Alcoa of Australia Limited

Attachment 3B – Kwinana Infiltration Project Supporting Document

March 26

Version	Description of Changes	Date	Approved by
0	Final Version Issued for release	26/03/26	[redacted]

Table Of Contents

Appendices

Tables

Figures

Charts

Plates

1. Introduction

1.1 Purpose

Alcoa of Australia Limited (Alcoa) is the owner and proponent of the Kwinana Alumina Refinery (Kwinana Refinery) in the Kwinana Industrial Area in Western Australia. The location is shown on Figure 1-1 and Figure 1-2.

This document has been prepared to support a works approval application for the Kwinana Infiltration Project (the Project) which includes:

- The construction of two infiltration galleries at Area O of the Main Residue Storage Area (RSA Main).
- Construction of a pipeline from the Water Treatment Plant (WTP) to the infiltration galleries.
- Installation of a post-treatment mineralisation system.
- Infiltration of up to 3.5 GL/year of treated water.
- Supporting infrastructure.

1.2 Background

Operations at the Kwinana Refinery are approved under Environmental Licence L5245/1967/14. The L5245/1967/14 Prescribed Premises and the proposed Works Approval Area are shown on Figure 1-2. Operations at the Kwinana Refinery include:

- An alumina refinery, which is no longer operational and will be permanently closed.
- A powerplant, which is no longer operational and will be permanently closed.
- A jetty for export of product and import of chemicals. This also serves Alcoa's other Western Australian operations.
- Product and raw materials storage and handling serving other Western Australian operations.
- Rail loading and unloading facilities.
- Operating RSA Main. Although residue is no longer being deposited, water management systems continue to operate. The WTP is under construction at RSA L. Dredge spoil from water storage ponds and filter cake from the WTP are stored inside impoundments.
- Closed Residue Storage Area (RSA ABC).
- Pipeline corridors with pipelines and associated infrastructure supporting active process water management systems.

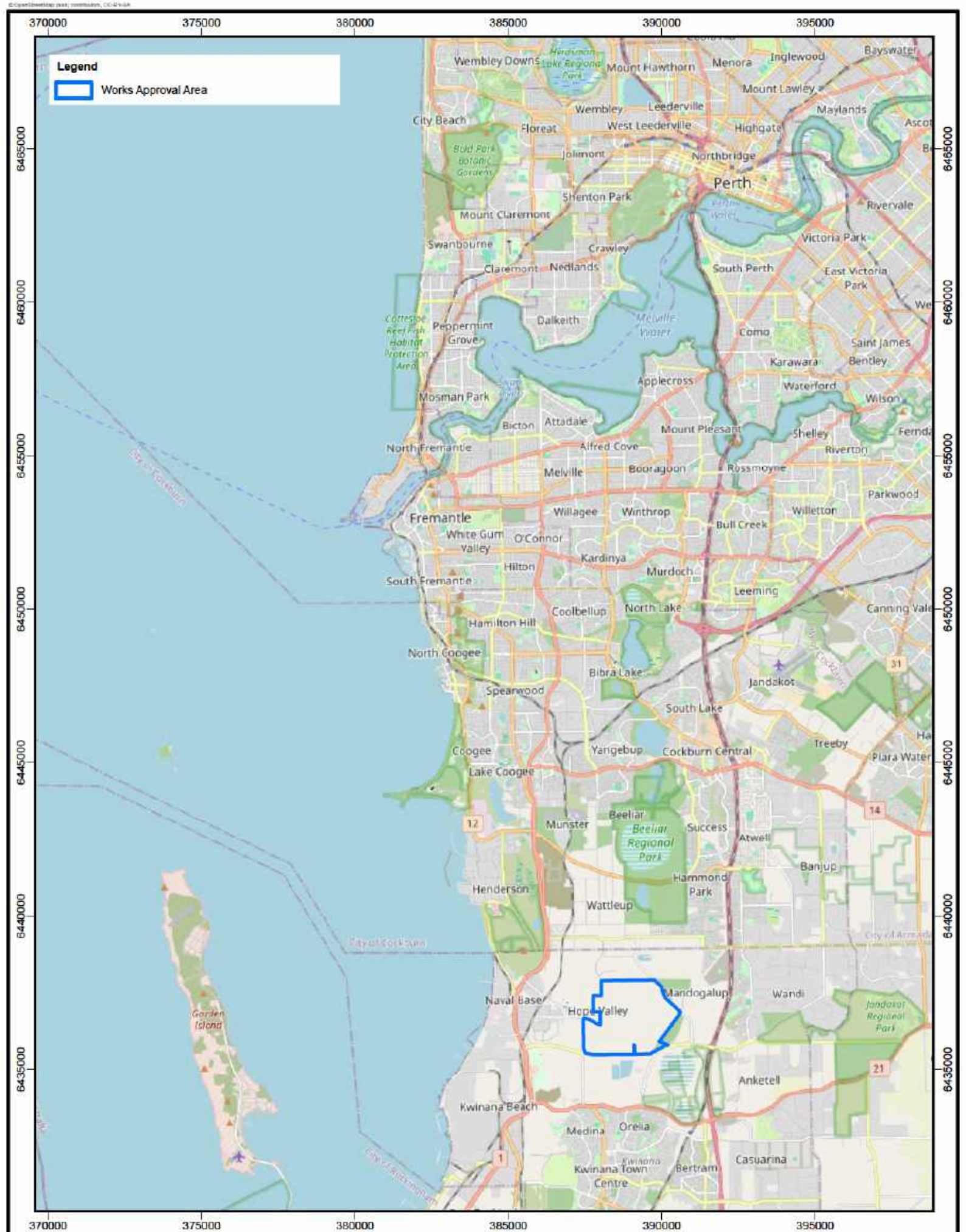
Alcoa has obligations under the *Contaminated Sites Act 2003* (CS Act) and Condition W1 of L5245/1967/14 to implement the Kwinana Groundwater Monitoring and Management Plan (GMMP) (Alcoa 2025) which outlines the monitoring and management requirements for the remediation program and related recovery bore abstraction. A significant amount of stormwater is also collected from the refinery process areas and Residue Storage Areas (RSAs) and process water ponds.

Historically, groundwater from environmental recovery bores and harvested stormwater was used as process water. The site operated with a negative water balance with the deficit made up with abstracted groundwater. Now that the alumina refinery has ceased to operate, processing does not consume water, currently leaving the site with a surplus. Whilst water will be required for closure processes (dust management, capping and revegetation) there is a need to manage the current surplus water as part of the transition to closure. Alternative solutions have been implemented to manage surplus water:

- Surplus water was initially evaporated in the refinery during the transitional operating phase (TOP). TOP ceased on 15 December 2025.
- Surplus water is currently evaporated via mechanical evaporators at RSA Main.
- A WTP has been approved and is under construction with commissioning scheduled in July 2026.
- A works approval application will be submitted for a Mechanical Vapour Recompression (MVR) Plant to treat high TDS water streams that are not amenable to reverse osmosis at the required rates.
- The infiltration of treated water is scheduled for quarter 3 of 2026. Once infiltration commences, mechanical evaporation will only be required after extreme rainfall events if at all.

As closure progresses, capping of the Residue Storage Areas (RSAs) will reduce the volume of contaminated stormwater requiring treatment. Once capped, underdrainage systems will cease to flow over time and, over a period of several years, contaminant plumes will likely dissipate allowing environmental recovery of groundwater to cease. Once groundwater abstraction has ceased, and all water in ponds has been treated, water treatment will no longer be required.

For clarity, the infiltration of clean stormwater, without prior treatment, has not been considered in this Works Approval application.


Legend
Works Approval Area
370000
375000
380000
385000
390000
395000
6465000
6460000
6455000
6450000
6445000
6440000
6435000
Wembley Downs
Mount Hawthorn
Menora
Inglewood
Bayswater
Mount Lawley
Maylands
Wembley
Leederville
City Beach
Floreat
West Leederville
Highgate
Joondalup
Northbridge
Perth
Shenton Park
Rivervale
Mount Claremont
Victoria Park
Swanbourne
Crawley
Claremont
Nedlands
South Perth
East Victoria Park
Peppermint Grove
Dalkeith
Como
Saint James
Karawara
Bentley
Applecross
Waterford
Wilson
Mosman Park
Bicton
Attadale
Mount Pleasant
Shelley
North Fremantle
Alfred Cove
Riverton
Melville
Booragoon
Rossmoyne
Parkwood
Fremantle
Willagee
Winthrop
Willetton
White Gum Valley
O'Connor
Bull Creek
Kardinya
Hilton
Murdoch
South Fremantle
Leeming
Coolbellup
North Lake
Canning Vale
Hamilton Hill
North Coogee
Bibra Lake
Jandakot
Spearwood
South Lake
Coogee
Yangebup
Cockburn Central
Treeby
Lake Coogee
Munster
Beeliar
Success
Atwell
Beeliar Regional Park
Banjup
Hammond Park
Henderson
Wattleup
Naval Base
Mandogalup
Wandi
Hope Valley
Jandakot Regional Park
Anketell
Kwinana Beach
Medina
Orelia
Casuarina
Kwinana Town Centre
Bertram
N
0
2.5
5
km
Scale: 1:150,000
GDA2020 MGA Zone 50
Alcoa
Kwinana Infiltration Project
Figure 1-1 Location
Drawing #: Figure 1-1 Location
Author: smita
Date: 24/03/2026
Rev: A
A4
Date Printed: 24/03/2026
Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

N

0 500 1,000

m

Scale: 1:25,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 1-2 Prescribed Premises

Drawing #: Figure 1-2 Prescribed Premises			Author: smita	
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026	

1.3 Application Form

The Works Approval Application has been prepared in accordance with the requirements of Section 59B of the *Environmental Protection Act 1986* (EP Act) and the Industry Regulation Guide to Licencing (DWER 2019). This supporting document is Attachment 3B of the DWER Application Form.

Table 1-1 shows DWER Application Form completion matrix and addresses each information requirement.

