promotion of its mobility that occurs because of displacement of PFHxS from soil matrixes by longer-chain PFAS in the upper layers. The result is groundwater that has a much higher proportion of PFHxS versus other PFAS than occurs in the original contaminant source (IPEN, 2019).

Research into the effects of PFAS on organisms, such as potential multigenerational effects on aquatic wildlife, is ongoing (NEMP, 2020).

PFAS are synthetic compounds, meaning there are no natural background levels in the environment. Importantly, it is difficult or impossible to reverse the adverse effects PFAS chemicals once they have been released to the environment.

3.3.2 Source: characterisation of emission

The Licence Holder is proposing to treat PFAS and hydrocarbon contaminated wastewater generated from the Orion and Arundel areas at the mine and discharge up to 219 ML per year of treated water to the environment, via the McKnoes Brook discharge point.

Contaminated surface water will be collected in several sumps at Orion and Arundel (as listed in Table 4) prior to being sent to the Arundel Pre-treatment Dams (APTD-001 and APTD-002) ahead of being treated for PFAS via the PTU. Water from Arundel workshops and wash down bays will be pre-treated for hydrocarbons and sediment prior to being sent to the Arundel Pre-treatment Dams for storage and then treatment for PFAS via the PTU.

Table 4: Volumes and storage locations of PFAS-contaminated water at the Premises

Location	Sump	Sump capacity (ML)
Orion	OS1	0.005
	OS2	1.5
	OS3	9
	OS4	7.4 (out of service)
Total capacity (in service) at Orion		10.505
Arundel	SW1	0.26
	SW2	1.1
	ASP	0.25
	AP1	0.168
	AP2	0.4
	AP3	0.3
	AP4	1.5
	AP5	4
	Boneyard Sump 1	6.5
	Boneyard Sump 2	2.6
	Boneyard Sump 3	2.8
	Pantaleo's Pond	8.5
	PTU-001	50
	PTU-002	60
Total capacity Arundel		138.3
Total capacity Orion + Arundel		148.805

On an annual basis, the Licence Holder has calculated that around 54 ML of PFAS contaminated water will need to be trucked from the Orion mining area and around 165 ML per year will be required to be piped from the Arundel mining area to the Arundel pre-treatment dams for treatment to remove PFAS compounds to acceptable concentrations prior to discharging to the environment.

The treated water discharge criteria as proposed by the Licence Holder, along with various guideline values is shown in Table 5 below.

Table 5: Licence Holder proposed discharge criteria against various guideline values

PFAS Compound (µg/L)	Licence Holder proposed discharge criteria (µg/L)	ANZ Guidelines 99% Freshwater species protection criteria AND PFAS NEMP (V2, 2020) (µg/L)	Toxicant Default Guideline Values for Aquatic Ecosystem Protection, PFOS in freshwater Draft Technical Brief (99% species protection criteria) (µg/L)	Australian Drinking Water Guidelines (Department of Health, 2017) (µg/L)	Recreational Water Quality Guideline (National Health and Medical Research Council 2019) (µg/L)	PFAS 30-Ultra-trace ^{1, 2} (µg/L)
Perfluorooctanoic acid (PFOA)	0.56	19	-	0.56	10	0.0001
Perfluorooctanoic sulfonic acid (PFOS)	0.0091	0.00023	0.0091	0.07	-	0.001
Perfluorohexane sulfonic acid (PFHxS)	None proposed	-	-	0.07	-	0.001
Sum of PFOS and Perfluorohexane sulfonic acid (PFHxS)	0.07	-	-	0.07	2	-

Note 1: Example limits of reporting for commercial ultra-trace PFAS analysis. These examples are indicative, and LORs for individual compounds will vary between analysis providers.

Note 2: Refer to Appendix 2 for expanded PFAS 30 Ultratrace list of 31 PFAS compounds

Modelling of streamflow with additional discharge of treated water to McKnoes Brook

The Licence Holder engaged a consultant to develop a hydraulic model of McKnoes Brook using Mike21 software to simulate the proposed release of treated water into the Brook. The model was used to replicate the flow hydraulics in McKnoes Brook during a range of natural flow conditions in addition to the proposed treated water discharge and compare the predicted change in flow rates and water levels downstream of the discharge location. This was used to predict potential for impacts to the ecology of McKnoes Brook from increased flow rates. The model extended along McKnoes Brook from approximately 1.5km upstream of the proposed discharge point to 3.7km downstream, covering the extent of the channel expected to convey streamflow for the range of scenarios tested.

The following seasonal flow rate scenarios were modelled:

- Highest average monthly flow rate, which occurs in August; and
- The lowest average monthly flow rate, which occurs in February.

For each seasonal flow rate, two discharge scenarios were modelled:

- 10 L/s constant release rate; and
- 20 L/s for 60 hours followed by 60 hours with no discharge, repeating.

The modelling indicates that flow depths vary in the stream from summer to winter and along the channel. The two release rates, 10 L/s and 20 L/s, increase flow depths by between 29 mm in summer and 13 mm in winter near the discharge point. The increase in water level reduces with distance downstream as natural flows in the stream increase with catchment area.

Technical review of the modelling found that on average, if the water quality of releases is suitable, the proposed releases are likely to have little impact on McKnoes Brook (either 10 L/s continuous release rate or 20 l/s for 60 hours followed by 60 hours with no discharge, repeating). However, release of 10 or 20 L/s into a natural system during periods of low or no flow have the potential to impact the natural system. Ecosystems are adapted to natural and historic streamflow regime and impacts to ecosystems, especially aquatic fauna, can occur when they are exposed to a prolonged artificial water regime and this is then suddenly stopped.

It is noted however that the Arundel operation has released water to McKnoes Brook under the existing licence via Arundel Pond 5 for over 20 years with no restriction on discharge rate. This indicates that the McKnoes Brook ecosystem is likely adapted to a modified streamflow regime.

Given there is no recorded streamflow at the discharge point, it is difficult to determine the likely environmental impacts of releases during summer, however, the risks of releases can be minimised and monitored by implementing the following controls:

1. Limiting the discharge rate to either 10 L/sec continuous flow or 20 L/sec for 60 hours followed by 60 hours with no discharge, repeating as per model.
- 2.
3. instantaneous (daily) water level (stream flow) monitoring upstream of the discharge point to allow for streamflow calculations within McKnoes Brook. Monitoring, daily of the discharge volumes to McKnoes Brook from PFAS treatment plant.

Review of historical treated water quality and current licence discharge criteria

Attachment 8G of the licence amendment application (Alcoa 2023) includes recent and historical water quality data for sumps within the Orion and Arundel mine sites, with discharge water quality significantly lower than the current discharge criteria approved under Licence L6465/1989/10.

Table 6 gives a comparison of the authorised discharge criteria specified under the existing licence L6465/1989/10 against the Water Quality Australia: Australian and New Zealand Guidelines (Water Quality Australia Guidelines) for Fresh and Marine Water Quality (2018) 99% Freshwater Species Protection guideline, as well as the Bindjareb Djilba – Peel-Harvey (DWER 2020) guideline and the Statewide River Water Quality Assessment (2009) Classification – very high guideline.

Table 6: Comparison existing Licence L6465/1989/10 discharge criteria to water quality guidelines

Parameter	Unit	Proposed discharge criteria	ANZG (2018)		Bindjareb Djilba – Peel-Harvey (DWER 2020)	Statewide River Water Quality Assessment (2009) Classification – very high
			95%	99%		
pH	-	4.7-9	6.5-8.0			
Total dissolved solids (TDS)	mg/L	1000				
Total suspended solids (TSS)		80				> 25 mg/L
Surfactants as MBAS		5				
Total phosphorus		2			0.1	> 0.2 mg/L
Oil and grease		5				
Chromium		0.06	0.0033			
Copper		1	0.0014	0.001		
Zinc		5	0.008	0.0024		

Given the proposed change in licensed discharge location, volume and timing from periodic, distributed discharge to ongoing, directed discharge of larger volumes to a natural creekline, the Delegated Officer has reviewed the discharge criteria for potential parameters of concern and has revised the currently approved discharge values for pH, total suspended solids, total phosphorus, chromium, copper and zinc with regard to the ecological values of McKnoes Brook.

The Delegated Officer considers that the discharge criteria for the above parameters should be in line with ANZG (2018) 99% Freshwater Species Protection levels given the substantial change in discharge location, volume and timing, particularly during periods of low or no flow where releases of water exceeding these values could be detrimental to the ecology (further discussed in section 3.3.7). Total Phosphorus levels should comply with the Statewide River Water Quality Assessment (2009) Classification – very high guideline.

Furthermore, in reviewing the proposed PFAS discharge criteria, and the significant annual discharge volumes the Licence Holder is proposing, the Delegated Officer considers that the approved discharge criteria for PFAS should be more conservatively set at the limit of reporting for ultra-trace levels of PFAS compounds. This will significantly reduce the likelihood of bioaccumulation in trout and other biota in McKnoes Brook that may pose a health risk through the human consumption pathway, as well as ensuring a higher level of protection of the environmental receptors supported by McKnoes Brook. Refer to section 3.3.8 for further discussion on the final approved discharge criteria for treated water to McKnoes Brook.

3.3.3 Characterisation of receiving environment

The Licence Holder performed sampling and analysis of surface water and sediment in McKnoes Brook in the vicinity of the discharge location, as well as groundwater in the vicinity of the PTU and Arundel Pre-treatment Dams. Analysis was performed for PFAS, metals and hydrocarbons. Table 7 provides results of the analysis for surface water. Table 8 and Table 9 show results for groundwater and sediment respectively.

Figure 12 depicts the locations of sample points and groundwater bores for this once off sampling event performed in July 2022. It should be noted that for the surface water sampling, all sample points are located downstream of the current licence discharge point from Arundel Sump number 5.

Table 7: Contaminant concentration levels in surface water samples from McKnoes Brook (as at July 2022)

PFAS Compound (µg/L)	Sample points				PFAS 2020 NEMP 99% Freshwater species protection criteria	Australian Drinking Water Guidelines 2018 (Health)	Limit of Reporting (µg/L)
	Proposed discharge point	T2	T3	T4			
Perfluorobutanoic acid (PFBA)	0.012	0.01	0.009	<0.005	-	-	0.005
Perfluorohexanoic acid (PFHxA)	0.018	0.019	0.014	<0.001	-	-	0.001
Perfluoropentanoic acid (PFPeA)	0.041	0.04	0.032	0.001	-	-	0.001
Perfluoroheptanoic acid (PFHpA)	0.008	0.008	0.007	<0.001	-	-	0.001
Perfluorooctanoic acid (PFOA)	0.001	0.001	0.001	<0.001	19	0.56	0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	0.009	<0.005	<0.005	<0.005			0.001
Perfluoropentanesulfonic acid (PFBS)	0.001	0.001	0.001	<0.001	-	-	0.001
Perfluoropentane sulfonic acid (PFPeS)	0.001	0.001	0.001	<0.001	-	-	0.001
Perfluorohexane sulfonic acid (PFHxS)	0.007	0.008	0.007	<0.001	-	-	0.001
Perfluorooctane sulfonic acid (PFOS)	0.007	0.007	0.006	<0.001	0.00023	0.07	0.0001
Sum of PFHxS and PFOS	0.014	0.015	0.013	<0.001	-	0.07	0.001
Sum of PFAS	0.105	0.095	0.078	<0.005	-	-	0.005
Sum of PFAS (PFOS + PFOA)	0.008	0.008	0.007	<0.001	-	-	0.001
Heavy metals (mg/L)	Proposed discharge point	T2	T3	T4	ANZ Guidelines 99% Freshwater species protection criteria	Australian Drinking Water Guidelines 2018 (Health)	Limit of Reporting (mg/L)
Aluminium (total)	0.12	0.25	0.21	<0.05	0.0008*	2**	0.05
Aluminium (dissolved)	0.12	<0.05	<0.05	<0.05	0.0008*	2**	0.05
Barium (total)	0.02	0.01	0.01	0.02	-	2	0.01
Barium (dissolved)	<0.01	<0.01	0.01	0.01	-	2	0.01
Cobalt (total)	<0.001	<0.001	<0.001	0.002	-	-	0.001
Manganese (total)	<0.005	<0.005	<0.005	0.084	1.2	0.5	0.005
Manganese (dissolved)	<0.005	<0.005	<0.005	0.06	1.2	0.5	0.005
Molybdenum (total)	0.002	0.003	0.002	<0.001	-	0.05	0.001

Molybdenum (dissolved)	<0.001	<0.001	0.002	<0.001	-	0.05	0.001
Nickel (total)	<0.001	<0.001	<0.001	0.003	0.008	0.02	0.001
Nickel (dissolved)	<0.001	<0.001	<0.001	0.003	0.008	0.02	0.001

Note 1: Bold data indicates detection above a LOR. Coloured cells indicate an exceedance with relevant assessment criteria

Note 2: * indicates criteria obtained from the ANZECC & ARMCANZ (2000) water quality guidelines - Upland Water

Note 3: ** indicates criteria from USEPA RSLs Tapwater THQ=0.1 used in the absence of national guideline

Table 8: Contaminant concentration levels in groundwater bores around PTU and Arundel Pre-Treatment Dams (as at July 2022)