Table 1-1: Information Relevant to DWER Application Form

Section in Application Form		Section in this Document
Part 1	Application type	Section 1
Part 2	Applicant details	Refer to Application Form
Part 3	Premises details	Section 2
Part 4	Proposed activities	Section 6
Part 5	Index of Biodiversity Surveys for Assessment (IBSA)	Refer to Application Form
Part 6	Other DWER approvals	Section 10
Part 7	Other approvals and consultation	Section 10
Part 8	Applicant history	Refer to Application Form
Part 9	Emissions, discharges and waste	Section 11
Part 10	Siting and location	Section 12
Part 11	Submission of any other relevant information	This document
Part 12	Category checklist	Not required
Part 13	Proposed fee calculation	Section 14
Part 14	Commercially sensitive or confidential information	Refer to Application Form
Part 15	Submission of application	Refer to Application Form
Part 16	Declaration and signature	Refer to Application Form
Attachments		
Attachment 1A	Proof of occupier status	Refer to Application Form
Attachment 1B	ASIC company extract	Refer to Application Form
Attachment 1C	Authorisation to act as a representative of the occupier	Not required
Attachment 2	Premises maps	Figure 1-2; Figure 6-1
Attachment 3A	Environmental commissioning plan	Section 6.7
Attachment 3B	Proposed activities	This Document
Attachment 3C	Map of area to be cleared	N/A
Attachment 3D	Additional information for clearing assessment	N/A
Attachment 4	Marine surveys	N/A
Attachment 5	Other approvals and consultation documentation	N/A

Section in Application Form		Section in this Document
Attachment 6A	Emissions and discharges	Section 11
Attachment 6B	Waste acceptance	N/A
Attachment 7	Siting and location	Section 12
Attachment 8	Additional information submitted	N/A
Attachment 9	Category-specific checklist(s)	N/A
Attachment 10	Proposed fee calculation	Section 14
Attachment 11	Request for exemption from publication	Refer to Application Form

1.4 Current Part V Approval Applications

The status of current and recent works approval applications and applications to amend L5245/1967/14 to support the transition to closure at Kwinana is provided in Table 1-2.

Table 1-2: EP Act Part V Approvals

Project	Description	Status
Mechanical evaporators on RSA K and the ROWS Pond	15 evaporators on the ROWS Pond and 6 on RSA K.	Licence amendment approved 25 June 2024
Mechanical evaporators on RSAs J, H and F6	16 Mechanical evaporators on RSA J(5), H(5) and F6(6).	Licence amendment approved 22 August 2025
Mechanical evaporators on RSA F7	6 Mechanical Evaporators on RSA F7	Licence amendment approved 22 December 2025.
Water Treatment Plant (WTP)	Reverse osmosis treatment plant on RSA L. Product water to be returned to ROWS Pond and brine directed to the Lake Water Pond.	Works approval approved 5 February 2026.
MVR Plant	Mechanical Vapour Recompression Plant to treat high TDS water streams. Condensate to be infiltrated. Concentrate to be sent to Pinjarra or Wagerup as a process input or sold commercially to other buyers.	Works Approval Application to be submitted
Infiltration of Treated Water	Discharge of treated water into the Tamala Limestone via infiltration galleries in Area O.	This works approval application

2. Premises Details

2.1 Works Approval Area

The Prescribed Premises for Environmental Licence L5245/1967/14 and the Works Approval Area are shown on Figure 1-2.

The Works Approval Area is the entirety of Lot 501 on Plan 72707 (Lot 501). Only part of Lot 501 is currently inside the L5245/1967/14 Prescribed Premises and an amendment to the Prescribed Premises is required when the Project transitions from operating under a Works Approval to a Licence.

2.2 Prescribed Premises Categories

Prescribed Premises categories on L5245/1967/14 are listed in Table 2-1. This Works Approval application is relevant to Category 46. No change to assessed design capacities is proposed.

Table 2-1: Assessed Design Capacities on L5245/1967/14

Prescribed premises category description (Schedule 1, Environmental Protection Regulations 1987)	Assessed design capacity
Category 5: Processing or beneficiation of metallic or non-metallic ore	5,000,000 tonnes per year (filter mud cake from filtration facility, dry)
Category 46: Bauxite refining	2,409,000 tonnes per year (smelter grade alumina equivalent)
Category 52: Electric power generation	78.5 MW in aggregate
Category 58: Bulk material loading or unloading	4,818,000 tonnes per year
Category 64: Class II or III putrescible landfill site	1,000 tonnes per year
Category 67: Fuel burning	65,000 m^3 per hour

2.3 Land Tenure and Ownership

The Works Approval Area comprises Lot 501 - a single, freehold allotment held by Alcoa. A certificate of title is included as Attachment 1A of the Works Approval application.

3. EHS Risk Assessment

Alcoa engaged EHS Support Pty Ltd (EHS) to design the infiltration galleries and undertake a detailed Commissioning and Operational Risk Assessment (CORA) for the Project. In the development of the risk assessment, EHS followed the approach in the *Australian Guidelines for Water Recycling: Managed Aquifer Recharge* (NRMMC 2009). EHS:

- Described and identified the legislative framework (Section 1) and Environmental Setting (Section 3).
- Considered all potential receptors and assessed whether a plausible impact pathway exists (Section 3.9).
- For receptors where there is a plausible pathway, identified environmental and beneficial groundwater uses that need to be protected (Section 3.10).
- Undertook a Stage 1 Risk Assessment to confirm Project feasibility and identify any supplemental studies required (Section 4).
- Described the supplemental studies undertaken and the findings (Section 5).
- Undertook a final risk assessment (Section 6) using the risk definitions and approach in DWER guidance for Part V assessments (DWER 2020c).
- Presented a summary of findings and how these were integrated into Project design (Section 7).

EHS used an iterative approach to the Project in the CORA with each step of the process informing the location and design of the Project. The findings of supplementary studies and the risk assessment also informed the Monitoring and Management Plan (MMP) for the Project.

The CORA (EHS 2026a) is attached as Appendix 1. The MMP (EHS 2026b) is attached as Appendix 2.

This supporting document largely summarises the findings of the CORA and duplicates the final risk assessment. Relevant sections of the CORA and MMP are referenced where required. This includes references to other technical documents that are appendices to the CORA.

The CORA and MMP and all technical appendices were also provided to the Contaminated Sites Auditor and a Mandatory Auditors Report (MAR) has been prepared for submission to the Contaminated Sites Branch of DWER.

4. Terms Used

Table 4-1 contains the terms used in this supporting document.

Table 4-1: Terms Used

Term	Definition
Background UPL	The predicted maximum background concentration of analytes in the Tamala Limestone aquifer. Used to define baseline water quality in the Tamala Limestone aquifer.
Baseline UPL	Revised UPLs to be calculated prior to the commencement of infiltration using additional baseline water quality data collected from new and existing monitoring bores. Will be used to define baseline water quality in the Tamala Limestone once infiltration starts.
Brine	High TDS liquid waste stream from the WTP.
Concentrate	Highly concentrated product streams from MVR plants. Commercially valuable product that will be sold to third parties or trucked to Pinjarra or Wagerup as process inputs.
Condensate	Treated water from the MVR Plant. Condensate is essentially condensed steam and is very pure water.
Infiltration Area	The area within Area O of RSA Main within which the infiltration galleries and supporting infrastructure such as fences will be constructed.
MMP	Monitoring and Management Plan (EHS 2026b). Attached as Appendix 2.
MVR Plant	Mechanical Vapour Recompression Plant. A highly efficient water treatment process where high TDS water is heated to produce steam which is then condensed with heat recovered and reused. Separate works approval applications will be applied for MVR Plant(s). This works approval application includes the mineralisation and infiltration of condensate from MVR Plants.
CORA	Kwinana Infiltration Project: Commissioning/Operational Risk Assessment (EHS 2026a). Attached as Appendix 1.
RO	Reverse Osmosis. A critical treatment stage in the WTP where water is forced through a partially permeable membrane to produce a low TDS permeate and a high TDS brine.
Treated Water	Treated and mineralised water suitable for infiltration. This includes permeate from the WTP; Condensate from the MVR Plant or a blend of both.
UPL	Upper Prediction Limit. A statistical calculation of background water concentration from monitoring results. The expected concentration of an analyte that will not be exceeded in the next round of sampling at a 99% confidence level.
WQIZ	Water quality impact zone. The area where infiltrated water is expected to travel in the Tamala Limestone.
WTP	Reverse Osmosis Water Treatment Plant. The WTP is currently under construction on RSA L. This works approval application includes the mineralisation and infiltration of permeate from the WTP.

5. Water Treatment

Surplus water at the Kwinana refinery is not suitable for infiltration without treatment. A water treatment plant is currently being constructed in accordance with W3105/2025/1 and separate works approval applications will be submitted for addition water treatment plant projects. While not included in this Works Approval application, additional detail on water treatment has been included here as the treatment processes and water quality are important considerations for the Project.

With all treatment plants running, an average of up to 395 kL/h (3.5 GL/y) of treated water will be produced in wet years consisting of ~312 kL/h (2.75 GL/y) of permeate and ~83 kL/h (0.75 GL/y) of condensate. Although treated water volumes are expected to vary seasonally and decline over time as RSAs are capped, ongoing infiltration at the maximum rate has been assumed in the CORA.

Additional detail on water treatment considerations is in Section 5.1 of the CORA (Appendix 1). Information of the quality of infiltrated water is included in Section 6.3 of this document.

5.1 Reverse Osmosis Treatment

The Reverse Osmosis Water Treatment Plant (WTP) will treat water from the ROWS Pond and F -Surge Pond via a series of steps:

- pH adjustment.
- Clarification.
- Filtration.
- Ultrafiltration.
- Reverse Osmosis (RO) via several stages including high pressure RO, ultra-high pressure RO and polishing RO to produce a high quality permeate suitable for infiltration.

The WTP is approved via Works Approval W3105/2025/1 and is under construction. W3105/2025/1 approves the discharge of permeate back into the ROWS Pond.

5.2 MVR Treatment

Mechanical Vapour Recompression (MVR) treats water by:

- Thermal evaporation to produce vapour or steam.
- Mechanical compression of vapour further increasing heat.
- Condensing vapour into condensate and recovering heat for reuse in evaporation.

The MVR process is similar to distilling water and the resulting treated water or condensate is very pure (~150 mg/L TDS is anticipated). Condensate will either be blended with permeate from the WTP, remineralised and infiltrated or may be sent to the WTP for further polishing.

The concentrate from the MVR plants will be removed from site and used as process inputs at the Pinjarra and Wagerup refineries; or sold commercially.