PFAS Compound (µg/L)	Monitoring bore							PFAS NEMP 2020 99% Freshwater species protection criteria	Australian Drinking Water Guidelines 2018 (Health)	Limit of Reporting (µg/L)
	BH01	BH04	BH05	BH07	BH08	BH10	BH11			
Perfluorohexanoic acid (PFHxA)	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	-	-	0.001
Perfluoroheptanoic acid (PFHpA)	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	-	-	0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	<0.005	<0.005	<0.005	<0.005	0.048	0.006	0.005			0.001
Perfluoropropane sulfonic acid (PFPrS)	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001			
Perfluorobutane sulfonic acid (PFBS)	0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	-	-	0.001
Perfluoropentane sulfonic acid (PFPeS)	0.001	<0.001	<0.001	0.001	0.003	<0.001	<0.001	-	-	0.001
Perfluorohexane sulfonic acid (PFHxS)	0.002	<0.001	<0.001	0.003	0.02	<0.001	<0.001	-	-	0.001
Perfluorooctane sulfonic acid (PFOS)	<0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	0.00023	0.07	0.0001
Sum of PFHxS and PFOS	0.002	0.001	<0.001	0.003	0.021	0.001	<0.001	-	0.07	0.001
Sum of PFAS	<0.005	<0.005	<0.005	0.007	0.075	0.007	0.005	-	-	0.005
Sum of PFAS (PFOS + PFOA)	<0.001	0.001	<0.001	<0.001	0.001	0.001	<0.001	-	-	0.001
Heavy metals (mg/L)	BH01	BH04	BH05	BH07	BH08	BH10	BH11	ANZ Guidelines 99% Freshwater species protection criteria	Australian Drinking Water Guidelines 2018 (Health)	Limit of Reporting (mg/L)
Aluminium (total)	0.54	11.5	5	8.3	3.3	7.9	7.2	0.0008*	2**	0.05
Aluminium (dissolved)	<0.05	0.11	<0.05	1.2	<0.05	<0.05	<0.05	0.0008*	2**	0.05
Arsenic (total)	<0.001	<0.001	<0.001	0.002	<0.001	0.006	0.002	0.001	0.01	0.001

Barium (total)	0.04	0.056	0.04	0.09	0.03	0.04	0.08	-	2	0.01
Barium (dissolved)	0.04	0.03	0.02	0.068	0.01	<0.01	0.02	-	2	0.01
Chromium (total)	0.001	0.008	0.008	0.011	0.004	0.024	0.007	-	0.05**	0.001
Chromium (dissolved)	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	-	0.05**	0.001
Cobalt (total)	<0.001	0.002	<0.001	0.002	<0.001	0.001	0.002	-	0.0006**	0.001
Copper (total)	0.004	0.012	0.005	0.025	0.006	0.011	0.008	-	0.0006**	0.001
Copper (dissolved)	<0.001	0.008	<0.001	0.01	<0.001	<0.001	<0.001	0.001	2	0.001
Lead (total)	<0.001	0.028	0.006	0.035	0.01	0.059	0.047	0.001	0.01	
Lead (dissolved)	<0.001	<0.001	<0.001	0.009	<0.001	<0.001	<0.001	0.001	0.01	
Manganese (total)	0.057	0.082	0.031	0.1	0.013	0.095	0.22	1.2	0.5	0.005
Manganese (dissolved)	0.057	0.035	0.019	0.063	0.007	0.037	0.074	1.2	0.5	0.005
Mercury (total)	<0.0001	<0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.00006	0.001	0.0001
Molybdenum (total)	<0.001	<0.001	<0.001	<0.001	0.003	0.001	0.001	-	0.05	0.001
Molybdenum (dissolved)	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	-	0.05	0.001
Nickel (total)	0.003	0.002	0.003	0.006	0.002	0.008	0.004	0.008	0.02	0.001
Nickel (dissolved)	0.003	0.002	<0.001	0.003	0.001	0.001	0.002	0.008	0.02	0.001
Titanium (total)	0.025	0.5	0.095	0.47	0.21	0.042	0.58	-	-	0.005
Uranium (total)	<0.001	0.004	0.003	0.009	0.002	0.031	0.016	-	0.017	0.005
Vanadium (total)	<0.005	<0.005	0.012	0.013	0.006	0.033	0.01	-	0.0086**	0.005
Zinc (total)	0.007	0.016	<0.005	0.014	0.022	0.007	0.015	0.0024	3^	0.005
Zinc (dissolved)	0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0024	3^	0.005

Note 1: Bold data indicates detection above a LOR. Coloured cells indicate an exceedance with relevant assessment criteria

Note 2: * indicates criteria obtained from the ANZECC & ARMCANZ (2000) water quality guidelines - Upland Water

Note 3: ** indicates criteria from USEPA RSLs Tapwater THQ=0.1 used in the absence of national guideline

Note 4: *** indicates criteria obtained from WHO DWQG 4th Ed used in the absence of national guideline values

Note 5: ^ indicates ADWG 2018 Aesthetic guideline used in absence of national guideline values (health)

Table 9: Contaminant concentration levels in sediment samples from McKnoes Brook (as at July 2022)

PFAS Compound (µg/kg)	Sample points			NEPM 2013 Table 1B(5) Generic EIL - Areas of Ecological Significance	-	-	Limit of Reporting (µg/kg)
	T2	T3	T4				
Perfluoropentanoic acid (PFPeA)	0.0003	0.0001	<0.0001	-	-	-	0.0001
Heavy metals (mg/kg)	T2	T3	T4	NEPM 2013 Table 1B(5) Generic EIL - Areas of Ecological Significance	ANZG 2018 Sediment DGV	NEPM 2013 Table 1A(1) HILs Comm/Ind D Soil	Limit of Reporting (mg/kg)
Aluminium (total)	10,000	7,900	42,000**	-	-	110,000*	1
Barium	13	14	80**	-	-	22,000*	1
Beryllium	0.4	0.3	3**	-	-	500	0.1
Cadmium	<0.01	<0.01	0.2	-	1.5	900	0.1
Chromium (III + IV)	15	14	280**	130 (CrIII)	80	3,600 (CrVI)	1
Cobalt	1.7	<0.1	130	-	-	4,000	1
Copper	8.3	<1	53	30	65	240,000	1
Lead	<1	<1	32**	470	50	1,500	1
Manganese	7.4	11	1,060**	-	-	60,000	1
Mercury	0.09	0.06	0.21	-	0.15	730	0.02
Molybdenum	<2	<2	6.6**	-	-	580*	2
Nickel	7.4	8.4	170	5	25	6,000	1
Selenium	<2	<2	9.9	-	-	10,000	2
Titanium	100	70	360**	-	-	-	1
Uranium	<0.5	<0.5	20.2**	-	-	23*	0.5
Vanadium	29	31	150**	-	-	580*	2
Zinc	5.3	5.8	87	50	200	400,000*	1
TRH (mg/L)	T2	T3	T4	CRC 2011 Table A(4) HSLs Direct Contact Recreational / Open Space	CARE 2011 Table A(4) HSLs Direct Contact Comm/Ind D Soil	-	Limit of Reporting (mg/kg)
>C10-C16 Fraction (F2)	<50	<50	130**	3,800	20,000	-	50
>C10-C16 Fraction (F2 minus	<50	<50	130**	-	-	-	50

Naphthalene)							
>C16-C34 Fraction (F3)	<100	<100	710**	5,300	27,000	-	100
>C34-C40 Fraction (F4)	<100	<100	110**	7,400	38,000	-	100
>C10-C40 Fraction (Sum)	<100	<100	950**	165,000	-	-	100

Note 1: Bold data indicates detection above a LOR. Coloured cells indicate an exceedance with relevant assessment criteria

Note 2: F1 to F4 = four carbon chain fractions based on fractions adopted in the Canada-wide standard for petroleum hydrocarbons (PHC) in soil. For comparison to assessment criteria, only F1, F2, F3 and F4 are applied.

Note 3: *Criteria from USEPA, Nov 2020, USEPA RSLs Industrial Soil THQ=0.1 used in the absence of national guideline

Note 4: **indicates that the Duplicate or Triplicate concentrations has been adopted as a conservative measure

The results of the monitoring of the receiving environment show that there are detections of contaminants of concern that have made their way into the surface water, sediment and groundwater at the Premises, likely from activities associated with historical bauxite mining operations.

Surface water monitoring (Table 7) shows PFOS levels exceeding the 99% species protection level (0.00023ug/L) (PFAS NEMP, 2020) at three of the sample sites: discharge (0.007ug/L), T2 (upstream of discharge point – 0.007ug/L) and T3 (downstream of discharge point – 0.006ug/L). Surface water monitoring also showed some exceedances of metals against guideline criteria (aluminium and cobalt) along McKnoes Brook.

Groundwater monitoring (Table 8) showed detections of a number of PFAS compounds above the limit of reporting (LOR) in all bores, and exceedances of the 99% species protection (PFAS NEMP, 2020) for PFOS in three out of five bores (B04, B8 and B10 at 0.001ug/L). PFOS levels in groundwater appear to be lower than those in surface water. Some exceedances of metals were also detected in all bores, though it is noted that geology of the area is likely to be naturally enriched with metals. Bores BH04 and BH07 are upgradient of the pre-treatment dams, while bores BH10 and BH11 are located downgradient of the dams.

Sediment monitoring showed elevated nickel levels at three sample sites (one upstream and two downstream of discharge point), elevated chromium (III & IV), copper, mercury and zinc at the T4 sample site. Only one PFAS compound (PFPeA) was detected above LOR at T3 sample site.

The Delegated Officer notes that the Licence Holder is currently carrying out a Stage 3 Detailed Site Investigation as required under the *Contaminated Sites Act 2003*, that will consider the impacts and remediation actions required from any contamination from PFAS and other contaminants caused from mining activities. The DSI will assist in understanding the nature and extent of PFAS and other contaminants present across the entire Premises and their transport routes both on- and off-site. This will support an update to the preliminary Conceptual Site Model that has been developed and will determine whether PFAS poses an unacceptable risk to the surrounding environment and human health. It will also inform the need for further investigations and management actions.

The Delegated Officer considers regulation and any required remediation of the existing contamination status of the entire mine site from previous mining operations is best regulated under the *Contaminated Sites Act 1986*. The assessment for this licence amendment application will focus on the treatment and discharge of contaminated surface water generated from operational areas at Orion and Arundel areas only and will set appropriate controls to ensure any future discharges to McKnoes Brook does not result in unacceptable risks to the environment and human health.

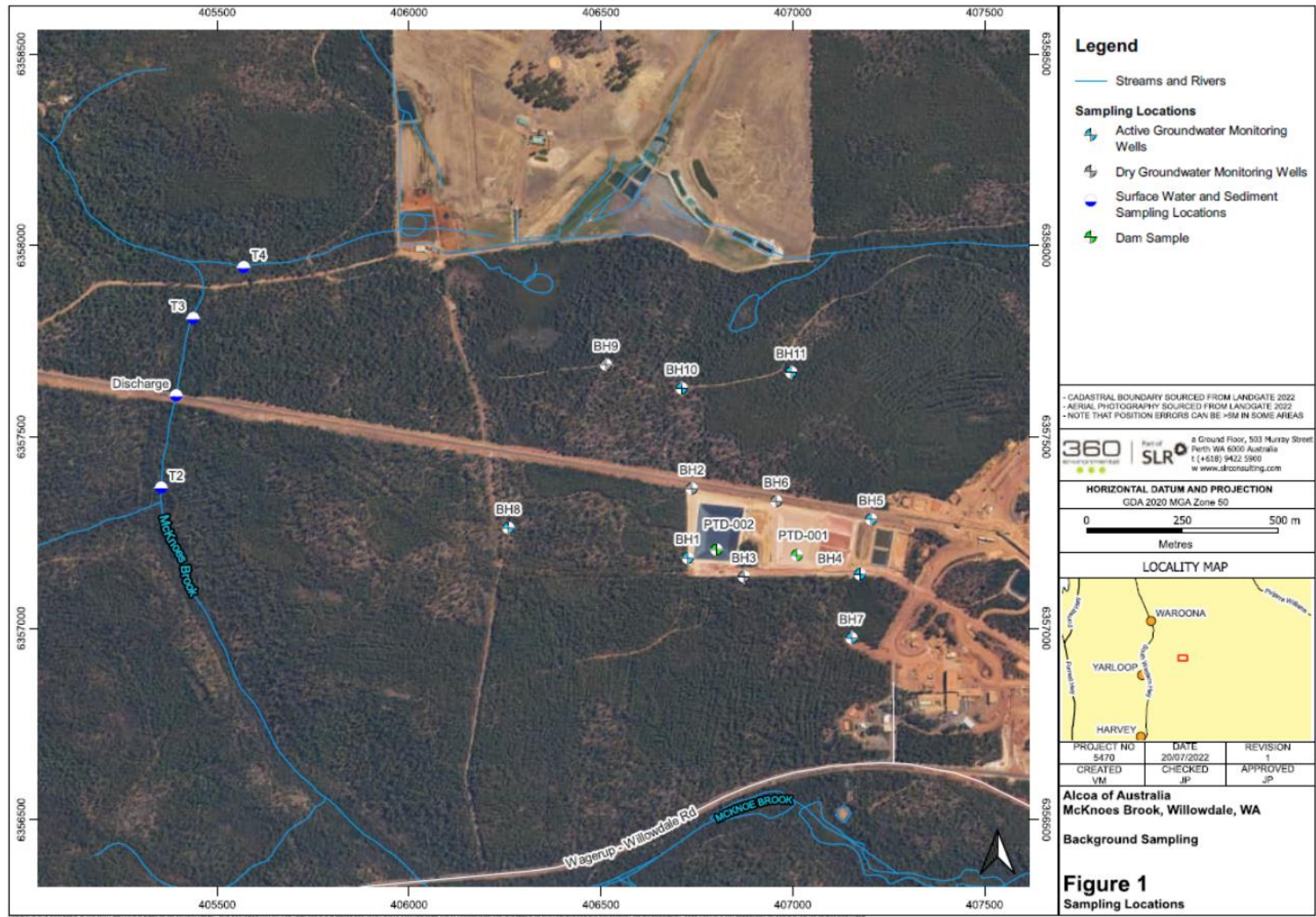


Figure 14: Sampling locations within McKnoes Brook and groundwater bores around the PTU (July 2022)

3.3.4 Pathway

McKnoes Brook is an ephemeral creek approximately 10 km long flowing in a westerly direction, with headwaters emanating from the Darling Scarp that flows onto the Swan Coastal Plain, where it joins Samson Brook and contributes to supplying the Waroona Irrigation District. McKnoes Brook is located outside of the Samson Brook Priority 1 Public Drinking Water Source Area (PDWSA), which is located 350 m east of the Arundel site.

Predominant land uses in the area include agriculture and industry. Sensitive land uses include endemic jarrah forest reserves, drinking water catchment protection, a farm located 1.3 km to the northwest of Arundel, and a recreational scout camp (Waterous Camp Site) located 1.2 km downstream of the proposed treated water discharge point.

Beneficial uses of McKnoes Brook include public recreation and fishing activities, water supply (including irrigation for grazing and cropping and aquaculture) and ecosystem services (aquatic and riparian habitat, including for some threatened and priority fauna).