6. Proposed Activities

Proposed infrastructure is shown in Figure 6-1 and described under the sub-headings below.

6.1 Infiltration Galleries

Two infiltration galleries or trenches will be constructed in Area O inside the Infiltration Area shown in Figure 6-1. A concept design of the galleries is provided in Figure 6-2.The southern gallery will be ~400 m long and the northern trench ~100 m long. Both galleries will be ~20m wide at the base and ~2m deep though depth will vary with surface topography. Galleries will be fenced to prevent access by the public and terrestrial fauna.

Galleries will be rock armoured at outlets and, if required, crushed limestone may be added to the base.

The galleries have been sized based on field measurements of permeability and field trials so that they can accept the required infiltration amount without overtopping. Groundwater level and quality data will inform operation of the galleries, which may be sub-divided into smaller areas with discharge cycled between them.

If a gallery does start to fill then internal barriers can be removed, spreading the discharge across a wider area. If required, the discharge rate can also be adjusted. In the unlikely event galleries overtop, the discharge will be confined to the Area O quarry, which has been excavated to below natural ground level. If overtopping does occur, water cannot escape the quarry and will either evaporate or infiltrate.

Groundwater level and quality data from adjacent sentinel bores in Area O will inform operation of the galleries. To the extent possible, the galleries will be operated to encourage vertical migration of infiltrated water to the base of the Tamala Limestone. This will be achieved by confining the discharge to smaller areas within each gallery to maximise hydraulic head. Should this increase mounding beyond anticipated limits, the discharge will be spread out to reduce vertical hydraulic gradients, which may decrease vertical migration. The operational intent is to cycle infiltration between and within the galleries to allow periodic drying out and prevent the formation of a freshwater ecosystem.

6.2 Mineralisation

Treated water is very pure and will be hardened prior to discharge to prevent dissolution of the Tamala Limestone aquifer. Remineralisation will be achieved by dosing water with lime putty or milk of lime[1] followed by pH adjustment using CO_2. A purpose-built unit, consisting of a 60 kL agitated tank and dosing system is proposed that can be delivered as a turn-key solution. A photo of a similar system is provided in Plate 1.

Depending on the required hardness specification and the amount of water infiltrated ~200 tonnes of hydrated lime solids will be required each year, which equates to 700 kL – 1,400 kL of milk of lime depending on the concentration supplied. This will be delivered in 20 kL trucks at a rate of 1 to 3 deliveries per fortnight.

[1] Lime putty and milk of lime are both suspensions of hydrated lime ($Ca(OH)_2$) in water with lime putty having a higher percentage of hydrated lime. Hereafter the term milk of lime will be used; however, suppliers may use the term lime putty depending on the mineralisation product selected.

Plate 1: Milk of Lime Dosing System

The mineralisation system will be located adjacent to the filter press inside the envelope shown on Figure 6-1. Milk of lime will be added to the pipeline and water will then be passed through a settlement tank (the redundant caustic wash tank will be cleaned and repurposed) where residual solids in the milk of lime will drop out. Water will be collected from the top of the tank and pumped to the infiltration galleries. A photo of the proposed location, including the existing caustic wash tank that will be repurposed is provided in Plate 2.

Approximately 20 tonnes per year of residual solids are anticipated and the settlement tank has a hopper bottom design with a cone shaped floor to provide for easy and complete drainage of contents. Residual solids from milk of lime will mostly consist of sand as well as various insoluble calcium solids and are expected to be geochemically benign. Solids will be periodically removed and disposed of appropriately in a lined RSA.

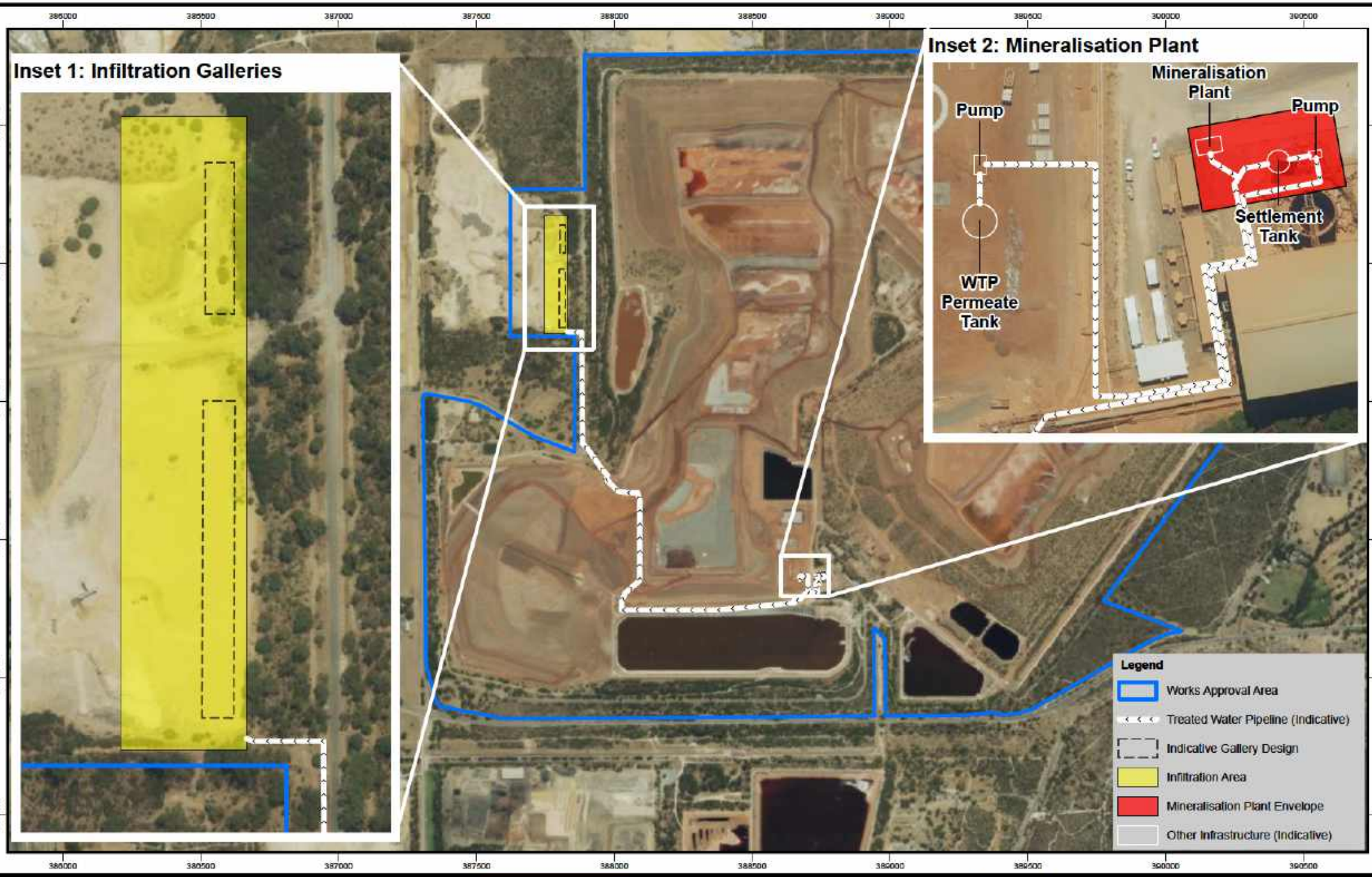
As residual solids will be collected in the settlement tank, limited passthrough to the infiltration galleries is expected. Any sediments discharged into the galleries will not enter or travel through the aquifer and will be periodically removed and disposed of into a lined RSA as part of general maintenance.

Remineralisation will increase the pH of treated water and subsequent pH adjustment will be undertaken to ensure infiltrated water is within the required pH range (6.5 – 8.5). Either CO_2 or sulphuric acid will be used for pH adjustment and will be injected into the settlement tank where mixing will occur. If CO_2 is used, this will be supplied from the CO_2 pipeline to the WTP. If sulphuric acid is used, this will be dosed with a small peristaltic pump from IBCs placed on bunded pallets adjacent to the settlement tank. A 5% acid solution is proposed and approximately 200L to 400L per day are expected to be required.

The milk of lime dosing rate for mineralisation will be calculated from the concentration of the milk of lime, the flow rate and the required hardness of infiltrated water. Continuous pH and EC monitoring will indicate that the required specification is being achieved, and this will be confirmed by weekly laboratory testing of the discharge. The dose rate will be primarily driven by the concentration of the milk of lime and is expected to be between 0.1 - 0.25 L/kL (litres of milk of lime per kilolitre of treated water).

The results of commissioning testing of the permeate will be used to determine the required hardness (and hence dose rate) via calculation of the Langelier Saturation Index (LSI) — a widely used water-chemistry indicator that predicts whether water will be undersaturated (with potential to dissolve calcium), balanced, or oversaturated (and potentially scale-forming) based on calcium carbonate content and pH. The dose rate may be further refined during operations for example, if calcification is observed in the galleries. A marginally negative LSI will be used to suppress dissolution and prevent potential calcification and clogging of the Tamala Limestone.