3.3.5 Criteria for assessment

The relevant Specific Consequence Criteria for health or environment to assess the Licence Holder's proposal against are as follows:

- PFAS National Environmental Management Plan (2020) Freshwater species protection criteria
- Water Quality Australia Guidelines 99% Freshwater species protection criteria
- Australian Drinking Water Guidelines (Health and Aesthetic)(Department of Health, 2017)
- Limits of Reporting for ultra-trace analysis of PFAS compounds.

3.3.6 Licence Holder controls

The Licence Holder is proposing to construct a PFAS treatment unit (PTU) to treat and discharge up to 219 ML of treated water per year to the environment. This is being proposed to assist with clean up and remediation of identified contamination sources at the Premises. The PTU will have a design production capacity of 40 m³ per hour. It is a package plant system based on Granular Activated Carbon / Ion Exchange resin technology. The PTU will be located on a concrete base draining to a sump with a pump that will discharge any collected water back to APTD-001.

- Key design elements of PTU treatment system:
 - PTU has been designed to meet the PFAS-30 Ultra-trace Limit of Reporting levels as outlined in Appendix 3, based on Granular Activated Carbon / Ion Exchange resin treatment technology
 - Pipeline for PFAS impacted water from Arundel to Pre-treatment Dams: 72m³ per hour. Approximately 1km of 125mm HDPE pipeline to be laid in existing easements
 - Treated Water Dams 1 – 3: in-situ earthen construction with clay liners and also HDPE liners providing less than 1×10^{-9} m/s permeability. 4.5 ML storage design capacity for each dam (13.5 ML combined capacity). Designed to meet ANCOLD specifications.
 - If treatment fails to meet the relevant discharge criteria, water will be discharged back into the Pre-treatment Dams to be retreated through the PTU. Should the PFAS treatment rates be unable to keep pace with PFAS affected water storage volumes at Orion, the Licence Holder will engage a third party licenced controlled waste contractor to truck PFAS affected water offsite for treatment and disposal.

- Treated water discharge pipeline: Arundel PTU to McKnoes Brook. Approximately 2km of 125mm HDPE pipeline to be laid in existing easements with 72m³ per hour design capacity.
- McKnoes Brook discharge point: Proposing to discharge up to 72m³ per hour via a pipeline into McKnoes Brook utilising existing rock dominated channel to control erosion and sedimentation, preventing damage to bed and banks.

Additional infrastructure and controls proposed by the Licence Holder to manage treated water discharge to McKnoes Brook include:

- New oil-water separator at Arundel workshops to enable all water reporting to the PTU to be pre-treated for hydrocarbons and solids (up to 90% solids reduction and 90% Oils and Grease reduction). Oil-water separator has 30L/min treatment design capacity, 1,000L polyethylene solids interceptor tank for settlement with oily water which then gravity feeds to a polyethylene oil-water separator.
- Arundel water collection pond to support new oil-water separator: in-situ earthen construction with clay liner and also HDPE liner providing less than 1×10^{-9} m/s permeability. 1.5 ML storage design capacity designed to meet ANCOLD specifications.
- Annual health assessment of riparian and riparian adjacent vegetation of McKnoes Brook along four transects to detect any changes in:
 - mean number of tree species stem counts within transects
 - proportions of health category ratings of mean tree stem counts within transects
 - obvious signs of erosion, and
 - comparison of results between upstream and downstream transects.

3.3.7 Assessment and risk rating

Consequence

Environment: The Delegated Officer notes that the Licence Holder has proposed to treat and discharge water to meet the default guideline value for 99% species protection for PFAS compounds, as specified in the PFAS NEMP 2020 and Water Quality Australia Guidelines. The Delegated Officer considers that changes to water quality from the proposed discharge of treated water to McKnoes Brook could have mid-level on-site impacts to the ecosystem of the Brook, and low-level offsite impacts on a local scale. This is because even at very low levels, PFAS is very persistent, bioaccumulative, toxic, and has potential to undergo long-range transport in the environment. There is also a high level of uncertainty around the cumulative risks posed by many other PFAS compounds that may be present in the discharge. Therefore, the Delegated Officer has determined that the consequence of the treated water discharge impacting ecosystem health would be **Moderate**.

Human health: The Delegated Officer considers that changes to water quality from the proposed discharge of PFAS treated water to McKnoes Brook could result in adverse human health effects. Even at low concentrations, there is the potential that PFAS compounds may bioaccumulate in the tissue of some fish and marron that are targeted for recreational fishing species throughout the year. Some PFAS compounds are toxic and can persist for quite long periods in the human body, and may therefore be expected to cause long-term adverse health effects. Therefore, the Delegated Officer has determined that the consequence of the treated water discharge impacting human health would be **Major**.

Likelihood

The Delegated Officer has had regard for the Licence Holder's controls, particularly the proposed discharge criteria and batch treatment process, and considers the risk event could occur at some time. This is possible given the significant volumes of treated water that is proposed for treatment and discharge. Noting also the existing site monitoring data that shows presence of contaminants already in the ambient surface water and groundwater, likely due to historical mining practices, and the potential of PFAS to bioaccumulate in the environment, the Delegated Officer has determined the likelihood of the discharge to McKnoes Brook impacting human health and / or the environment through changes to water quality to be **Possible**.

Overall risk rating

The Delegated Officer has applied the consequence and likelihood ratings described above to the Risk Criteria table in the *Guidance Statement: Risk Assessments* (DWER 2020) and determined that the overall rating for the risk of the discharge to McKnoes Brook impacting human health is **High**. The Delegated Officer has therefore applied additional regulatory controls as outlined in section 3.3.8.

The overall rating for the risk of the discharge to McKnoes Brook impacting the environment to be **Medium**. This risk event rating is acceptable, subject to the regulatory controls specified in Sections 3.3.8 and 3.5.

3.3.8 Additional regulatory controls

The assessment identified that the overall risk of human health impact from the proposed discharge of treated water to McKnoes Brooke is high, and the overall risk to ecosystem receptors is medium. The Delegated Officer has reviewed the results of surface water and sediment samples taken from McKnoes Brook and groundwater samples from the vicinity of the PTU and Pre-treatment dams, which have demonstrated detections of PFAS and metals. PFOS in surface water was shown to exceed the PFAS NEMP (2020) 99% freshwater species protection criteria in some locations.

The Delegated Officer considers it unlikely that these levels are reflective of 'ambient' levels upstream of mining operations. The Department's own ambient investigations in the South West region have shown that in catchments where the predominant land use is uncleared forest, minor detections occasionally occur, but most sites return non-detects. Department investigations showed that PFOS was the only substance detected in bushland catchments, with detection recorded at 21% of sampling sites with a median concentration of 0.00005 µg/L. Both the median and the 80% percentile concentrations from this data set were below the 99% freshwater species protection level.

The locations sampled by the Licence Holder along McKnoes Brook (surface water) and around the proposed PTU and existing Pre-treatment Dams (groundwater) are not considered consistent with an 'uncleared bushland' catchment and given the Licence Holder's surrounding mining activity, these sampling locations are not considered appropriate to characterise ambient background concentrations. Bauxite mining is a major and widespread land use in the area and appears to be the most likely source of any PFAS detected.

Noting the above and taking into account the significant annual discharge volumes the Licence Holder is proposing, the Delegated Officer considers that the approved discharge criteria for PFAS should be more conservatively set at the limit of reporting for ultra-trace levels of PFAS compounds. This will reduce the potential for bioaccumulation in trout and other biota in McKnoes Brook that may pose a health risk through the human consumption pathway, as well as ensuring a higher level of protection of the ecosystems supported by McKnoes Brook.

The above approach is considered to be in line with the principles of the PFAS NEMP (2020) in that:

- Treatment and discharge to limit of reporting ultra-trace levels for PFAS is in line with precautionary principle, noting quantification of health and environmental risks of a number of PFAS compounds is still outstanding (refer section 3, page 12 of the PFAS NEMP);
- The principle that discharging low levels of PFAS to areas that have even lower or no levels of PFAS should be considered only in consultation with the relevant regulatory authority in exceptional circumstances where there is no feasible, practicable alternative. This is noted in Section 12.1.1, page 62 of the PFAS NEMP in relation to soil reuse, but it is a principle that should logically be applied more broadly in relation to environmental discharges of PFAS-impacted water;
- Although quoted in relation to reuse of water (rather than discharge) the following statement from Section 12.3, page 65 of the PFAS NEMP is relevant: Where reuse involves the discharge of PFAS-contaminated water to land, the risk assessment should not only consider the potential for PFAS transport to off-site sensitive receptors, but also the potential for long-term build-up of the total PFAS mass in the receiving soils, groundwater and plants;
- The DGVs for 99% Freshwater species protection specified in the PFAS NEMP (2020) do not account for protection of terrestrial ecosystems that are dependent on aquatic systems for their survival. Biomagnification in the food web may result in significant adverse effects on higher trophic levels in the foodchain; and
- The DGVs for 99% Freshwater species protection specified in the PFAS NEMP (2020) should be used to inform site investigations and consider environmental management objectives, they are not intended to be used as clean up criteria or authorisation to pollute to these values.

Discharge criteria for the primary PFAS compounds of concern, notably PFOA, PFOS and PHHxS, along with the longer chain PFAS compounds that pose a higher toxicity risk, have been set using standard ultra-trace levels offered by commercial laboratories (0.001-0.005 µg/L). These levels are lower than DGVs for 99% Freshwater species protection specified in the PFAS NEMP. Discharge criteria for PFAS compounds of lesser concern that are also likely to have variable (higher) LORs at some laboratories have been set at the standard ultra-trace levels or less than the selected laboratory LOR.

In addition to setting the approved discharge criteria at the limit of reporting for ultra-trace levels for PFAS, the Delegated Officer has reviewed the authorized limits for pH, Total Suspended Solids, Chromium, Copper and Zinc to align with the Water Quality Australia (2018) 99% Freshwater Species Protection levels. Total Phosphorus levels will be required to comply with the Statewide River Water Quality Assessment (2009) Classification – very high.

To ensure potential impacts to McKnoes Brook from increased flowrates are adequately monitored, the Delegated Officer has imposed vegetation health monitoring of riparian vegetation along McKnoes Brook, as well as water level monitoring upstream of the discharge location. Authorised discharge shall only occur at 10 L/sec continuous release rate or 20L/sec for a pulse pattern release rate.

The Delegated Officer has also imposed surface water monitoring of McKnoes Brook. The Licence Holder will be required to sample water from the four sites sampled in July 2022 on a quarterly basis, for PFAS, hydrocarbons, nutrients, major ions and metals analysis. This is to obtain a complete baseline characterisation, understand seasonal variations and ensure the receiving environment remains suitable for ongoing discharges at the volumes proposed. Improved understanding of baseline ambient levels and seasonal variability is important given the concentrations of some major ions, pH and TDS can influence PFAS adsorption to

sediments. Daily cumulative discharge volumes must also be recorded.

The additional regulatory controls imposed (more stringent discharge criteria) are in line with advice received from other regulatory agencies in relation to this application.

Given the requirement to discharge PFAS compounds at or below the LOR for ultra-trace levels for PFAS compounds, and noting the Detailed Site Investigations occurring under the *Contaminated Sites Act 2003* across the broader premises, the Delegated Officer does not consider that ambient trigger values for PFAS compounds need to be applied to surface water, groundwater or sediment at this time.

3.4 Detailed risk assessment for loss of containment from sumps and dams at Orion and Arundel areas

3.4.1 Overview of risk event

The risk event assessed is loss of contaminated water from sumps and dams from overflows, spills or seepage, resulting in releases of contaminants including PFAS, heavy metals and hydrocarbons to soils and / or surface water, causing contamination of soils, surface water and groundwater and therefore, potential adverse impacts to human health, flora, fauna and ecological communities.

As outlined in section 3.3.1 above, the most significant risk event would be from release of PFAS compounds, which are persistent, bioaccumulative, toxic, and have potential to travel long distances once released into the environment.

The high solubility of many PFAS in water means that PFAS may readily leach from soils and sediments into surface water and groundwater, where they can enter creeks, rivers and lakes, and become part of the food chain, being transferred from organism to organism as they accumulate, posing a risk of causing adverse effects to human health and the environment, even at low concentrations.

Release of heavy metals and hydrocarbons into the environment may also cause contamination of soils, surface water and groundwater, as these contaminants are also toxic and have potential to impact human health and biota.

3.4.2 Source: characterisation of emission

The Licence Holder has performed sampling and analysis of the contaminated water in the Arundel Pre-treatment Dams as shown in Table 10. Analysis was performed for Total Recoverable Hydrocarbons (TRH), BTEX, heavy metals (total and dissolved) and PFAS compounds.

Table 10: Contaminant concentration levels in Pre-treatment dams 001 and 002 (as at July 2022)

PFAS Compound (µg/L)	APTD-001 (µg/L)	APTD-002 (µg/L)	PFAS NEMP 2020 99% Freshwater protection species criteria (µg/L)	Australian Drinking Water Guidelines 2018 (Health)	Limit of Reporting (µg/L)
Perfluorooctane sulfonic acid (PFOS)	0.0009	0.0003	0.00023	0.07	0.0001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	0.012	<0.005	-	-	0.005
Perfluoroheptanoic acid (PFHpA)	0.01	<0.00	-	-	0.001

Heavy metals (mg/L)	PTD-001 (mg/L)	PTD-002 (mg/L)	ANZ Guidelines 99% Freshwater species protection (mg/L)	Australian Drinking Water Guidelines 2018 (Health)	Limit of Reporting (mg/L)
Aluminium (total)	0.36	0.40	0.0008	2*	0.05
Aluminium (dissolved)	<0.05	0.07	0.0008	2*	0.05
Chromium (total)	0.004	0.002	-	0.05^	0.001
Chromium (dissolved)	0.002	<0.001	-	0.05^	0.001
Molybdenum (total)	0.007	<0.001	-	0.05	0.001
Molybdenum (dissolved)	0.005	<0.001	-	0.05	0.001
Zinc (total)	0.029	<0.005	0.0024	-	0.005
Zinc (dissolved)	0.005	<0.005	0.0024	-	0.005
TRH (mg/L)	PTD-001 (µg/L)	PTD-002 (µg/L)	ANZ Guidelines 99% Freshwater species protection (µg/L)	Australian Drinking Water Guidelines 2018 (Health)	Limit of Reporting (µg/L)
TRH C16-C34	0.2	<0.1	-	90**	0.1

Note 1: Bold data indicates detection above a LOR. Coloured cells indicate an exceedance with relevant assessment criteria

Note 2: *indicates criteria obtained from USEPA RSLs Tapwater THQ=0.1 used in the absence of national guideline

Note 3: **indicates criteria obtained from the World Health Organisation - Petroleum Products in Drinking Water (2008)

Note 4: ***indicates criteria obtained from WHO DWQG 4th Ed used in the absence of national guideline values

Note 5: ^ indicates ADWG 2018 Aesthetic guideline used in absence of national guideline values (health)

Table 10 shows that PFAS concentration levels in PTU-001 and PTU-002 exceed the ANZ guideline values for 99% freshwater species protection for PFOS. PFAS compounds 6:2 FTS and PFHpA were also detected above trace levels in PTU-001. Results showed TRH and BTEX at concentrations below the LOR except for APTD-001 where TRH C16-C34 was detected just above the LOR.

Sampling and analysis performed in 2022 and 2023 of a number of surface water storage sumps at Orion and Arundel also show elevated levels of PFOS, PFOA, and PFHxS + PFOS, that also exceed guideline criteria. Compounds including PFBA, PFPeA and PFHxA have been detected above the ultra-trace LORs for those compounds.

3.4.3 Pathway

At the Arundel site groundwater is located between 14 and 18 mbgl and flows towards McKnoes Brook, which is around 1.4 m west/north-west of the pre-treatment dams and PTU and 300 m south/south-west of the stormwater collection pond.

Soil infiltration rates are highly permeable and vary considerably depending on depth. Topsoil permeability has been measured at 6.8 m/day and gravel lower in the soil profile measured at 0.05 m/day.

The Arundel site is approximately 3 km south-west of the Samson Brook Dam reservoir (P1 PDWSA).

3.4.4 Criteria for assessment

The relevant Specific Consequence Criteria for health or environment to assess the Licence Holder's proposal against are as follows:

- PFAS National Environmental Management Plan (2020) Freshwater species protection criteria
- Water Quality Australia Guidelines 99% Freshwater species protection criteria
- Australian Drinking Water Guidelines (Health and Aesthetic)(Department of Health, 2017)
- Limits of Reporting for ultra-trace analysis on PFAS compounds.

3.4.5 Licence Holder controls

All stormwater generated on the Premises is currently collected within existing lined and unlined sumps, dams and ponds or disposed offsite via a licenced third-party contractor.

Orion sumps

Existing sumps and dams at Orion are currently being managed with freeboard requirements that have been specified under the Environmental Protection Notice as outlined in section 2.6. controls include:

- Orion Sump 3 must be maintained and operated with a minimum freeboard of 50% of the sump capacity
- Orion Sump 3 HDPE liner must be maintained to prevent water loss via infiltration; and
- Orion Sumps 1 and 2 must be maintained and operated with a minimum freeboard of 30% of each sump capacity

Pre-treatment dams APTD-001 and APTD-002 design specifications:

- APTD-001 with storage capacity of 50 ML and APTD-002 with storage capacity of 60 ML
- designed to meet ANCOLD guidelines and comprise in-situ earthen construction with clay liner and HDPE liner providing less than 1×10^{-9} m/s permeability.
- Emergency spillways incorporated into the design to maintain embankment wall integrity. Spillway design allows for a 1:100,000 AEP 1 hour event (164 mm depth). The spillway would be activated if the 164 mm depth was reached and would prevent overtopping of the embankment walls. The emergency spillways discharge to an open drainage swale to the north of the Pre-treatment Dams and into McKnoes Brook.
- Design allowance for an average year's total wet season rainfall (70% of the annual average rainfall based on Bureau of Meteorology data which amounts to 790 mm).
- Plus an allowance to capture a 1:100 Annual Exceedance Probability (AEP) 72 hour storm event volume (229 mm).
- Total freeboard allowance of 500 mm.

Treated Water Dams 1 – 3:

- Each Treated Water batch pond to have storage design capacity of 4.5 ML (combined total of 13.5ML).
- All three batch ponds at the PTU have been designed to meet ANCOLD specifications and comprise in-situ earthen construction with clay liner and also HDPE liner providing less than 1×10^{-9} m/s permeability.

- Spillways are also incorporated into the design to maintain embankment wall integrity.

Anpress Pre-treatment Sumps:

The Licence Holder proposes to upgrade the existing 280 kL shotcrete cell (ASP2) (by replacing the liner) and installing a new 1.5 ML HDPE lined cell (ASP3). The design will be in accordance with the following:

- ANCOLD, DMP and Alcoa standards, with a 'Major' ANCOLD Consequence Assessment and Consequence Category – High C.
- Nominal capacity for 1:100 year annual rainfall storage capacity.
- Extreme storage allowance above Maximum Operating Level = 1000 mm; no spillage through the emergency spillways for a 1:100,000 year AEP Storm Event.
- Freeboard to cater for a 1:100 year AEP 72 hr rainfall event.
- Emergency spillway designed to relieve for up to a 1:100,000 year AEP Event. Spillway to relieve westwards towards ASW1.
- 1.5 mm thick HDPE liner with permeability of 2.27×10^{-17} m/s
- An electric leak detection survey (ELDS) will be carried out using the ARC testing method per ASTM D7953. If any liner damage or pinholes are identified, they will be rectified by the contractor.
- HDPE coupons (100 mm x 200 mm) welded to the top surface of the liner around the dams to enable future testing of the liner's integrity.
- 500 mm clay lining layer (permeability 7.46×10^{-8} m/s).
- 300 mm subgrade layer conforming to the embankment fill specification to prevent penetration of the liner system.

Existing pipelines for PFAS or hydrocarbon affected water at Orion, Arundel and Larego currently do not have secondary containment, as many of these are buried. The Licence Holder does not intend to provide secondary containment for pipelines at Orion as these pipelines are no longer in service and are scheduled for decommissioning by end 2024.

Secondary containment for the above ground pipeline between AP4 to the PFAS pre-treatment dams is not proposed as this pipeline is temporary and will be decommissioned within 12 months of the commissioning of the PFAS treatment system.

All new pipelines installed for the purposes of transferring hydrocarbon or PFAS affected water will be installed above ground, will be double skinned and will allow for leak detection.

3.4.6 Assessment and risk rating

Consequence

Environment: The Delegated Officer considers that loss of contaminated water from sumps and dams from overflows, spills or seepage, could result in specific consequence criteria for the environment not being met. This is because releases of contaminants including PFAS, heavy metals and hydrocarbons to soils and or surface water may cause contamination of soils, surface water and groundwater that could cause adverse impacts to flora, fauna and ecological communities in the vicinity of release. Therefore, the Delegated Officer has determined that the environmental consequence of loss of containment would be **Moderate**.

Human health: The Delegated Officer considers that loss of contaminated water from sumps and dams as a result of overflow, spills or seepage, could result in could result in specific consequence criteria for human health not being met. This is because PFAS are persistent, very bioaccumulative, toxic, and have potential to undergo long-range transport once released into

the environment. The close proximity of the Samson Dam P1 PDWSA presents a potential pathway for this risk event to a public drinking water resource. Therefore, the Delegated Officer has determined that the public health consequence of loss of containment would be **Major**.

Likelihood

In consideration of the Licence Holder's proposed controls, the Delegated Officer considers the risk event will probably not occur in most circumstances. Therefore, the Delegated Officer has determined the likelihood of the loss of containment impacting human health and / or the environment to be **Unlikely**.

Overall risk rating

The Delegated Officer has applied the consequence and likelihood ratings described above to the Risk Criteria table in the *Guidance Statement: Risk Assessments* (DWER 2020) and determined that the overall rating for the risk of loss of containment events impacting human health and the environment is **Medium**. This risk event rating is acceptable, subject to the regulatory controls specified in Section 3.5.

3.5 Licence controls

The assessment identified that:

- the overall risk of human health impact from the proposed discharge of treated water to McKnoes Brooke is high, and the overall risk to ecosystem services is medium; and
- the overall risk from loss of containment is medium.

To manage the risk of PFAS bioaccumulation and biomagnification presented by the proposed discharge of treated water to McKnoes Brook, the amended licence will only authorise discharges of treated mine surface waters at the volumes and rates that are considered to be acceptable, subject to a number of regulatory controls. Those PFAS compounds that have been shown to be detected at the Premises will have appropriate discharge limits applied (21 PFAS compounds in total). For some PFAS compounds, the discharge concentration approved has been set at ultra-trace non-detect levels (the laboratory limit of reporting for that compound), noting there are some PFAS compounds that commercial laboratories will not be able to analyse to ultra-trace levels. This is not the case for PFOA and PFHxS, or most of the long-chain (> 6 carbon atom) PFAS species, which will be required to meet ultra-trace non-detect levels specified in the licence. The discharge concentration for PFOS will be set slightly higher than the ultra-trace limit of reporting (discharge limit set at 0.0002ug/L).

Further controls to be applied to the amended licence are detailed in sections 3.3.6 (Licence Holder controls for discharge of treated water to McKnoes Brook), 3.3.6 (additional regulatory controls imposed by the Delegated Officer for discharge of treated water to McKnoes Brook), and 3.4.5 (Licence Holder controls for loss of containment from sumps and dams at Orion and Arundel areas).

3.5.1 Monitoring reports

The Licence Holder will be required to comply with construction compliance reporting requirements in relation to all new infrastructure authorised under this licence amendment, including noise reporting requirements to ensure compliance with the Noise Regulations. Annual reporting requirements are also conditioned in relation to all monitoring required under L6465/1989/10. This includes:

- A summary of any failure of pollution control equipment and any environmental incidents that have occurred
- Waste types generated / managed and disposed from the premises
- A summary of inspections and maintenance performed on infrastructure on the premises

- Volumes of PFAS contaminated water accepted, treated and discharged to McKnoes Brook, and the results from sampling / analysis of treated water discharged, along assessment and interpretation of the data, including comparison to historical trends
- A summary of results from the Annual Health Vegetation Assessment
- Copies of results from sampling / analysis of ambient surface water and groundwater monitoring at the premises and an interpretive summary and assessment of the results against relevant assessment levels for surface water and groundwater
- Any non-compliance with conditions of L6465/1989/10
- summary of complaints received, and any action taken to investigate or respond to any complaint; and
- an Annual Audit Compliance Report.

4. Consultation

Table 11 provides a summary of the consultation undertaken by the department. Where the points are numerous or require a detailed response they will be expanded in Appendix 2.

Table 11: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website (21/07/2023)	Seven responses received during public comment period. The comments are summarised with other community stakeholders in Appendix 2.	Refer to Appendix 2
Shire of Waroona advised of proposal (21/07/2023)	The Shire of Waroona responded on 26/07/2023 that no planning approval was required for the proposed activity.	No response required.
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal (21/07/2023)	No response received	N/A
Department of Biodiversity, Conservation and Attractions (DBCA) advised of proposal (21/07/2023)	DBCA responded on 1/08/2023 noting the capacity of DWER to apply appropriate regulatory measures for environmental management under Part V of the EP Act. They had no comments on the application.	N/A
Department of Health (DoH) advised of proposal (21/07/2023)	DoH responded on 11/08/2023 with the following comments: They do not oppose the licence amendment providing – 1. Any discharge meets the Australian Drinking Water Guidelines and does not measurably increase stream turbidity. 2. Ongoing routine monitoring of discharge water by Alcoa is monthly and provided to both DoH and DWER.	The Delegated Officer notes the comments and they have been incorporated into this risk assessment and conditioned as controls as required.

	<ol style="list-style-type: none"> 3. Transport and storage of untreated or contaminated water is done in accordance with regulatory controls and does not generate a public health risk. 4. Treatment to remove legacy contamination within Samson Dam Catchment Area should be located at the source of contamination. Use of pipelines to traverse the catchment area is not supported. 5. DWER and DoH is notified within 24 hours of any loss of containment involving discharge of water not meeting point 1 above. 6. Any future material change made to the activity is brought to the attention of DWER and DoH. 	
<p>Department of Jobs, Tourism, Science and Industry (JTSI) advised of proposal (21/07/2023)</p>	<p>JTSI response was received 14/08/2023. The following points were raised:</p> <p>JTSI is pleased that Alcoa has proposed additional solutions to matters previously identified in the Works Approval application (ref: W6721/2022/1) referred to JTSI for comment on 7 October 2022.</p> <p>JTSI notes that Alcoa’s mining operations have been third-party referred to the Environmental Protection Authority (EPA). Part 1.3.1 of the Company’s Supporting Information Document for the Licence Amendment application suggests that the application should not form part of a referral to the EPA. Consideration should be given to the scope of the referral currently before the EPA, particularly whether the proposed works within the Licence Amendment application falls within the scope of the EPA referral.</p> <p>JTSI urges DWER to resolve with the Company any outstanding issues that may arise through the referral process. This way the Company can positively respond to improvements in process, leading to improved outcomes through the EP Act Part V licensing process.</p>	<p>The Delegated Officer notes the comments and advises that the EPA processes have been taken into consideration in respect to this application.</p>

<p>Water Corporation advised of proposal (21/07/2023)</p>	<p>Water Corporation responded on 5/9/2023.</p> <p>Water Corporation provided additional comments on 4/12/2023</p> <p>The comments provided have been detailed in Appendix 2.</p>	<p>Refer to Appendix 2</p>
<p>Department of Primary Industries and Regional Development (DPIRD) advised of proposal (27/7/2023)</p>	<p>DPIRD responded on 29/09/2023. The response included the following background points and recommendations:</p> <p>The release of PFAS contaminated water, even at the low levels after the extraction treatment proposed by Alcoa, is concerning to DPIRD and the level of PFAS (and associated chemicals) in water released should be below detectable limits.</p> <p>McKnoes Brook is a valued and important recreational fishing site considered a premium trout water that has been regularly stocked by DPIRD. Currently the brook is stocked with around 2000 trout fry annually into the upper reaches around Scarp Road, and further stocking of the waters has been carried out by the Pemberton Freshwater Research Centre in 2023.</p> <p>Alcoa should undertake further chemical residue survey work at their site to determine if and where the PFAS contamination is entering the McKnoes system from their site. Ideally this would enable the future prevention of further contamination.</p> <p>DPIRD recommends monitoring of the downstream receiving waters and relevant organisms before any treated water enters the system (to obtain baseline data) and for a period of time after water treatment commences.</p> <p>DPIRD consider it unlikely that there will be any negative impact on agricultural/primary industries activity downstream due to the proposed activity provided the water treatment parameters set by your DWER are adhered to.</p>	<p>The Delegated Officer notes the advice regarding the release of trout and the use of McKnoes Brook for recreational fishing. These activities were considered during the detailed risk analysis within Section 3.3 of this report.</p> <p>The discharge limits for PFAS compounds within the licence is at Level of Reporting for ultra-trace PFAS analysis.</p>