Plate 2: Proposed Mineralisation Plant Location



N

0 125 250 500

m

Scale: 1:17,500

AGD 1984 AMG Zone 50

Alcoa

Kwinana Infiltration Project

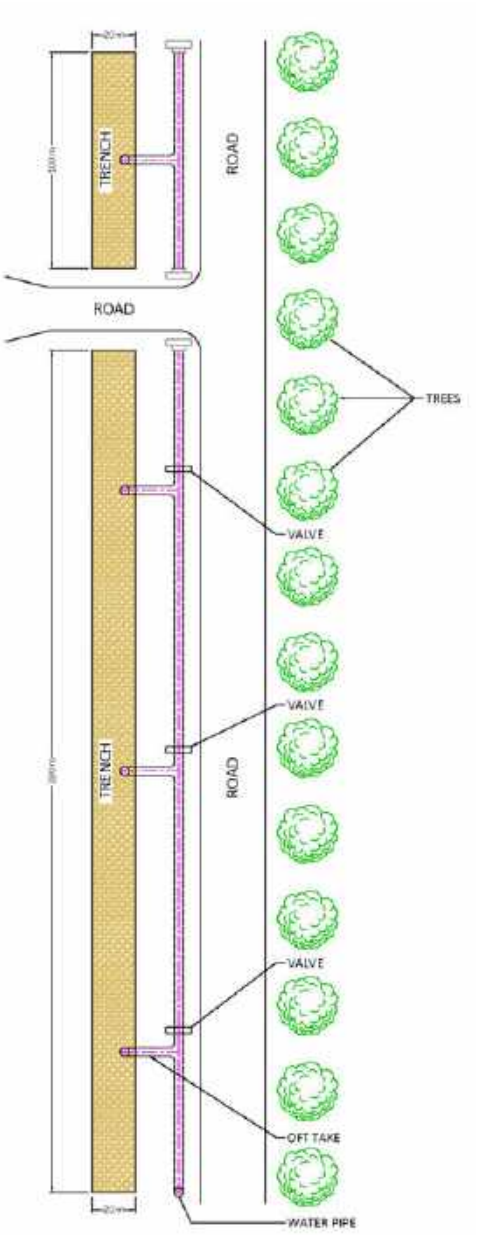
Figure 6-1 Proposed Infrastructure

Drawing #: Figure 6-1 Proposed Infrastructure

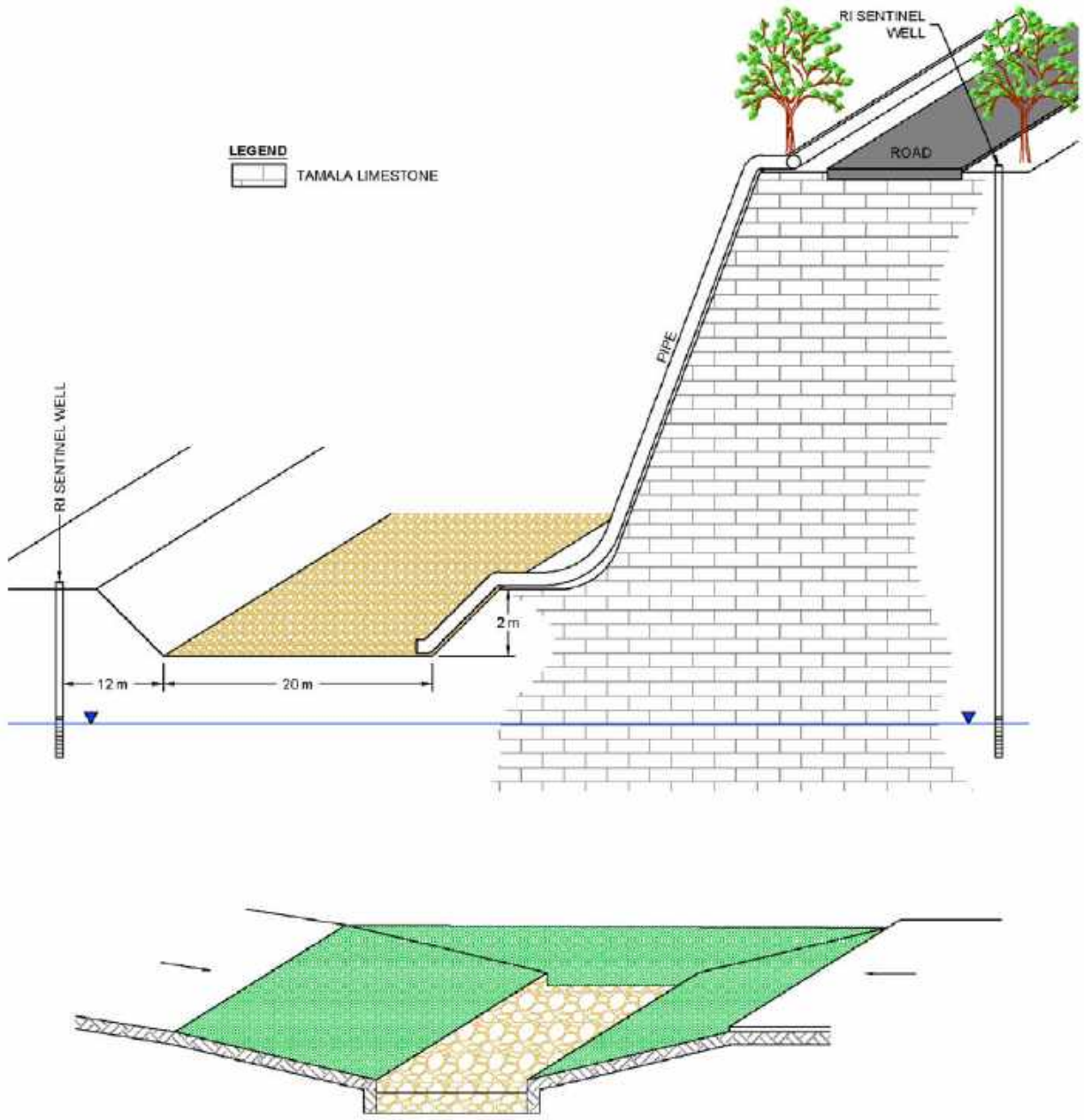
Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

Surficial View:



Sectional View:



Source: EHS (2025a)

Drawing #: Figure 6-2 Concept Design			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Alcoa

Kwinana Infiltration Project

Figure 6-2 Concept Design

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

6.3 Discharge Quality

The expected quality of infiltrated water is a critical component of the environmental risk assessment for the Project. EHS identified a Primary Water Quality Suite via a comprehensive analysis of feedwater and the expected quality of permeate to determine the constituents that may be present in treated water.

The steps EHS took to develop the Primary Water Quality Suite are summarised below and described in detail in Section 2.4 of the MMP (Appendix 2).

6.3.1 Identification of Constituents of Potential Concern

EHS analysed the results of pilot plant testing for the WTP to identify Constituents of Potential Concern (COPCs) in treated water. While samples were taken from each treatment step in the Pilot Plant (neutralisation, clarification, filtration, ultrafiltration & reverse osmosis), the analysis focused on the neutralised feed water, prior to subsequent treatment stages (i.e. what is in the feed water, rather than what is in the treated water).

Three samples of feed water were tested for 185 analytes. EHS screened the results as follows:

- Constituents below the limit of detection in all three samples (123 of 185 analytes) were not considered further.
- Constituents below both the Non-Potable Use Guidelines (DoH 2014) and the Background UPL[2] were not considered further.
- Constituents without NPUG criteria and below the Background UPL were not considered further.

EHS used NPUG criteria and natural background levels to screen results as filtration and ultrafiltration will remove solids from water and RO will reduce concentrations of dissolved constituents by orders of magnitude. Constituents within background levels prior to this treatment do not need to be considered further.

After the initial screening, more specific consideration was then given to certain analytes:

- Physical properties (non-ion specific criteria) were not considered.
- Gross alpha and gross beta radionuclide activity were excluded as concentrations are associated with solids in the feed water and activity is an order of magnitude lower after ultrafiltration (the last stage prior to RO).
- The rare earth minerals (hafnium, indium, niobium, tantalum and zirconium), without NPUG criteria or Background UPLs, in neutralised feed were not considered further due to being detected at very low concentrations that support removal to below detection limits by reverse osmosis.
- Nitrogen oxides were not considered further. Although there are no NPUG criteria or Background UPLs, assessment of ammonia, nitrate, nitrite and total Kjeldahl nitrogen is considered sufficient.

[2] The Background UPL is the predicted maximum background level of each constituent in the Tamala Limestone. See Section 8.4.4 for a description of the groundwater sampling and methods to calculate Background UPLs.

- N-Nitrosodimethylamine, phenol and thiosulfate and sulfide, all present at low concentrations in the neutralised feedwater, but without NPUG criteria were not considered further as these are known to be removed by membrane technologies and are readily biodegradable or will rapidly oxidise.
- The PFAS compounds PFBS (max 0.0053µg/L), PFHpA (max 0.029 µg/L), PFHxA (max 0.064 µg/L), PFPeS (max 0.0023 µg/L) were all detected in background samples but background UPLs were not calculated. The concentrations in the neutralised raw water feed were generally consistent with background and these compounds were not considered further. PFOS, PFOA, and PFHxS were included as there are relevant beneficial use criteria.
- Select key parameters with justification to remove, were retained.

After the process described above, the 25 analytes in Table 6-1 were identified as COPCs.

Table 6-1: COPCs

Chemical Name	Neutralised Feed Detect/Sample Count	Neutralised Feed Screening Outcome (NPUG or Background UPL)
Aluminium	3/3	Exceed
Ammonia as N	3/3	Exceed
Arsenic	3/3	Exceed
Boron	3/3	Exceed
Calcium*	0/3	Below
Chloride	3/3	Exceed
Cyanide	1/3	Exceed
Fluoride*	3/3	Below
Gallium*	3/3	Below
Magnesium*	0/3	Below
Molybdenum	3/3	Exceed
Nickel*	3/3	Below
Nitrate*	1/3	Below
PFHxS*	1/3	Below
PFOS*	1/3	Below
PFOA*	3/3	Below
Phosphate	3/3	Below
Potassium*	3/3	Below
Selenium	3/3	Exceed
Sodium	3/3	Exceed
Sulfate*	3/3	Exceed
Thorium	3/3	Exceed
Tin	1/3	Exceed

Chemical Name	Neutralised Feed Detect/Sample Count	Neutralised Feed Screening Outcome (NPUG or Background UPL)
TDS	3/3	Exceed
Total Kjeldahl Nitrogen	2/2	Exceed
Vanadium	3/3	Exceed

Source: Table 2-8 of MMP (Appendix 2); * Indicates constituents with justification to remove, however they have been retained as a key parameter for further assessment.

6.3.2 Permeate Quality Screening

Once COPCs were identified, the designer and operator of the WTP provided conservative concentrations for each COPC in the permeate based on expected feedwater concentrations. EHS then screened the predicted concentration of each COPC against:

- Background levels in the Tamala Limestone (Background UPLs).
- Tier 1 screening criteria based on protection of down-gradient receptors.

The screening assessment is shown in Table 6-2. Analytes below the Background UPL and all Tier 1 Screening criteria were not considered further, unless they support water quality assessment outcomes. Tier 1 screening criteria are guideline values relevant to down-gradient receptors. Although not used for screening, EHS also noted Australian Drinking Water Guideline values for additional context.