<p>Scouts (WA) advised of proposal (27/07/2023)</p>	<p>Scouts WA responded on 10/10/2023. In regard to the Waterous Scout Camp they have provided the following information.</p> <p>The scout groups do not have water-based activities at the camp.</p> <p>They do not fish but may explore and do environmental activities around McKnoes Brook.</p> <p>They do not drink from McKnoes Brook, and all drinking water is brought from off site.</p> <p>The source of shower water is not known but most of the youth members do not shower onsite as the water is unheated.</p>	<p>The Delegated Officer notes the comments and has taken this into account when assessing the risk to potential users of McKnoes Brook.</p>
<p>Other community stakeholders identified as potentially impacted by proposed discharge to McKnoes Brook (21/07/2023)</p>	<p>Five of the community stakeholders sent a letter advising of the proposal responded.</p> <p>These responses are combined with the responses received during the public comment period. These responses are summarised in Appendix 2.</p>	<p>Refer to Appendix 2</p>
<p>Licence Holder was provided with draft amendment on 15 December 2023. A response was received on 10 January 2024.</p>	<p>Refer to Appendix 1</p>	<p>Refer to Appendix 1</p>
<p>Licence Holder was provided with a second draft amendment on 1 February 2024. A response was received on 6 February 2024</p>	<p>Refer to Appendix 1</p>	<p>Refer to Appendix 1</p>

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

The licence has been amended into the current format for licencing with updated standard conditions and numbering used to replace older or redundant conditions.

Table 12 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 12: Summary of licence amendments

Condition no.	Proposed amendments
Definitions	Moved to the end of condition section as per current licence template.
Licence history	Included prior to the Interpretation section
General Conditions Licence limit exceedance reporting And Reporting requirements Conditions G1(a) – (c) and G2(a) – (g)	Replaced with standard records and reporting conditions. Condition 30 - 35.
New infrastructure construction and commissioning conditions 1 -5 (new)	Condition 1: Design and construction requirements/installation requirements. Includes Table 1 detailing the infrastructure to be constructed, the requirements, the location and the timeframe for construction/installation. Conditions 2 and 3: Compliance reporting requirements for infrastructure constructed or installed under Condition 1. Conditions 4 and 5: Environmental commissioning requirements. Includes Tables 2 and 3 outlining monitoring requirements during commissioning
Infrastructure and Equipment Design and construction Conditions C1 – C5	Deleted. Construction under these conditions has been completed. Infrastructure included in infrastructure and equipment condition 12.
Infrastructure and Equipment Operation Condition C6	Replaced with standard Condition 12. Expanded to include infrastructure previously constructed under conditions C1 – C5. Condition 12 includes Table 6: Infrastructure and equipment requirements.

<p>New noise emissions conditions 6 - 9</p>	<p>Condition 6: Requires a noise investigation after the completion of the construction of the noise mitigation infrastructure and works detailed in Table 1.</p> <p>Condition 7 and 8: Reporting required to be submitted to the CEO on completion of the noise investigation.</p> <p>Condition 9: Plan required if emissions do to comply with assigned levels in the <i>Environmental Protection (Noise) Regulations 1997</i>.</p>
<p>Specified Action conditions N1 – N4</p>	<p>Deleted as monitoring and reporting under these conditions was completed.</p>
<p>New acceptance and throughput restrictions conditions 10 - 11</p>	<p>Condition 10: acceptance criteria and specifications for acceptance of PFAS contaminated waters.</p> <p>Condition 11: Processing requirements for waste sludges and filter materials from the PFAS treatment unit and pre-treatment dams.</p>
<p>Emissions condition E1</p>	<p>Deleted. Redundant condition.</p>
<p>New Infrastructure and inspection conditions 12 -13</p>	<p>Infrastructure authorized for construction or operation under conditions C1 -C6 included in Table 5 of condition 12. PFAS treatment unit infrastructure and related containment dams and sumps and pipelines included in Table 6.</p> <p>Condition 13: Inspection requirements for specified infrastructure detailed in Table 7.</p>
<p>Water Pollution Control conditions W1 – W5(b)</p>	<p>Conditions deleted and, where suitable, incorporated into the new Emissions and discharges and Monitoring sections: conditions 14 – 29.</p> <p>Condition 24 amended to increase frequency of process monitoring required from Arundel wastewater Sump No. 4 from six monthly to monthly, to be consistent with process monitoring frequency for Orion wastewater sump no. 3. Monitoring for PFAS compounds added.</p> <p>Condition 27: monitoring of point source emissions to surface water and land – additional parameters added to better inform future risk assessments given increased volumes of treated wastewater to be discharged.</p> <p>Conditions 26 and 27: new conditions added requiring vegetation health assessment and contingency action in the event of response thresholds being triggered</p> <p>Condition 28: ambient surface water and groundwater quality monitoring requirements</p> <p>Condition 29 requires recording of all monitoring activities</p>
<p>Schedule 1 Maps</p>	<p>Figure 1, Premises map updated.</p> <p>Figure 2: Larego site layout plan replaced with Layout of Arundel PFAS water treatment system and discharge point.</p> <p>New Figure 3: PFAS treatment unit layout.</p> <p>New Figure 4: Conveyor 371 Noise enclosure.</p> <p>New Figure 5: Willowdale mine ore conveyor infrastructure and nearest noise sensitive premises (R1).</p> <p>New Figure 6: Surface water sampling locations within McKnoes Brook and groundwater monitoring bore locations around the PTU.</p> <p>New Figure 7: Orion site layout and drainage plan.</p> <p>New Figure 8: Arundel site layout and drainage plan.</p> <p>New Figure 9: Larego site layout and drainage plan.</p> <p>New Figure 10: Anpress Treatment Sump layout</p>

	New Figure 11: McKnoes Brook Baseline Flora and Vegetation Transect locations
Schedule 2	Deleted. Authorised works completed.
Schedule 3	Deleted. Table of categories now positioned on the cover of the licence.

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
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4. Environmental Protection Authority (EPA) 2021, *Ministerial Statement 728 Wagerup Alumina Refinery - Production to a maximum capacity of 4.7 million tonnes per annum and associated bauxite mining: as amended by Ministerial Statements 897, 1069 and 1157*, Environmental Protection Authority, Perth, WA.
5. Department of Water and Environmental Regulation (DWER) 2021, *Policy. Land use compatibility in Drinking water source areas*, Perth, Western Australia.
6. Heads of EPAs Australia and New Zealand (HEPA) 2020, *PFAS National Environmental Management Plan Version 2.0*, Australia.
7. Water Quality Australia: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (May 2023) Toxicant default guideline values for aquatic ecosystem protection - Perfluorooctane sulfonate (PFOS) in freshwater, Technical brief (DRAFT)
[Toxicant default guideline values for aquatic ecosystem protection Perfluorooctane sulfonate \(PFOS\) in freshwater - Technical brief - May 2023 \(waterquality.gov.au\)](https://www.waterquality.gov.au/toxicant-default-guideline-values-for-aquatic-ecosystem-protection-perfluorooctane-sulfonate-pfos-in-freshwater-technical-brief-may-2023)
8. Australian Governments: Commonwealth, state and territory (2019), National PFAS Position Statement [publisher] Australia
9. Human Health and Environmental Risk Assessments for:
 - a. Perfluorooctane sulfonate (PFOS) and its direct precursors
 - b. Perfluorooctanoic Acid (PFOA) and its Direct Precursors: Human health tier II assessment
<https://www.industrialchemicals.gov.au/consumers-and-community/and-poly-fluorinated-substances-pfas>
10. Department of Health (DoH) 2023, Per- and poly-fluoroalkyl substances Online resource (Per- and poly-fluoroalkyl substances (health.wa.gov.au))
11. IPEN 2019. White Paper for the Stockholm Convention Persistent Organic Pollutants Review Committee (POPRC-15). Perfluorohexane Sulfonate (PFHxS)—Socio-Economic Impact, Exposure, and the Precautionary Principle
12. Alcoa of Australia Limited (July 2021) Noise Management Plan Willowdale Mine – Noise Sensitive Premises R1 and R9 (Revision 0, July 2021)
13. Bindjareb Djilba – Peel-Harvey (DWER 2020) Peel-Harvey Estuary Protection Plan [Peel Harvey Estuary Protection Plan Bindjareb-Djilba.pdf \(www.wa.gov.au\)](https://www.wa.gov.au/government/publications/peel-harvey-estuary-protection-plan-bindjareb-djilba)
14. Statewide River Water Quality Assessment (2009) [Statewide River Water Quality Assessment \(DWER-038\) - Datasets - data.wa.gov.au](https://www.data.wa.gov.au/dataset/statewide-river-water-quality-assessment-dwer-038)

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

Condition	Summary of Licence Holder’s comment	Department’s response
<p>Condition 1, Table 1 Pipeline from PTU to McKnoes Brook discharge point.</p>	<p>The Licence Holder has requested the requirement for double skinned pipeline to be utilised for the discharge pipeline from the PTU to McKnoes Brook be removed.</p> <p>They have stated the level of risk posed by the treated water doesn’t warrant the requirement for double skinned pipelines. The water conveyed in the pipeline has been deemed to meet a standard acceptable for discharge to the environment and doesn’t pose a significant risk.</p>	<p>Noted and accepted. The requirement has been removed.</p>
<p>Condition 1, Table 1 Upgrade to Anpress Pre-treatment sump (shortcrete cell) (ASP2)</p>	<p>The Licence Holder is proposing to construct a new Anpress Pre-Treatment Sump (ASP3) (in addition to the existing Anpress Pre-Treatment Sump – ASP2) with the following design and construction requirements:</p> <ul style="list-style-type: none"> • Storage Capacity up to 1.5 ML • Clay liner and HDPE liner to meet maximum permeability of 2.27×10^{-17} m/s • Minimum design freeboard 1 m (sufficient to cater for a 1:100 year AEP 72 hr rainfall event) <p>The Licence Holder, therefore, requests ASP3 be included in Table 1.</p> <p>The Licence Holder intends to retain the existing ASP2 following the installation of the ASP3. Retaining the existing sump will provide further water storage capacity at the location and will be utilised to contain any emergency overflow waters from the Anpress Treatment System. The following changes to storage capacity and liner requirements associated with the upgrades to ASP2 are requested:</p> <ul style="list-style-type: none"> • Storage Capacity up to 280 kL. • Lined to meet maximum permeability of 2.27×10^{-17} m/s. 	<p>Noted and accepted. The new Anpress Pre-Treatment Sump (ASP3) has been added into Table 1.</p> <p>It is noted that this change was requested during the assessment process in October 2023. Updates to the conditions were mistakenly left out at the time of the first draft.</p> <p>The specification of the upgraded liner to ASP2 has been amended.</p>

Licence: L6465/1989/10

Condition	Summary of Licence Holder's comment	Department's response
	<p>In relation to ASP2, as the upgrade works will only be associated with rectifying the identified liner integrity issues, the capacity of the upgraded ASP2 will be similar to its current capacity of approximately 280 kL.</p> <p>The liner design is currently being evaluated and may be concrete. Removing the liner material specification and retaining the permeability requirement allows flexibility with regards to liner types whilst maintaining the environmental control. Relevant updated maps have been provided (as requested) which illustrate the location of each sump.</p>	
<p>Condition 1, Table 1 Noise mitigation infrastructure and works at Arundel</p>	<p>The condition requires installation of a 2.5 km enclosure around Conveyor 371 by 30 June 2024. The Licence Holder has reviewed the timeframes for fabrication and installation of the enclosure and is unable to complete the installation by 30 June 2024. Fabrication of the enclosure segments is scheduled for Q1 2024, and the installation works to commence in Q2 2024. Installation can only be undertaken during the weekly 12 hour conveyor shutdown period. It is anticipated that 20 m of enclosure can be installed during each shift. At this predicted installation rate, completion of the 2.5 km of enclosure would be completed by 31 December 2025. The Licence Holder therefore, requests the completion date is amendment to reflect 31 December 2025.</p>	<p>Noted and accepted.</p>
<p>Condition 4 and 5, Table 3 Discharge from PTU to Treated Water Storage Units (During Commissioning only) – Frequency – Prior to discharging to Treated Water ponds 1, 2 or 3.</p>	<p>The use of separate sealed units is not considered to provide any additional risk mitigation when compared to utilising the purpose built Treated Water Dams.</p> <p>Treated water from the PTU will be discharged directly to the Treated Water Ponds (ATWP001, 002 & 003) during commissioning. Spot samples will be taken from the Treated Water Ponds to validate the treatment process and confirm water quality limits are being met. The Licence Holder requests the "Monitoring point reference", "process Description" and "Frequency" be amended to be consistent with Table 13.</p> <p>Monitoring point reference – Arundel Treated Water Ponds 1, 2 and 3.</p> <p>Process description – Discharge from PTU Treated water ponds 1, 2 and 3 to McKnoes Brook.</p> <p>Frequency – Prior to any discharge from Treated Water ponds 1, 2 or 3.</p> <p>The Licence Holder requests the monitoring frequency for Cumulative volume be amended to "Continuous during discharge."</p>	<p>The licence holder initially stated within their application that during commissioning treated water from the PTU would be discharged to 'sealed units' and not to the treated water dams.</p> <p>However, this has been confirmed to no longer be the case and the licence holder is requesting for treated water during commissioning to be discharged to the Arundel treated water ponds (1-3). This is the same process as to what is proposed during operation. The Delegated officer agrees that this is acceptable.</p> <p>Condition 4 and condition 5 wording has been updated.</p>

Condition	Summary of Licence Holder's comment	Department's response
Condition 5, Table 3 Notes 2 and 3	Table 5 Notes 1 and 4 are clearly referenced, but no direct reference to Note 2 and 3 are present within the table. The Licence Holder requests notes 2 and 3 are reference in the Table.	Notes 2 and 3 have been included in error. They have now been removed and Note 4 has now been updated to Note 2.
Condition 6(c) Noise Emissions	The Licence Holder requests the duration stipulated in Condition 6(c) be amended to 60 days to allow suitable time for the preparation, review and finalisation of the report. The 30 day time period is not considered sufficient to allow for report preparation an finalisation to be undertaken. Typographical error in the first sentence requires amendment to: "Within 30 days of the noise mitigation infrastructure and works listed in Table 1 being completed..."	Noted and accepted. The timeframe has been amended to 60 days. The typographical error has been corrected.
Condition 8	The Licence Holder requests the wording of the condition be amended as follows: "The licence holder must submit to the CEO the report prepared pursuant to condition 6(c) within 14 days of <i>it being finalised</i> ."	Noted and accepted. The wording has been amended.
Condition 10, Table 4 Quantity Limit – 219,000 tonnes per annual period	The Licence Holder requests the quantity limit unit of measure be amended to "kL per annual period" as this is typical unit of measure associated with water and water treatment plant processing. For consistency, the Licence Holder requests the reference to the two Arundel Pre-Treatment Dams to be amended to APTD-001 and APDT-002. Updated maps have been provided.	The unit "tonnes per annual period" has been used in the licence to be consistent with the Act and Regulations. The Delegated Officer, however, accepts the comment and the units have been changed to kL.
Condition 10, Table 4 Tanker route	The condition states the tanker route must take the most direct route available as shown in Figure 1 and must not traverse the Reservoir Protection Zone for the Samson Brook Catchment. The Licence Holder has concerns this condition is not appropriate as it is regulating activities outside of the Premises Boundary. They suggest the condition is amended to remove reference to a specific route: "Tanker must not traverse the Reservoir Protection Zone for the Samson Brook Catchment."	Reference to a figure outlining the truck route has been removed, however the requirement for the tanker's not to traverse the Reservoir protection zone has been retained.
Condition 11, Table 5	The Licence Holder requests Table 5 be amended as per the below to ensure consistency and to reduce complexity. They request the time period for disposal to be removed. Disposal will be undertaken at a point when the storage container reaches its safe capacity and following	Noted and accepted. Wording updated.

Condition	Summary of Licence Holder's comment	Department's response												
	<p>appropriate analysis and review of results.</p> <table border="1" data-bbox="555 300 1335 903"> <thead> <tr> <th data-bbox="555 300 815 379">Waste type</th> <th data-bbox="815 300 1075 379">Processes</th> <th data-bbox="1075 300 1335 379">Process limits and/or specifications</th> </tr> </thead> <tbody> <tr> <td data-bbox="555 379 815 651">Sludge from PTU</td> <td data-bbox="815 379 1075 651" rowspan="2">To be dewatered and analysed for PFAS chemicals listed in Table 10 by a NATA accredited laboratory, prior to disposal. Dewatered water to be returned to APTD-001 or APTD-002.</td> <td data-bbox="1075 379 1335 651" rowspan="2">Must be stored in impervious, sealed containers prior to being disposed of to an appropriately licensed facility. Any leachate generated must be returned to APTD-001 or APTD-002.</td> </tr> <tr> <td data-bbox="555 379 815 651">Sludge from APTD-001 and APTD-002</td> </tr> <tr> <td data-bbox="555 651 815 715">Waste zeolite</td> <td data-bbox="815 651 1075 903" rowspan="3">Removal and temporary storage prior to offsite disposal.</td> <td data-bbox="1075 651 1335 903" rowspan="3"></td> </tr> <tr> <td data-bbox="555 715 815 794">Waste granular activated carbon</td> </tr> <tr> <td data-bbox="555 794 815 903">Waste Anionic exchange resin (PFAS-specific, single use)</td> </tr> </tbody> </table>	Waste type	Processes	Process limits and/or specifications	Sludge from PTU	To be dewatered and analysed for PFAS chemicals listed in Table 10 by a NATA accredited laboratory, prior to disposal. Dewatered water to be returned to APTD-001 or APTD-002.	Must be stored in impervious, sealed containers prior to being disposed of to an appropriately licensed facility. Any leachate generated must be returned to APTD-001 or APTD-002.	Sludge from APTD-001 and APTD-002	Waste zeolite	Removal and temporary storage prior to offsite disposal.		Waste granular activated carbon	Waste Anionic exchange resin (PFAS-specific, single use)	
Waste type	Processes	Process limits and/or specifications												
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Sludge from APTD-001 and APTD-002														
Waste zeolite	Removal and temporary storage prior to offsite disposal.													
Waste granular activated carbon														
Waste Anionic exchange resin (PFAS-specific, single use)														
<p>Condition 12, Table 6</p>	<p>The following Operational Requirements are included in Table 6 related to the DAF Treatment Plant:</p> <p>“Following water quality testing, successful water quality results allow the transfer of treated water to the clean water sump.”</p> <p>The Licence Holder requests the text be amended to reflect updates to the pond and sump names at Larego to address naming errors in the initial submission. The change also accurately captures the existing discharge options to treated water.</p> <p>“Following water quality testing, successful water quality results allow the transfer of treated water to the Flinders C Sump or Larego Water Storage Reservoir.”</p> <p>Updated maps have been provided to depict water flows and infrastructure names.</p>	<p>Noted and Accepted. Wording and maps updated.</p>												

Condition	Summary of Licence Holder's comment	Department's response
Condition 13(b)	<p>The Licence Holder requests amendment of Condition 13(b) due to the current wording being ambiguous. Request condition reworded from:</p> <p>“where an inspection requirement as detailed in Table 7 is not met, take corrective action within 30 calendar days to mitigate adverse environmental consequences”</p> <p>to:</p> <p>“where an <i>inspection identified that an</i> inspection <i>requirement</i> as detailed in Table 7 is not met, take corrective action within 30 calendar days to mitigate adverse environmental consequences</p>	Accepted, wording updated.
Condition 13, Table 7	Update table reference error. Reference to Table 6 instead of Table 5	Reference error corrected
Condition 13, Table 7	The Licence Holder requests the inspection frequency required be amended from daily to weekly. Daily would not be beneficial during dry months.	<p>Not accepted.</p> <p>Inspection requirements are to remain daily for the infrastructure specified in Table 7. The risk of rupture of pipeline carrying PFAS water, warrants daily inspections. This was a proposed control by the Licence Holder in the application. The Delegated Officer has confirmed the daily requirement of inspections will remain.</p>
Condition 14	<p>The Licence Holder requests a change to the wording to ensure compliance with the condition can be achieved. The condition states, “The licence holder shall immediately recover, or remove and dispose of, spill of environmentally hazardous materials...”</p> <p>The Licence Holder wishes to change the wording to:</p> <p>“The licence holder <i>shall as soon as practicable</i> recover, or remove and dispose of spills of environmentally hazardous materials...”</p> <p>This is due to immediate action not always being possible if there is a risk to personnel safety, for example in the case of a bushfire.</p>	Accepted – wording changed
Condition 16 Contaminated stormwater runoff prevention	The Licence Holder has requested this condition is removed, as it is general in nature, broad and may be difficult to enforce or assess compliance against. The provision of the EP Act and Unauthorised Discharge Regulations address emissions, discharges and subsequent environmental harm.	The Delegated Officer acknowledges the comment. However, a stormwater condition is required and as such, the wording has been changed to the following: “Stormwater is to be diverted around and away from operational areas to prevent it becoming contaminated.”

Condition	Summary of Licence Holder's comment	Department's response
	<p>Second comment received 06/02/2024:</p> <p>Alcoa's internal compliance assessment process is unable to confirm compliance with this condition due its scale and absolute nature. Non-compliance with this condition would be triggered in the event stormwater originating from a non-operational area enters an operational area via overland flow. Whilst Alcoa implements and maintains a complex network of stormwater management infrastructure to prevent impacts, and adhere to the Mining and Management Program (MMP) and Drainage Control Management Plans endorsed under the site's and associated Forest Clearing Advices (FCAs), there are likely to be circumstances where stormwater from non-operational areas does flow into operational areas under certain rainfall conditions.</p> <p>To manage this occurrence, Alcoa installs and maintains drains, sumps and treatment systems to ensure any potentially contaminated water is captured, contained and treated to prevent negative impacts to surrounding environmental values. To enable accurate assessment and reporting against the condition, Alcoa requests the following changes to better reflect the onsite controls and practical management of stormwater at the site.</p> <p><i>"Diversion drains and bunds shall be installed to minimise the volume of stormwater runoff entering operational areas. Potentially contaminated stormwater shall be captured and treated via onsite stormwater drains, sumps and associated treatment systems."</i></p>	<p>Response to second comment: The Delegated officer accepts the proposed wording change in part. The condition has been modified to state:</p> <p>"Diversion drains and bunds shall be installed and maintained to minimise the volume of stormwater runoff entering operational areas, with potentially contaminated or contaminated stormwater being captured and prevented from being released into the environment'.</p>
<p>Condition 17 Dust management</p>	<p>The Licence Holder has requested the condition is amended to account for the dust management actions undertaken at the site and to be consistent with conditions detailed in newly approved licences for similar operations.</p> <p>The current condition is as follows:</p> <p>"The licence holder must manage dust generation at the premises by:</p> <ul style="list-style-type: none"> (a) Wetting down unsealed roads and exposed areas with a water truck; and (b) Ensuring product and waste stockpiles are adequately dampened to reduce potential for dust lift-off." <p>Proposed amendment:</p> <p>"The licence holder must implement the following actions when discernible levels of dust are generated from ground surfaces and</p> 	<p>Not accepted.</p> <p>The Delegated Officer is satisfied Condition 17 is valid and enforceable for the Licence Holder to manage dust at the Premises.</p> <p>Response to second comment: The Delegated officer has reviewed the wording of this condition and accepts Alcoa's proposed wording.</p>

Condition	Summary of Licence Holder's comment	Department's response
	<p>stockpiles on the Premises and there is a risk of dust affecting sensitive receptors:</p> <ul style="list-style-type: none"> (a) Operating water truck(s) or sprays; and/or (b) Reducing or limiting dust generating activities” <p>Second comment received 06/02/2024:</p> <p>Alcoa’s internal compliance assessment process is unable to confirm compliance with this condition due to the specifics regarding management method and ambiguity with regards to outcomes (i.e. adequately damp to reduce potentially dust lift-off).</p> <p>Alcoa could potentially be considered non-compliant with this condition if dust lift-off occurred at any stockpile onsite, irrespective of the dust volume, severity, presence of a sensitive receptor, or level of impact. Water cannot be applied to certain stockpiles, such as topsoil stockpiles, to ensure their viability and to maximise species recruitment in rehabilitation.</p> <p>However, Alcoa utilises a number of dust control measures in addition to the application of water via water carts, including the application of mulch, bitumen emulsion and proprietary dust suppressants, to successfully minimise dust emissions.</p> <p>Alcoa requests the condition be amended to allow for flexibility with regards to dust control measures and to better reflect the practical dust control measures implemented at the site.</p> <p><i>“The licence holder must manage dust generation at the premises by:</i></p> <ul style="list-style-type: none"> <i>• Minimising dust from unsealed roads and exposed areas via the use of water carts or other alternate methods; and</i> <i>• Reducing or limiting dust generating activities at product and waste stockpiles”</i> 	
<p>Condition 18, Table 8</p> <p>Treated wastewater from DAF Sumps 1, 2 and 3</p>	<p>The Licence Holder request the text be amended to reflect updates to the ponds and sumps at Larego to address naming errors in the initial submission. The change also accurately captures the existing discharge options for treated water.</p> <p>Following water quality testing, successful water quality results allow the transfer of treated water to the Flinders C Sump or Larego Water Storage Reservoir.</p> <p>They have requested the condition reads:</p>	<p>Accepted and condition amended</p>

Condition	Summary of Licence Holder's comment			Department's response
	Emission	Discharge point	Discharge point location	
	Treated wastewater from DAF Sumps 1, 2 and 3 (as shown in Figure 9 in Schedule 1, labelled as DAF Testing Ponds)	Flinders C Sump or Larego Water Storage Reservoir	As shown in Figure 9 of Schedule 1	
Condition 19, Table 9	<p>Condition 19, Table 9 restricts the volume of water permitted for discharge based on the daily streamflows measured in McKnoes Brook. Alcoa requests this condition be amended to remove this restriction.</p> <p>The Arundel operation has released water to McKnoes Brook under the existing licence via Arundel Pond 5 (AP5) for 20+ years. These discharges were ceased upon receipt of the s. 73A Prevention Notice on 3 March 2023 to manage the risk of potential PFAS contamination. The cessation of discharge was not related to potential streamflow impacts resulting from the volume of discharged water.</p> <p>It is important to note the stormwater collected at the Arundel facility would naturally report to McKnoes Brook if Alcoa's operations were not present. By collecting and treating the water, the flow rates within McKnoes Brook are artificially reduced. The proposed condition restricts discharge volumes based on the artificially reduced flowrates in McKnoes Brook. This is not considered to be an appropriate condition.</p> <p>Additionally, restricting discharges, particularly to zero, will impact the site's ability to effectively manage water volumes within the Pre-treatment and Treated Water Dams. If there is limited flow or no flow for an extended period of time, the risk of water holding capacity breaches increases. The storage of large volumes of untreated water poses a higher risk than that posed by discharging treated water at 20L'sec to McKnoes Brook.</p>			<p>The Licence Holder engaged a consultant to develop a hydraulic model of McKnoes Brook using Mike21 software to simulate the proposed release of treated water into the Brook. The model was used to replicate the flow hydraulics in McKnoes Brook during a range of natural flow conditions in addition to the proposed treated water discharge and compare the predicted change in flow rates and water levels downstream of the discharge location.</p> <p>Technical review of the modelling found that on average, the proposed releases (either 10 L/s continuous release rate or 20 l/s for 60 hours followed by 60 hours with no discharge, repeating) are likely to have little impact on McKnoes Brook</p> <p>It is noted that the Arundel operation has released water to McKnoes Brook under the existing licence via Arundel Pond 5 for over 20 years with no restriction on discharge rate. This indicates that the McKnoes Brook ecosystem is likely adapted to a modified streamflow regime.</p> <p>The Delegated Officer agrees that the risk of managing the storage of untreated water (increased risk of overtopping etc of PFAS contaminated water into the environment) outweighs the risk of discharging the treated water to McKnoes Brook.</p> <p>Based on the comment, along with the risk of potential overflows of storage water, and with the knowledge regarding historical flows of McKnoes Brook, the condition has been amended to remove the Column 2 of the Table.</p> <p>As an alternative, the condition now has authorised release rates of either 'not more than 10 L/second of continuous</p>