Based on the assessment, permeate will contain:

- 10 COPCs at or above the Background UPL or at least one Tier 1 screening criterion.
- 15 COPCs below both the Background UPL and all Tier 1 screening criteria.
    - Of these, six were retained in the Primary Water Quality Suite

Alcoa

Table 6-2: Permeate Specification

Parameter	Units	Permeate Quality	Background UPL[1]	Tier 1 Screening Criteria				Drinking Water[6]
				NPU[2]	Short-term Irrigation[3]	95% ANZG[4]	Cockburn Sound[5]	
Aluminium	mg/L	0.15	**0.04**	0.2	20	**0.055**	**0.086**	0.2*
Ammonia as N	mg/L	0.1	0.18	0.41	-	0.74	1.2	0.41*
Ammonia	mg/L	0.12	0.22	0.5	-	0.9	1.46	0.5*
Arsenic	mg/L	0.01	0.03	0.1	2	0.013	0.017	0.01
Boron	mg/L	0.9	**0.13**	40	-	0.94	5.1	4
Calcium	mg/L	1 / 50^	350	-	-	-	-	-
Chloride	mg/L	17.5	222	250	-	-	-	250*
Cyanide	mg/L	0.0007#	0.004	0.8	-	0.007	0.004	0.08
Fluoride	mg/L	0.5	**0.41**	15	2	1.7	-	1.5
Gallium	mg/L	0.005	**0.002**	-	-	-	1.1	-
Magnesium	mg/L	0.1 / 5^	40	-	-	-	-	-
Molybdenum	mg/L	0.09	**0.007**	0.5	**0.05**	**0.034**	6.2	**0.05**
Nickel	mg/L	0.002	0.002	0.2	2	0.011	0.2	0.02
Nitrate	mg/L	2	47.4	500	-	29	121.6	-
PFOS	µg/L	<0.01	0.00066	2	-	0.48	0.13	0.008
PFOA	µg/L	<0.01	0.01	10	-	220	220	0.2
PFHxS	µg/L	<0.01	0.0043	2	-	-	-	0.03
Phosphate	mg/L	0.02	0.03	-	-	-	-	-
Potassium	mg/L	1.2	10.1	-	-	-	-	-
Selenium	mg/L	0.01	**0.004**	0.1	0.05	0.011	0.01	**0.004**
Sodium	mg/L	150	**129**	-	-	-	-	180*
Sulfate	mg/L	20 / 50^	640	1000	-	-	-	250*
Thorium	mg/L	0.00007#	0.002	-	-	-	-	-
TDS	mg/L	600	1093	-	-	-	-	600*
TKN	mg/L	0.5	1.2	-	-	-	-	-
Tin	mg/L	0.002	**0.001**	-	-	-	-	-
Vanadium	mg/L	0.01	**0.009**	-	0.5	**0.006**	0.16	-
	Analyte is equal to or above the Background UPL and/or at least one Tier 1 screening criterion.							
	Analytes below Background UPL and all Tier 1 screening criteria, but retained regardless.							
	Concentration in permeate is equal to guideline value							
	Concentration in permeate exceeds guideline value							

Source: Table 2-10 and Table 2-11 of MMP (Appendix 2)

[1] Upper Prediction Limit (UPL) for groundwater in the Tamala Limestone (EHS 2025b). Further description is provided in Section 8.4.4 .

[2] Non-potable use guidelines (DoH 2014).

[3] Guidelines for short term irrigation water (ANZEEC & ARMCANZ 2000b).

[4] Guidelines for the protection of 95% of species in moderately disturbed freshwater ecosystems (ANZG 2018).

[5] Moderate Ecological Protection Criteria for Cockburn Sound (EHS 2025c).

[6] Australian Guidelines for Drinking Water Quality (NHMRC & NRMMC 2011). * denotes aesthetic guideline values; otherwise health guideline values are provided.

^Expected maximum concentrations of Calcium, Magnesium and Sulphate are provided pre- and post-mineralisation. Maximum Calcium concentration to be calculated from commissioning phase testing prior to infiltration.

#Expected maximum concentration is below the limit of detection.

6.3.3 Primary Water Quality Suite

The Primary Water Quality Suite is shown in Table 6-3, with the maximum concentration of key analytes in treated water. The Primary Water Quality Suite consists of:

- All analytes identified in the Permeate Quality Screening stage above.
- Additional analytes that inform the operation of water treatment plants.

Table 6-3: Primary Water Quality Suite

Parameter		Units	Maximum Concentration in Infiltrated Water
General Parameters	pH	-	6-5 - 8.5
	TDS	mg/L	600
	Alkalinity	mg/L as $CaCO_3$	-
	Hardness	mg/L as $CaCO_3$	*
Major Cations	Calcium	mg/L	*
	Magnesium	mg/L	5
	Sodium	mg/L	150
	Potassium	mg/L	-
Major Anions	Chloride	mg/L	17.5
	Fluoride	mg/L	0.5
	Sulphate	mg/L	50
	Nitrate	mg/L	-
Metals	Aluminium	mg/L	0.15
	Arsenic	mg/L	0.01
	Boron	mg/L	0.9
	Gallium	mg/L	0.005
	Molybdenum	mg/L	0.09
	Nickel	mg/L	0.002
	Selenium	mg/L	0.01
	Tin	mg/L	0.002
	Vanadium	mg/L	0.01

*Hardness and Calcium criteria to be calculated from commissioning phase test results.

Source: Table 4.3 of MMP (Appendix 2)

Note EHS also developed a more comprehensive Commissioning Phase Suite for the testing of water from each treatment plant prior to mineralisation and infiltration. This is described in Section 9.1.

6.4 Pipeline

Treated water will be transported from the permeate tank at the water treatment plant to the infiltration galleries in a ~2.3 km long High Density Polyethene (HDPE) pipeline. The pipeline route is shown in Figure 6-1.

The pipeline will be constructed in previously disturbed areas and no clearing of remnant native vegetation is required.

The pipeline will be visually inspected and tested to above operating pressure prior to the commencement of infiltration and visually inspected weekly thereafter. Due to the high quality of treated water in the pipeline, significant environmental impacts are not anticipated should leaks occur.

6.5 Supporting Infrastructure

Other Supporting infrastructure includes:

- Pumps.
- Flow meters.
- Cameras.
- Electrical services.
- Fencing.
- Existing access roads and tracks.

6.6 Noise

Limited noise is anticipated during construction of the Project. New noise sources associated with the Project include:

- Pumps to transport water to the infiltration gallery.
- The mineralisation plant with small dosing pumps and intermittent agitation producing minimal noise.

These are not expected to significantly add to noise received at receptors due to the distance to receptors and the surrounding RSAs acting as a barrier.

The most significant source of noise at RSA Main are the mechanical evaporators and associated pumps and generators at the ROWS Pond, RSA K, RSA J, RSA H, RSA F6 and RSA F7. Noise assessments were undertaken to support approval of the mechanical evaporators and the modelled sound powers are in Table 6-4.

Table 6-4: Modelled Sound Power for Mechanical Evaporators

Equipment	Quantity (units)	Modelled Sound Power Per Unit - dB(A)
Area K Evaporators	6	114
Area K Pumps	1	97
Area K Generator	1	96
Feed Pump	1	97
ROWS Pond Evaporators	15	102

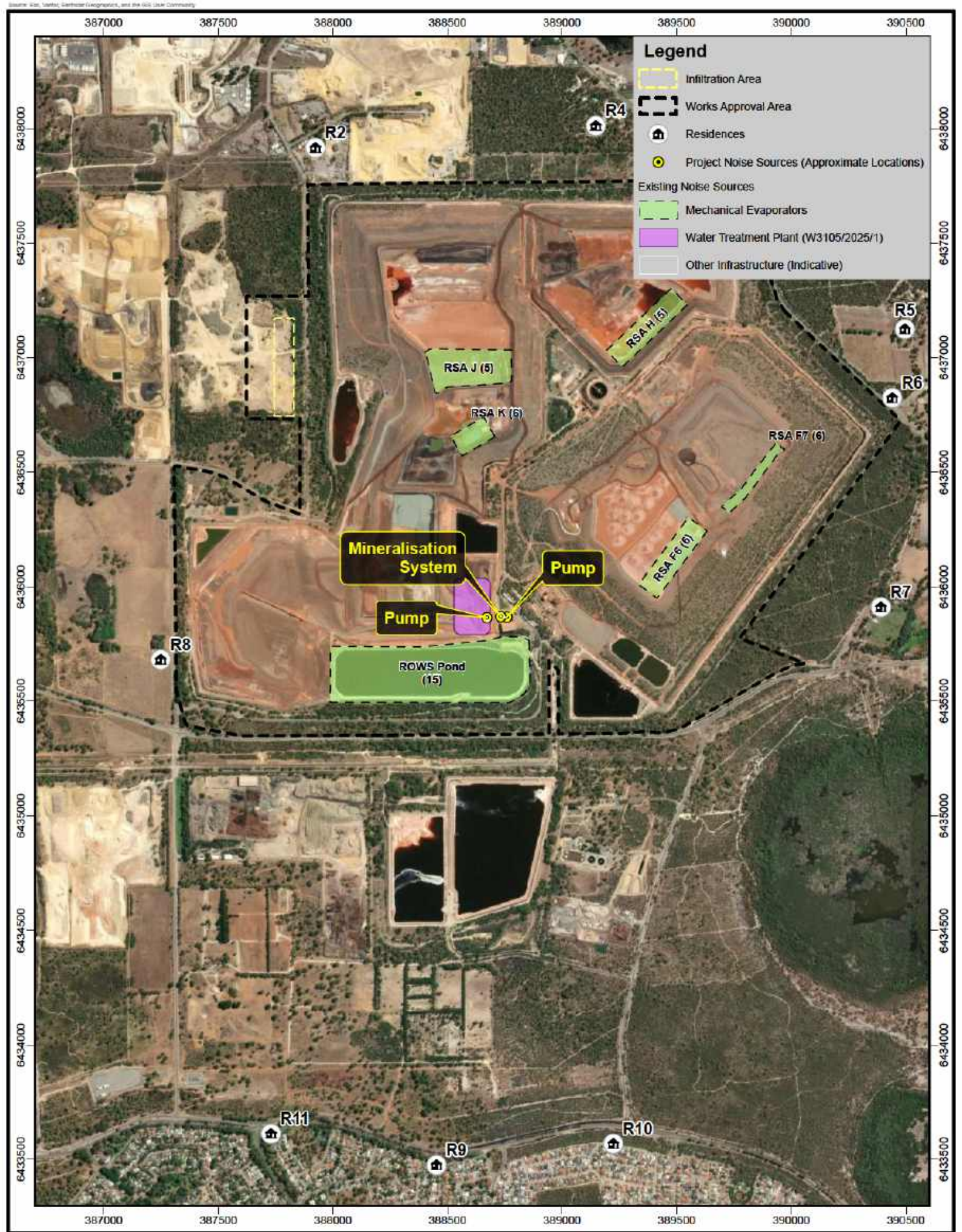
Equipment	Quantity (units)	Modelled Sound Power Per Unit - dB(A)
Area J, H, F6, F7 Evaporators	22	96
Area J, H, F6, F7 Pumps	22	97
Area J, H, F6, F7 Generators*	22	87 - 89

Source: Wood (2025) except Area J, H, F6 and F7 Generators*, which were modelled at 100 dB(A). Quieter generators will be operating when infiltration commences.

Alcoa considers that the Project will result in a significant decrease in noise emissions from the Prescribed Premises as:

- Noise at sensitive receptors can be managed within assigned levels with the mechanical evaporators and WTP operational.
- Once infiltration commences, mechanical evaporation will significantly decrease and will only be required after significant rainfall events.
    - Notably at nighttime, when assigned levels are lowest, the need to operate mechanical evaporation can be reduced.
- The sound power associated with 27 land-based and 15 ROWS-pond evaporators is significantly higher than the noise generating equipment associated with the Project.
- Evaporators and associated equipment are located closer to receptors than the noise sources associated with the Project.
- Noise sources associated with the Project are minor and would be unlikely to cause assigned levels to be exceeded at receptors, even if mechanical evaporators were running
- Noise sources associated with the Project will be located in the middle of RSA Main where RSAs shield receptors from noise. Mechanical evaporators by contrast are mostly located on RSA surfaces.
- Noise modelling for the WTP (Wood 2025) determined that the noise from the WTP would not be a significant contributor to noise at receptors. The additional pumps and sumps proposed in this works approval application are insignificant compared to the WTP and existing evaporators.

The locations of mechanical evaporators and noise sources associated with the Project are shown on Figure 6-3.



N

0 250 500

m

Scale: 1:20,000

AGD 1984 AMG Zone 50

Alcoa

Kwinana Infiltration Project

Figure 6-3 Noise Sources

Drawing #: Figure 6-3 Noise			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

6.7 Environmental Commissioning

Apart from the discharge pipeline, limited environmental commissioning activities are proposed for the Project and there is no distinct environmental commissioning phase.

Commissioning of the discharge pipeline will consist of:

- Visual inspection for leaks and defects.
- Filling the pipeline to above operating pressure, visual inspection and monitoring of pressure.
- If pressure does not hold, leaks will be repaired and the process repeated.
- If pressure holds, commissioning is complete and the pipeline is operational.

Note that CORA and Section 9.1.1 of this works approval application refer to Commissioning Testing. This testing does not relate to commissioning of the infiltration galleries, but to commissioning of water treatment plants and will occur prior to any infiltration from that source.

6.8 Time Limited Operations

A time limited operations provision will be required in the Works Approval to allow for infiltration until such time as a licence amendment with operational conditions is granted. A period of 180 days is requested. Time limited operations are unlikely to differ from licenced operations.

6.9 Preparatory Works

Several new environmental monitoring bores are proposed for the Project. These are being progressively installed to provide for the collection of baseline data prior to commencement of infiltration activities and are not included in the Works Approval application.

Alcoa will complete the following as preparatory works prior to a works approval being granted:

- Ground preparation activities including the preparation of hardstands for the mineralisation plant and preparation of the pipeline corridor.
- Installation of fencing in Area O.

Alcoa will not excavate the infiltration galleries, construct pollution control equipment or lay out sections of pipeline prior to a works approval being granted.

7. Alternatives Considered

Alcoa considered the following alternatives:

- Not proceeding with the Project.
- Discharge to the Peel Main Drain.
- Supply to a third-party.
- Alternative locations and methods for discharge of treated water into the Tamala Limestone.

The option of not proceeding with the Project was not considered as:

- An outlet for treated water is preferable to ongoing mechanical evaporation to maintain the water balance.
- The RSAs cannot be capped and closed if mechanical evaporators are required to maintain the water balance and an alternative outlet is required if the site is to progress to permanent closure.

Alcoa discussed the possibility of using the Peel Main Drain with regulators. The advice received was that this was not a viable option due to the capacity of the drain and it was not pursued further.

At the time of submission, no agreement has been reached with third parties to take treated water, although Alcoa continues to pursue this option. Even if an agreement were in place, Alcoa would still need to apply for a works approval for the full 3.5 GL/year as, if the taker's operations were disrupted, the site water balance could not be maintained without an approved outlet to the environment.

The use of reinjection wells and/or infiltration galleries was considered at the five locations shown in Figure 7-1. Of the five locations considered, locations 1 and 2, in and near Area O, were considered viable with 3, 4 and 5 not considered further due to the potential for interaction with contaminated land. Of the two viable locations, Location 1 is further from Long Swamp and was selected for the Project.

The alternatives in Figure 7-1 are discussed in Section 5.7 of the CORA.

N

0 1

km

Scale: 1:30,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 7-1 Alternatives

Drawing #: Figure 7-1 Alternatives			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

8. Existing Environment and Potential Impacts

8.1 Setting

The Kwinana Refinery is in the Kwinana Industrial Area (KIA) on the Swan Coast Plain ~27 km south of the Perth CBD in Western Australia. RSA Main is ~3.5 km inland from Cockburn Sound. Infiltration galleries will be excavated into the floor of an existing quarry in Area O, downgradient from operating RSAs.

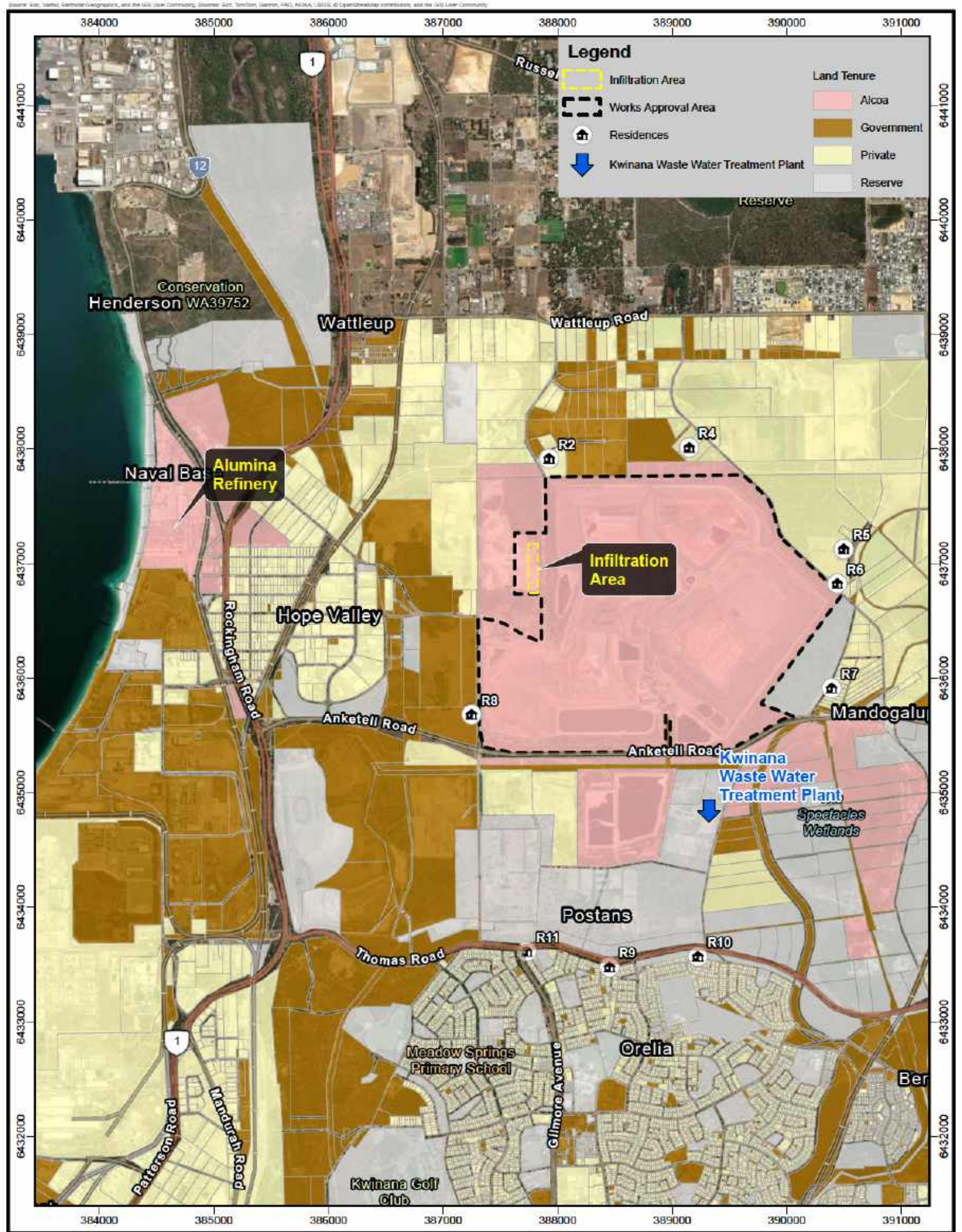
Surrounding land uses are industrial and rural. Land tenure and the closest residential receptors are shown in Figure 8-1.

8.2 Nearby Infiltration Projects

The Water Corporation (WaterCorp) operates the Kwinana Wastewater Treatment Plant (KWWTP) approximately 2.5 km southeast and upgradient of the Project. Environmental Licence L6543/1991/12 permits infiltration of an average of 4.7 ML of treated wastewater per day (~1.95 GL/annum). The location is shown on Figure 8-1.