Condition	Summary of Licence Holder's comment	Department's response
		<p>release rate' or 'not more than 20 L/second for 60 hours, followed by 60hours of no discharge, repeating.</p> <p>The licence holder will still be required to undertake daily monitoring of the water level within McKnoes Brook upstream of the discharge point in order to allow streamflow to be calculated. This information will help inform the department on future assessment and evaluation of the ongoing discharge to McKnoes brook as streamflows and release rates will be known through this data.</p>
<p>Condition 20, Table 10 McKnoes Brook (sample locations from Arundel Treated Water Dams 1, 2 and 3) PFAS Parameters</p>	<p>Due to the time sensitive nature of this Licence Amendment and need for commencement of construction of the PFAS Treatment Plant, the Licence Holder has stated they accept the proposed limits specified in Table 10.</p> <p>The Licence Holder suggested that limits for PFAS species included <LOR. This request was based on likely increases in LORs due to the proper application of USEPA Method 1633.</p> <p>Without the provision of "<LOR" as a limit criteria, there is a possibility that future non-compliances and subsequent licence amendments may be required to increase the specified limits in Table 10 to align with achievable LORs under USEPA Method 1633.</p> <p>To avoid potential misinterpretation associated with parameters with both a numeric and <LOR limit, Aloca requests the following note be applied to the 7 relevant parameters. Superscript "2" should be applied in the table against the 7 relevant parameters and the noted inserted below the table.</p> <p>Note 2: Where laboratory analysis reports a result <LOR, and the LOR is greater than the corresponding numeric limit, this is compliant result.</p>	<p>Noted and accepted. Footnote 2 has been added and referenced within the table to the relevant seven PFAS species.</p>
<p>Condition 20, Table 10 Larego 10 ML Cleanwater Sump (discharge from DAF Sumps 1, 2 and 3)</p>	<p>The Licence Holder has requested the parameter limits associated with the DAF Treatment System be amended to reflect the existing Licence. There have been no changes to the DAF treatment unit as part of this Licence Amendment and the system was designed to met the limit requirements specified in the existing Licence.</p> <p>The limits specified for Chromium, Copper and Zinc in Table 10 are less than the achievable LOR. Achievable LORs for the parameters are as follows: Chromium – 0.005 mg/L</p>	<p>The limits for the Larego DAF treatment system have been amended to reflect the existing licence with the exception of the limits for Chromium, Copper and Zinc which have been amended to reflect the achievable LOR.</p> <p>Discharge point wording updated.</p> <p>Corresponding note for oil and grease monitoring updated.</p>

Condition	Summary of Licence Holder's comment	Department's response
	<p>Copper – 0.005 mg/L</p> <p>Zinc – 0.01 mg/L</p> <p>It is requested the limits for these parameters be amended to reflect the achievable LOR.</p> <p>The naming convention for the Sumps and Ponds at Larego have been modified to address naming errors in the original application. Refer to the updated Larego Maps provided. Changes include:</p> <ul style="list-style-type: none"> • Cleanwater Sump (10ML) changed to Tasman Haul Rd B Sump • Infiltration Sump (1.36ML) changed to Flinders C Sump <p>The Licence Holder requests the following text changes to reflect the existing discharge points associated with the DAF Treatment Plant:</p> <p>Discharge Point: Flinders C Sump and Larego Water Storage Reservoir (discharge from DAF Treated Water Ponds 1, 2 and 3).</p> <p>The Oil and Grease parameter has a superscript “4” present, however there is no corresponding note below Table 10.</p> <p>Second comment received 06/02/2024:</p> <p>As per Alcoa's initial response, Alcoa requests all limits associated with the DAF treatment system be amended to reflect the existing licence, as detailed below:</p> <ul style="list-style-type: none"> • pH 4.7 – 9, • Chromium 0.06 mg/L, • Zinc 5 mg/L and • Copper 1 mg/L. 	<p>Response to second comment:</p> <p>It was understood by Alcoa's original comment that it was requested to change the limits associated with the DAF treatment system to those reflected in the existing licence with the exception of limits for Chromium, Copper and Zinc which was requested to be amended to the achievable LOR.</p> <p>It is clear now that that interpretation was incorrect, and that Alcoa is requesting for the limits associated with the DAF treatment system to reflect the existing licence for all parameters, including Chromium, Copper and Zinc. The Delegated Officer is happy to accept this as the risk of impact is low.</p>
<p>Condition 23, Table 11</p>	<p>The Licence Holder requests the “Unit” in Table 11 be amended to kL as this is the typical unit of measure for water</p>	<p>The unit “tonnes per annual period” has been used in the licence to be consistent with the Act and Regulations.</p> <p>The Delegated Officer, however, accepts the comment and the units have been changed to kL.</p>
<p>Condition 25</p>	<p>There is a typographical error in Condition 25 with one of the Table numbers missing.</p> <p>Table 13, column 2 details the following “Process description”.</p> <p>“Discharge from Larego DAF sumps 1, 2 and 3 to Cleanwater sump.”</p>	<p>Accepted and typographical error corrected.</p> <p>Wording in Table 13 updated.</p>

Condition	Summary of Licence Holder's comment	Department's response
	Alcoa requests the wording be amended to: "Discharge from Larego DAF Treated Water Ponds 1, 2 and 3 to Flinders C Sump and Larego Water Storage Reservoir. "	
Condition 27	The condition states that should changes in response thresholds in Annual Vegetation Health Assessment be detected, the Licence Holder engages a waterway health expert within 30 days of becoming aware of the change. The Licence Holder has requested this time period is changed from 30 to 60 days to allow adequate time to engage the required consultant.	Accepted and timeframe changed.
Conditions 28 and 29	There is a typographical error in Conditions 28 and 29 where the single condition appears to have been split over two conditions. The Licence Holder requests it's updated accordingly. In addition, the condition states: "The licence holder must undertake the monitoring in Table 14 and Table 15 according to the specifications in those tables and record and investigate results that indicate an exceedance of the trigger value specified." There are no trigger values specified in Table 14 or 15. It is therefore requested the references to trigger values be removed from this condition.	Accepted and printing error corrected. The reference to trigger values have been removed from the wording of the condition as there are no trigger values within Table 14 and 15.
Definitions, Table 17 PT-001 and PT002 means Pre-treatment dam 002 as shown in Figure 2 and Figure 8	The Licence Holder requests the following amendment to the definitions table: APTD-001 and APTD-002 : means Arundel Pre-treatment dam 001 and Arundel Pre-treatment dam 002 as shown in Figure 2 and Figure 8.	Accepted – Definition Table updated
Decision Report S2.2, pg 1	Under the "Construction" heading, the Licence Holder request an addition point detailing the construction of a new 1.5 ML Anpress Pre-Treatment Sump (ASP3) at Arundel.	Noted and additional point added to the section for construction of ASP3
Decision Report S2.5, pg 6	The Licence Holder requests wording is amended to the following to align with proposed works and to better identify the facility names: Upgrades to the Anpress Pre-treatment sump (ASP2) are also proposed, due to concerns raised by the department about the capacity and integrity	Accepted and wording updated.

Condition	Summary of Licence Holder's comment	Department's response
	<p>of the shotcrete liner. The Anpress pre-treatment sumps are located west of the Arundel workshops and consists of two sump cells:</p> <ul style="list-style-type: none"> • One 280 kL shotcrete (concrete sprayed at high pressure onto earthen walls) lined cell to the north (ASP2); and • One 250 kL concrete lined cell to the south (ASP1) <p>The Licence Holder is proposing to re-line the 280 kL shotcrete cell (ASP2) and constructed a new 1,500 kL (1.5 ML) pond (ASP3), which will be a 1.5 mm high density polyethylene 9HDPE) lined cell, providing a 1:100 year annual rainfall storage capacity and 1,000 mm freeboard.</p>	
<p>Decision Report S3.2.2, pg 29</p>	<p>Current wording is:</p> <p>“The modelling indicates that flow depths vary in the stream from summer to winter and along the channel. The two release rates, 10 L/s and 20 L/s, increase flow depths by between 8 mm in summer and 23 mm in winter near the discharge point. The increase in water level reduces with distance downstream as natural flows in the stream increase with catchment area.”</p> <p>Based on the information provided in the RFI response provided by the Licence Holder on 13 October 2023, the following updates to flow depths are required:</p> <p>“The two release rates, 10 L/s and 20 L/s, increase flow depths by between 29 mm in summer and 13 mm in winter near the discharge point. The increase in water level reduces with distance downstream as natural flows in the stream increase with catchment area.”</p>	<p>Accepted and wording updated.</p>
<p>Decision Report S3.3.3, Table 7, pg 31</p>	<p>Table 7 indicates Manganese exceed the ADWG Health criteria of 0.5 mg/L. The results in the table are below 0.5 mg/L for both parameters. Alcoa requests the table and any linked text be updated to reflect this.</p> <p>They also note the health criteria listed in Table 7 and 8 for Manganese is different and the actual health criteria detailed in the ADWG is 0.5 mg/L.</p>	<p>Table 7 incorrectly had the results highlighted as exceedances. This has now been corrected.</p> <p>Table 8 had the incorrect limit. It has now been updated to 0.5 mg/L as per ADWG.</p>

Appendix 2: Stakeholder comments on application

Stakeholder	Summary of stakeholder comment	Department's response
<p>Public and community stakeholders (13 respondents in total)</p>	<p>The following are the collated concerns and comments received from the community. They are limited specifically to the comments relevant to the activities covered by the application, that is, the collection, containing, transport and treating of wastewater contaminated by PFAS and the discharge of the treated water to McKnoes Brook.:</p> <ol style="list-style-type: none"> 1. Seven respondents considered the proposal as a whole and/or the discharge of waste to McKnoes Brook unacceptable. 2. Six respondents expressed concern over the potential for loss of containment of wastewater or that Alcoa has a history of non-compliance with environmental management. 3. Five respondents were concerned that there is potential for health impacts from the use of McKnoes Brook for water consumption by people including drinking water, irrigation and agriculture/aquaculture. Also, to the native flora and fauna that rely on the brook. 4. Four respondents have raised concerns that there have been inadequate studies/monitoring done for background environmental factors such as potential vegetation impacts and hydrology. 5. Four respondents expressed concern over the transport of contaminated wastewater for treatment. 6. Three respondents queried if the proposal should be referred to the EPA or overlaps with the referral of the Mining and Management Programs referred to the EPA. 7. Other comments include the need for Alcoa to <ol style="list-style-type: none"> a. better inform the community on an ongoing basis, b. monitoring and operation should be to appropriate standards/best practice; and c. the treatment of the water will use large amounts of energy. 	<p>The Delegated Officer has considered the comments received during the consultation with the community and makes the following responses:</p> <ol style="list-style-type: none"> 1. The DWER identified the discharge of treated wastewater to McKnoes Brook as being a key point of concern and a detailed risk assessment within Section 3.3 of this report addresses the potential impacts of the discharge. This assessment has identified controls suitable for conditioning on the licence to manage the risks of the activity. 2. The assessment of loss of containment was also subject to a detailed risk assessment in Section 3.4 of this report. This assessment has identified controls suitable for conditioning on the licence to manage the risks of the activity. 3. The risk to health for both humans and the environment is assessed within Section 3.3 of this report. Additional controls to those proposed by the applicant have been applied to the licence to manage the risk to health. 4. Requests for further information were made during the assessment process to Alcoa. Also, technical advice was requested from internal specialists within the DWER and other departments including the Department of Health and the Water Corporation. The information and advice provided was taken into consideration when assessing the risks of the proposed activity. 5. The transport of water via truck to the treatment plant via public roads will be managed under the <i>Environmental Protection (Controlled Waste) Regulations 2004</i>. Further details of the consideration of this risk are included in Table 3 of Section 3.2 of this report. 6. The EPA has been kept advised of the application and advice has been provided that the assessment of

Stakeholder	Summary of stakeholder comment	Department's response
		<p>this application has not been constrained by the current referral to the EPA and the Mining and Management Programs.</p> <p>7.</p> <ul style="list-style-type: none"> a. The licence will contain standard conditions for reporting that includes the requirement for an Annual Audit of Compliance Report that will be available via the DWER website. b. Limits are set on the quality of the water permitted to be discharged after consideration of available standards and advice from the relevant experts in community health and contaminated sites. c. The management of energy consumption and any emissions due to the production of that energy is outside the scope of this approval process.
Water Corporation	<ol style="list-style-type: none"> 1. The proposed treatment plant and McKnoes Brook discharge point are both located outside of Public Drinking Water Source Areas. 2. Water Corporation note contaminated sumps on Orion are contained in the Samson Brook Dam drinking water catchment. 3. Figure 1-1 Willowdale PFAS Treatment Process Chart – The proponent is requested to confirm that the multiple sources identified in Figure 1-1 are limited to OS1, OS2, OS3, OS4. 4. Section 1.3.7 Project Need - Proponent Statement: “54 ML/yr of PFAS affected water has the potential to be discharged to the environment via the current licenced discharge point at Orion (OS4) (refer Attachment 2D), located within the Samson Brook Dam PDWSA. All discharge estimates are based on a 90th percentile rainfall year”. Water Corporation requests further clarity on this statement, does this statement mean: “In the event of a 90th percentile rainfall period occurring, then it is estimated that 54 ML of untreated wastewater would spill from OS4 to the surrounding environment”. 5. Section 4.2 Dam / Pond Design and Construction: <ul style="list-style-type: none"> a. The proponent states: “Design of pre-treatment dams appear to be designed to contain 1:100 year rainfall storage 	<ol style="list-style-type: none"> 1. Noted 2. The sumps at Orion are considered in the risk assessment of the proposed activity. 3. The DWER has been informed that the collection of water from Orion for transport to the PFAS treatment plant is from the Orion Sump OS3. 4. Section 2.5 of this report discusses the management of contaminated stormwater including current and future management of the Orion sumps. The Delegated Officer advises that the sump OS4 is no longer in use as a discharge point and that water contained in the sump is intersected groundwater. 5. The risk of overflow from the sumps and dams is considered in detail in section 3.4 of this report. The Delegated Officer advises that the risk rating has been found to be Medium with controls conditioned on the licence. 6. <ul style="list-style-type: none"> a. The route for the transport of the wastewater from Orion is via public roads and therefore the transportation is required to meet <i>the Environmental Protection (Controlled Waste) Regulations 2004</i> and to be transported under the Controlled Waste Tracking System.

Stakeholder	Summary of stakeholder comment	Department's response
	<p>capacity, assuming the treatment plant is in full operation". Water Corporation requests that the statement is clarified to define the risks of the dam storage areas overflowing in the event that the plant is offline during a 1:100 rainfall event?</p> <p>b. The proponent states: "...no spillage through emergency spillways during 1:100,000 year AEP storm event. Emergency spillways designed to relieve for up to a 1:100,000 year AEP event". Water Corporation requests the meaning of a "1:100,000 year AEP"?</p> <p>6. 4.11 Operational Phase:</p> <p>a. The proponent states: "PFAS water will be trucked from Orion and piped from Arundel to the pre-treatment dams". Water Corporation requests the statement is clarified to include additional information regarding the risk assessment of the transport of contaminated water from Orion to Arundel. Additional information including risk assessment, routes and risk mitigation strategies.</p> <p>b. The proponent states: "If treatment fails to meet the treatment criteria, water will be discharged back into the pre-treatment dams and retreated". Water Corporation requests the statement clarifies the risk assessment undertaken considers the likelihood and consequences of additional treatment being required. What is the risk that treatment rates will be impacted by the need for re-treatment and what is the potential for storages being overwhelmed, particularly on Orion. Does this potentially change the likelihood of unplanned discharge of untreated wastewater on Orion?</p> <p>7. 5.3.2 Leaks and Spills of Pre-treated Water:</p> <p>a. The proponent states: "Transport to the pre-treatment dams will be undertaken within the Arundel catchment and therefore any leaks and spills will be re-captured." Water Corporation requests the statement is clarified by including additional information regarding the context of the potential spills in the Orion catchment, with consideration for the volume of water identified to be trucked from Orion to Arundel. Additional information is requested associated with the risk assessment / mitigation strategies for the potential loss of containment of</p>	<p>Refer to Section 3 for the controls provided for the management of the transport of the water from Orion. Condition 9 requires tankers to not traverse the Reservoir Protection Zone for the Samson Brook Catchment.</p> <p>b. The risk of overflowing of containment infrastructure is considered in detail in section 3.4 of this report. The Delegated Officer advises that the risk rating has been found to be Medium with controls conditioned on the licence.</p> <p>7. Section 2.5 of this report discusses the management of contaminated stormwater including current and future management of the Arundel sumps. The risk of overflowing of containment infrastructure is considered in detail in section 3.4 of this report.</p> <p>8. a. The route for the transport of the wastewater from Orion is via public roads and therefore the transportation is required to meet the Environmental Protection (Controlled Waste) Regulations 2004 and to be transported under the Controlled Waste Tracking System. Refer to Section 3 for the controls provided for the management of the transport of the water from Orion.</p> <p>9. The transport of water via the pipeline has not been included within this assessment and the figures used within the decision report and licence do not include the pipeline. The Delegated Officer does not consider there is any ambiguity as to the authorised transport route of the wastewater from Orion.</p> <p>10. Noted.</p> <p>11. Section 3.4 outlines the risk assessment for containment of PFAS-contaminated water at Orion. Conditions have been added to the licence regarding maintaining the Orion sumps and freeboard requirements.</p> <p>12. The decommissioning and removal of the pipeline is managed by a separate compliance process.</p> <p>13. The local shire has been consulted as part of the assessment process.</p> <p>14. Noted. The amended licence only authorises the discharge of treated wastewater.</p>

Stakeholder	Summary of stakeholder comment	Department's response
	<p>untreated water in the Samson Brook Dam catchment.</p> <p>8. Table 5-3 Environmental Risk Assessment:</p> <p>a. The proponent states: "Consequence of loss of containment: Minor". Water Corporation requests the statement is clarified by defining the capacity of the trucks to be used in the transport of untreated wastewater? Is the assessed "minor" risk associated with likely minor leak or the loss of the entire contents of the truck due to fire and/or catastrophic accident? What is the likelihood of contamination and intended clean-up response to such an event? Regular inspection and maintenance of vehicles is not considered a control mechanism, rather this is considered standard practice.</p> <p>9. Attachments 2E, 2 F and 2G all contain the Orion – Arundel pipeline. Water Corporation requests the pipeline be removed from the Figures attached to the proposal to reduce any potential ambiguity regarding the nature of the transport of contaminated wastewater in the Sampson Brook Dam catchment.</p> <p>10. The proposed treatment plant and McKnoes Brook discharge point are both located outside of Public Drinking Water Source Areas.</p> <p>11. Water Corporation note contaminated sumps on Orion are contained in the Samson Brook Dam drinking water catchment. For this reason, these sumps should be designed, maintained and managed to avoid risk of discharge, this includes proactive water level reduction through increased carting to the treatment plant prior to rainfall events.</p> <p>12. The licence does not allow the pipeline to be used under any circumstances, subsequently Water Corporation recommend Alcoa decommission and remove the illegally constructed pipeline as a matter of urgency. This should be removed from the sump in a southward direction.</p> <p>13. Water Corporation recommends that as public roads are to be used for the controlled waste carting, engagement with the local Shire is necessary.</p> <p>14. Water Corporation does not support disposal of the PFAS-impacted wastewater prior to treatment to any waterway or to the Water Corporation sewer.</p>	

Appendix 3: Limit of reporting for ultra-trace PFAS analysis

Example limits of reporting for commercial ultra-trace analysis. These examples are indicative, and LORs for individual compounds will vary between analysis providers.

	PFAS-30 Ultratrace
Compounds included	LOR (ug/L)
Perfluoropropane sulfonic acid (PFPrS)	0.001
Perfluorobutane sulfonic acid (PFBS)	0.001
Perfluoropentane sulfonic acid (PFPeS)	0.001
Perfluorohexane sulfonic acid (PFHxS)	0.001
Perfluoroheptane sulfonic acid (PFHpS)	0.001
Perfluorooctane sulfonic acid (PFOS)	0.0001
Perfluorononane sulfonic acid (PFNS)	0.001
Perfluorodecane sulfonic acid (PFDS)	0.001
Perfluorododecane sulfonic acid (PFDoS)	0.001
Perfluorobutanoic acid (PFBA)	0.005
Perfluoropentanoic acid (PFPeA)	0.001
Perfluorohexanoic acid (PFHxA)	0.001
Perfluoroheptanoic acid (PFHpA)	0.001
Perfluorooctanoic acid (PFOA)	0.001
Perfluorononanoic acid (PFNA)	0.001
Perfluorodecanoic acid (PFDA)	0.001
Perfluoroundecanoic acid (PFUnDA)	0.001
Perfluorododecanoic acid (PFDoDA)	0.001
Perfluorotridecanoic acid (PFTrDA)	0.001
Perfluorotetradecanoic acid (PFTeDA)	0.001
Perfluorooctane sulfonamide (FOSA)	0.005
N-Methyl perfluorooctane sulfonamide (MeFOSA)	0.001
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	0.001
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	0.001
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	0.001
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	0.005
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	0.005
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	0.005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	0.001
10:2 Fluorotelomer sulfonic acid* (10:2 FTS)	0.001

Appendix 4: Application validation summary

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)					
Application type					
Amendment to licence	<input checked="" type="checkbox"/>	Current licence number:	L6465/1989/10		
		Relevant works approval number:	W6721/2022/1 Not granted, this application is in place of that assessment	N/A	<input type="checkbox"/>
Date application received		15/06/2023			
Applicant and Premises details					
Applicant name/s (full legal name/s)		Alcoa of Australia Limited			
Premises name		Willowdale Mine			
Premises location		Part of Mineral Lease 1SA			
Local Government Authority		Shire of Waroona			
Application documents					
HPCM file reference number:		2010/007470-1			
Key application documents (additional to application form):		<p>L6465/1981/10 Licence Amendment Application Supporting Information Willowdale PFAS Treatment System with following attachments:</p> <ul style="list-style-type: none"> • Attachment 2: Premises Maps • Attachment 5: 2021 Mine Management Plan approval • Attachment 3C: Proposed Clearing Area • Attachment 8A: Proposed Infrastructure Drawings • Attachment 8B: McKnoes Brook Hydraulic Modelling Report • Attachment 8C: McKnoes Discharge Point Monitoring Bore Locations • Attachment 8D: Baseline Flora and Vegetation Survey of proposed Discharge Area of McKnoes Brook • Attachment 8E: Arundel Water Treatment Plant Noise Assessment • Attachment 8F: Background Sampling McKnoes Brook Discharge Point • Attachment 8G: Water Quality Results from Orion and Arundel Sumps • Attachment 8H: PFAS Water Containment Geotechnical Design Report • Attachment 8I: Peer Review of Geotechnical Design Report for AP10 and AP11 Lined Impoundments Willowdale Dam Project • Attachment 8J: Alcoa Willowdale Mine Water Storage Dams Liner Integrity Survey Assessment Report • Attachment 8K: Arundel Pre-Treatment Dams and Treated Water Ponds As Built Drawings 			

Scope of application/assessment	
<p>Summary of proposed activities or changes to existing operations.</p>	<p>Installation and operation of PFAS water treatment plant.</p> <p>Amendment to allow for installation of a water treatment plant to remove PFAS contaminants from waste water prior to discharge and a stormwater collection pond at the Arundel premises.</p> <p>Approval to operate already constructed infrastructure associated with the PFAS treatment plant. Approval to discharge waste water to McKnoes Brook when a suitable water quality has been attained.</p> <p>Construction activities associated with:</p> <ul style="list-style-type: none"> • Installation of an oil/water separator at Arundel workshops; • New stormwater collection pond at Arundel workshops; • Pipelines transporting PFAS affected water from Arundel to the PFAS Treatment Unit; • Arundel PFAS Treatment Unit; and • Treated Water Discharge Pipe to McKnoes Brook. <p>Construction activities will include earthworks and installation of structural, mechanical and electrical components.</p> <p>Environmental commissioning activities will include dry and wet testing of the Arundel PFAS Treatment Unit. Commissioning emissions and discharges are anticipated to the same as for operations.</p>

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

Table 1: Prescribed premises categories

Prescribed premises category and description	Assessed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 5: Processing or beneficiation of metallic or non-metallic ore	16,000,000 tonnes per year	N/A

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 checked="" 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: Several ministerial statements affect the management and expansion of operations on the premises but not directly the management of PFAS contaminated water
Has the proposal been referred and/or assessed under the EPBC Act?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Reference No:

<p>Has the applicant demonstrated occupancy (proof of occupier status)?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>	<p>EMining lease / tenement <input checked="" type="checkbox"/> ML 1SA Expiry: 2045 according to application form, 29/04/2024 according to GeoVIEW.WA, DMIRS website</p>
<p>Has the applicant obtained all relevant planning approvals?</p>	<p>Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/></p>	<p>If N/A explain why? Operating under state agreement and ministerial statements on a mineral tenement.</p>
<p>Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>Exemption applies. Section 3 of the Environmental Protection (Alcoa – Huntly and Willowdale Mine Sites) Exemption Order 2004. Clearing in accordance with an approved mining plan: Mining and Management Plan 2021 – 2025 approved by the Minister for State Development.</p>
<p>Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>Exemption applies. Section 3 of the Environmental Protection (Alcoa – Huntly and Willowdale Mine Sites) Exemption Order 2004. Clearing in accordance with an approved mining plan: Mining and Management Plan 2021 – 2025 approved by the Minister for State Development.</p>
<p>Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>	<p>Application reference No: Licence/permit No: SWL601024 (taking water from Samson Brook) Bed and banks permit not required. Water Working Arrangements Between Alcoa World Alumina, Department of Water and Environmental Regulation and Water Corporation Covering Alcoa's Mining Operations 2018 – 2023. Section 4.2.1 states that Alcoa is exempt from requiring a Bed and Banks Permit when disturbance is to be undertaken within ML1SA. Approval is delegated to the Mining and Management Program Liaison Group (MMPLG). Disturbance is in accordance with Mining and Management Plan 2021 – 2025 approved by the Minister for State Development on advice from the MMPLG.</p>

<p>Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>Name: Waroona Irrigation District Type: Surface Water Area Has Regulatory Services (Water) been consulted? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A <input type="checkbox"/></p>
<p>Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>	<p>Name: Samson Brook Catchment Area Priority: P1 Are the proposed activities/ landuse compatible with the PDWSA (refer to WQPN 25)? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Area of PFAS plant is outside P1 area but the Orion 3 sump is inside of the area.</p>
<p>Is the Premises subject to any other Acts or subsidiary regulations?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>	<p><i>Alumina Refinery (Wagerup) Agreement and Acts Amendment Act 1978</i> <i>Environmental Protection (Unauthorised Discharge) Regulations 2004</i></p>
<p>Is the Premises within an Environmental Protection Policy (EPP) Area?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>N/A</p>
<p>Is the Premises subject to any EPP requirements?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>N/A</p>
<p>Is the Premises a known or suspected contaminated site under the <i>Contaminated Sites Act 2003</i>?</p>	<p>Yes <input type="checkbox"/> No <input type="checkbox"/></p>	<p>CSS ID 78395 (Orion sumps) and CSS ID 78396 (Arundel workshops and sumps) Classification: possibly contaminated – investigation required (PC-IR) Date of classification: 14/01/2021</p>