The KWWTP is ~500m west and hydraulically downgradient of the Spectacles Wetland (the Spectacles), a Nationally Important, Conservation Category wetland that is part of Beeliar Regional Park. The Peel Main Drain passes through the Spectacles which is ~17 km upstream of the confluence with the Serpentine River.

Infiltration at the KWWTP enters the groundwater and flows both east and west, partially reversing the natural hydraulic gradient. DWER estimates that ~240 kL/day of treated wastewater expresses into the Spectacles in summer months. In winter months, the Peel Main drain activates and surface water inflows into the Spectacles prevent expression of wastewater (DWER 2020a, DWER 2016).



N

0 0.5 1

km

Scale: 1:40,000

AGD 1984 AMG Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-1 Land Users

Drawing #: Figure 8-1 Land Users			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

8.3 Climate

The climate is mediterranean with hot, dry summers and mild, wet winters. Climate data from the closest weather station at Jandakot Aero, (#009172; ~5 km northeast) are shown in Chart 1. Average annual rainfall is 803 mm. Average summer temperatures range from 27°C - 32°C with days over 40°C common.

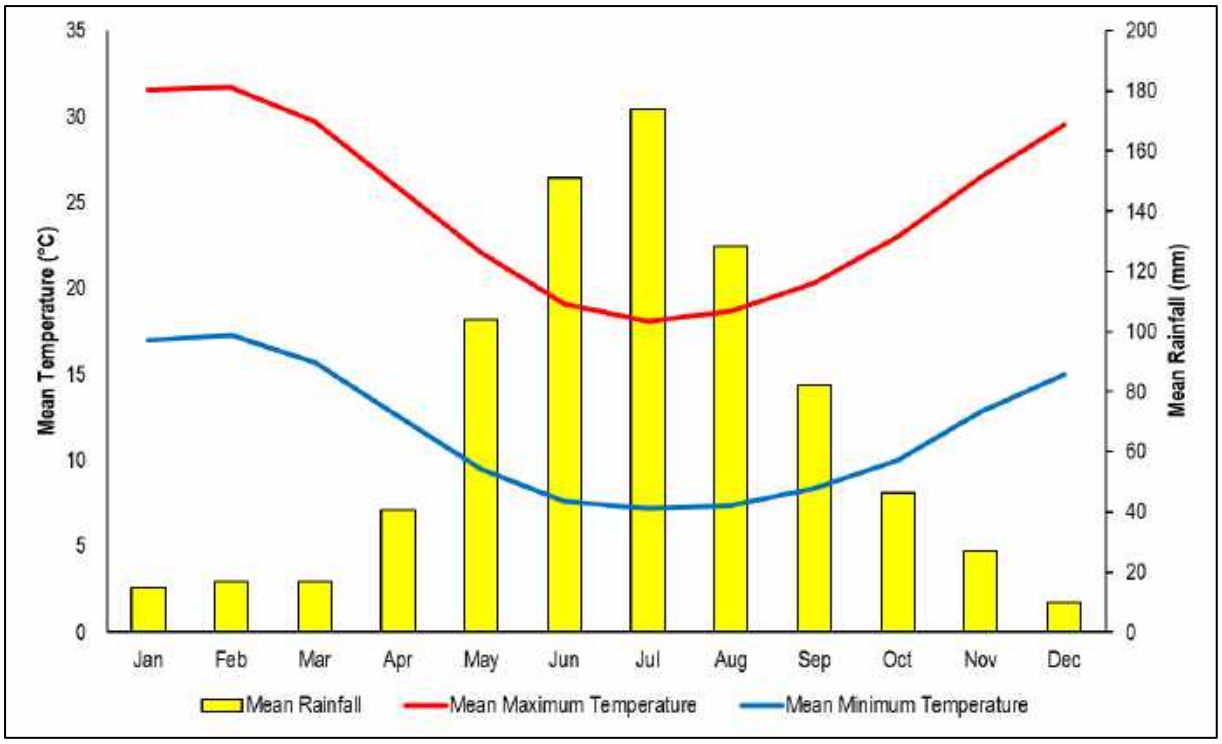


Chart 1: Climate Data (BOM 2025)

8.4 Groundwater

8.4.1 Hydrogeology

A description of the hydrogeological units in the Perth Basin is in Table 8-1.The surficial hydrogeology is shown on Figure 8-2 and a hydrogeological cross section is provided in Figure 8-3.

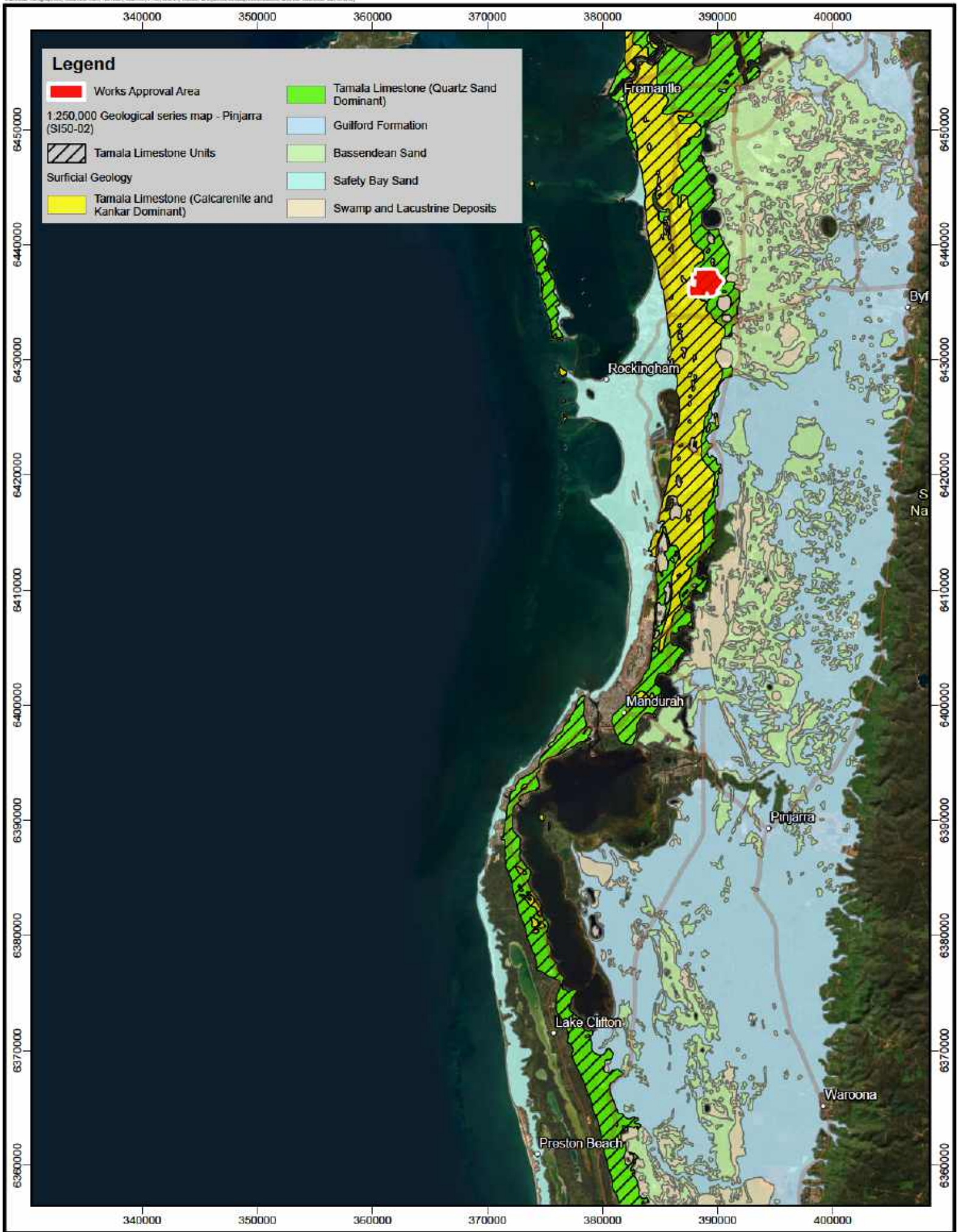
The surficial aquifer between RSA Main and the coast is within the Tamala Limestone and Ascot Formations. Infiltration will be into the top of the Tamala Limestone which is highly permeable. Permeability increases with depth and flows are higher at the base of the Tamala Limestone than at the surface.

Alcoa

Table 8-1: Hydrogeology

Age	Formation/Unit	Lithology	Presence
Superficial Formations			
Holocene	Wetland deposits (swamp and lacustrine deposits)	Peat and peaty sand	At swamps and wetlands
Pleistocene	Safety Bay Sand	White sand, fine to medium, silty at base. Abuts the Tamala Limestone to the east and overlies the Becher Sand which (where present) acts as a hydraulic barrier to the underlying Tamala Limestone.	Refinery
	Tamala Sands	Yellow sand	Alcoa RSA to near the coast.
	Tamala Limestone[1]	Limestone. High permeability due to solution voids. Permeability is highest at the base of the aquifer and generally increases towards the coast.	Alcoa RSA to the coast. Overlain by Safety Bay Sands at refinery.
	Gnangara Sand	Grey sand, coarse, silty. Low permeability.	Eastern portion of Alcoa RSA, upgradient of infiltration galleries. KWWPT and the Spectacles.
	Becher Sand	Grey silty and clayey sands. Low permeability. Acts as a hydraulic barrier between groundwater in the Safety Bay Sands and the Tamala Limestone when present.	Refinery.
	Bassendean Sand	Grey sand, medium. Moderately permeable.	Eastern portion of Alcoa RSA, upgradient of infiltration galleries. KWWPT and the Spectacles.
Pliocene	Ascot Formation	Limestone, sand, shells. Similar lithology to the Tamala Limestone, however is more clayey and shelly and generally less permeable. Basal unit of superficial formations.	Present between Alcoa RSA and coast. Sits between the Tamala Limestone and the Osborne Formation between the Alcoa RSA and the coast.
Unconformity			
Cretaceous	Osborne Formation (Kardinya Shale Member)	Glauconitic shale. Low permeability.	Present throughout model domain.

Source: Rockwater (2025)



N

0 5 10

km

Scale: 1:400,000

GDA2020 MGA Zone 50

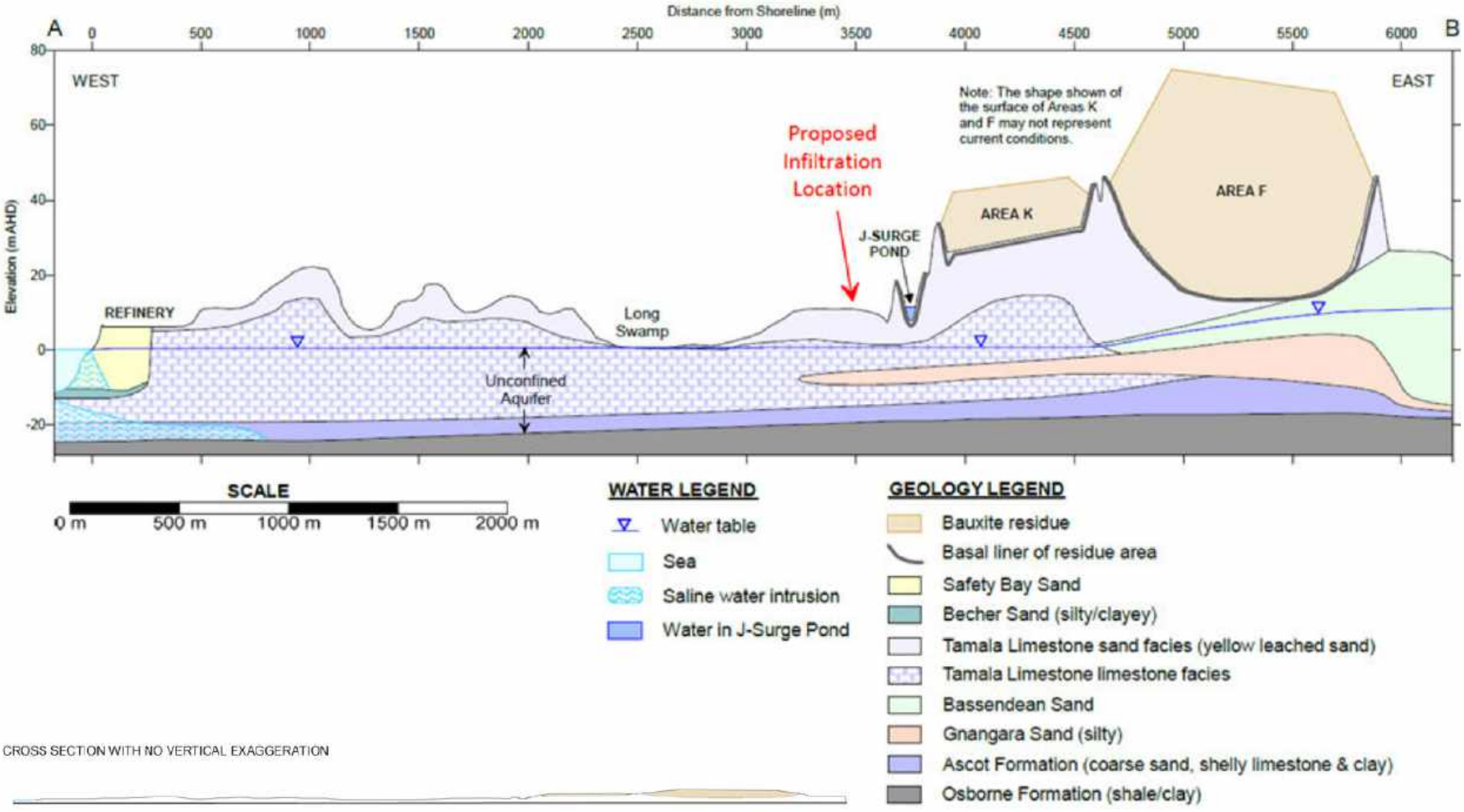
Alcoa

Kwinana Infiltration Project

Figure 8-2 Surficial Hydrogeology

Drawing #: Figure 8-2 Surficial Geology			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx



Source: Figure 3-6 of EHS (2026a)

Alcoa

Kwinana Infiltration Project

Figure 8-3 Hydrogeological Cross Section

Drawing #: Figure 8-3 Hydrogeological Cross

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

Path: L:\assets\Approved\EA\P0037\Projects\EA1P0037EA1P0037.aprx

8.4.2 Groundwater Model

A numerical groundwater model for the Project was developed by EHS and used to:

- Characterise baseline groundwater levels and flows.
- Predict the mounding and flow paths under infiltration.
- Predict changes in flux under infiltration.
- Support the location for the Project and the option selected.
- Support detailed environmental risk assessment of the Project.

The model domain is shown on Figure 8-4. The model included the following layers:

- Layer 1 – Tamala Sand / Safety Bay Sand
- Layer 2 and 3 – Base of Long Swamp / Tamala Limestone (shallow surficial aquifer)/
- Layer 4 – Tamala Limestone (intermediate surficial aquifer)
- Layer 5 – Tamala Limestone (deep surficial aquifer)
- Layer 6 – Bassendean Sand
- Layer 7 – Gnangara Sand
- Layer 8 – Ascot Formation
- Layer 9 – Osborne Formation

A copy of the modelling report (EHS 2025a) is included as Appendix B of the CORA (Appendix 1 of this supporting document). Numerical model findings are a key consideration in the CORA and referred to throughout the document with an overview provided in Section 5.7.3 of the CORA.

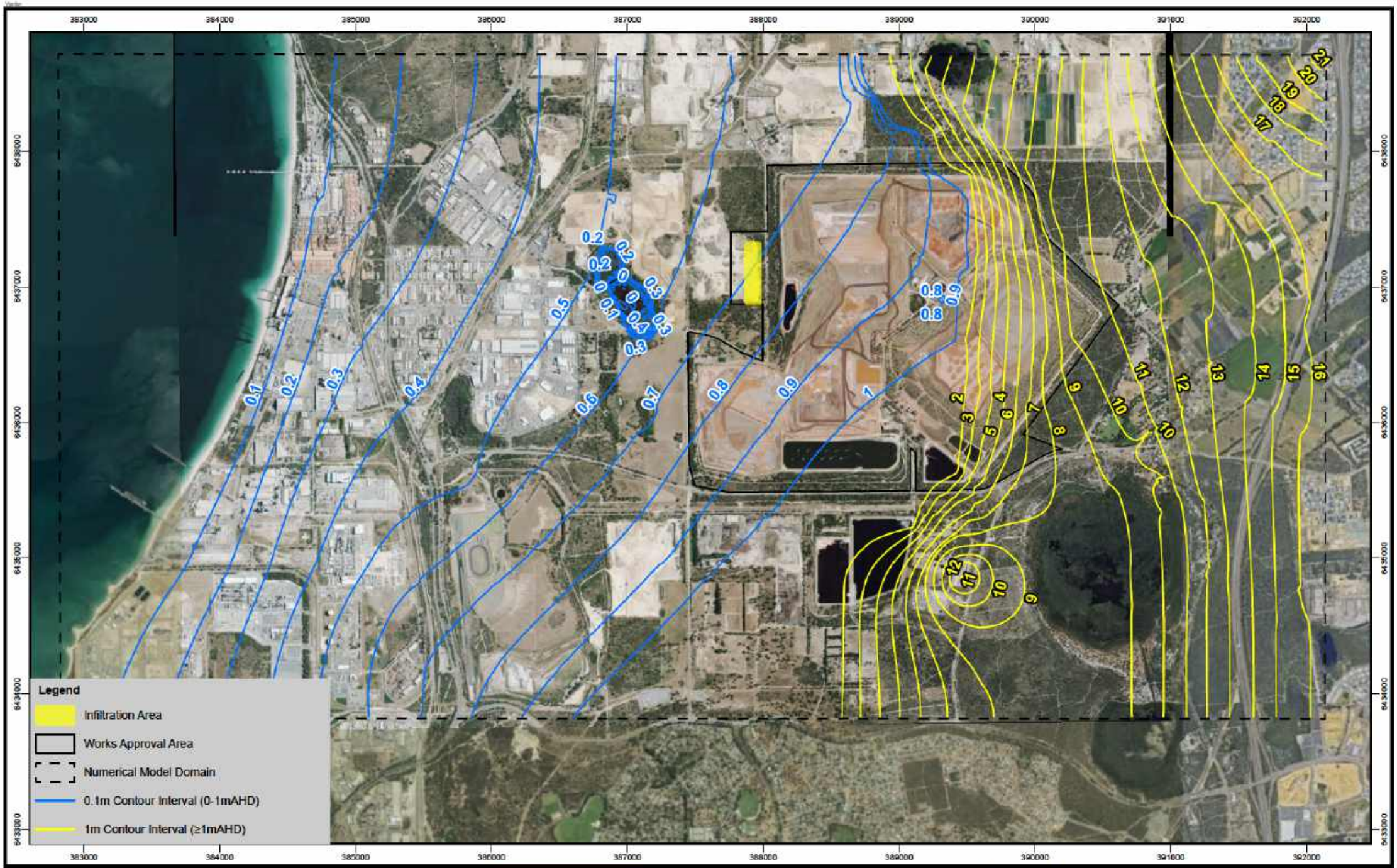
8.4.3 Groundwater Levels and Flow

Baseline Groundwater Levels modelled by EHS are shown on Figure 8-4 and Figure 8-5. The baseline flow from Area O is to the west-northwest towards the alumina refinery and Cockburn Sound. Note that these are modelled off groundwater levels in April 2024 and seasonal variation is ~0.5m to 1.0m in the Tamala Limestone.

Groundwater in the Tamala Limestone varies from 0 mAHD at the coast to ~1 mAHD at Area F of RSA Main (~5 km inland) and is ~0.7 mAHD at the Infiltration Area (~3.5 km inland). The flat groundwater gradient illustrates the high permeability of the Tamala Limestone.

Further east of Area F, groundwater levels increase to about 10 mAHD over a relatively short distance due to the lower permeability of the Bassendean Sands compared to the Tamala Limestone. The rise creates a steep hydraulic gradient, which will not be reversed by the Project.

Depth to groundwater varies with topography and ranges from ~0 m at wetlands to greater than 10m. At the Infiltration Area, groundwater is ~8m below the original ground level which is ~3m below the excavated base of the quarry.



N

0 0.5 1 1.5

km

Scale: 1:35,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

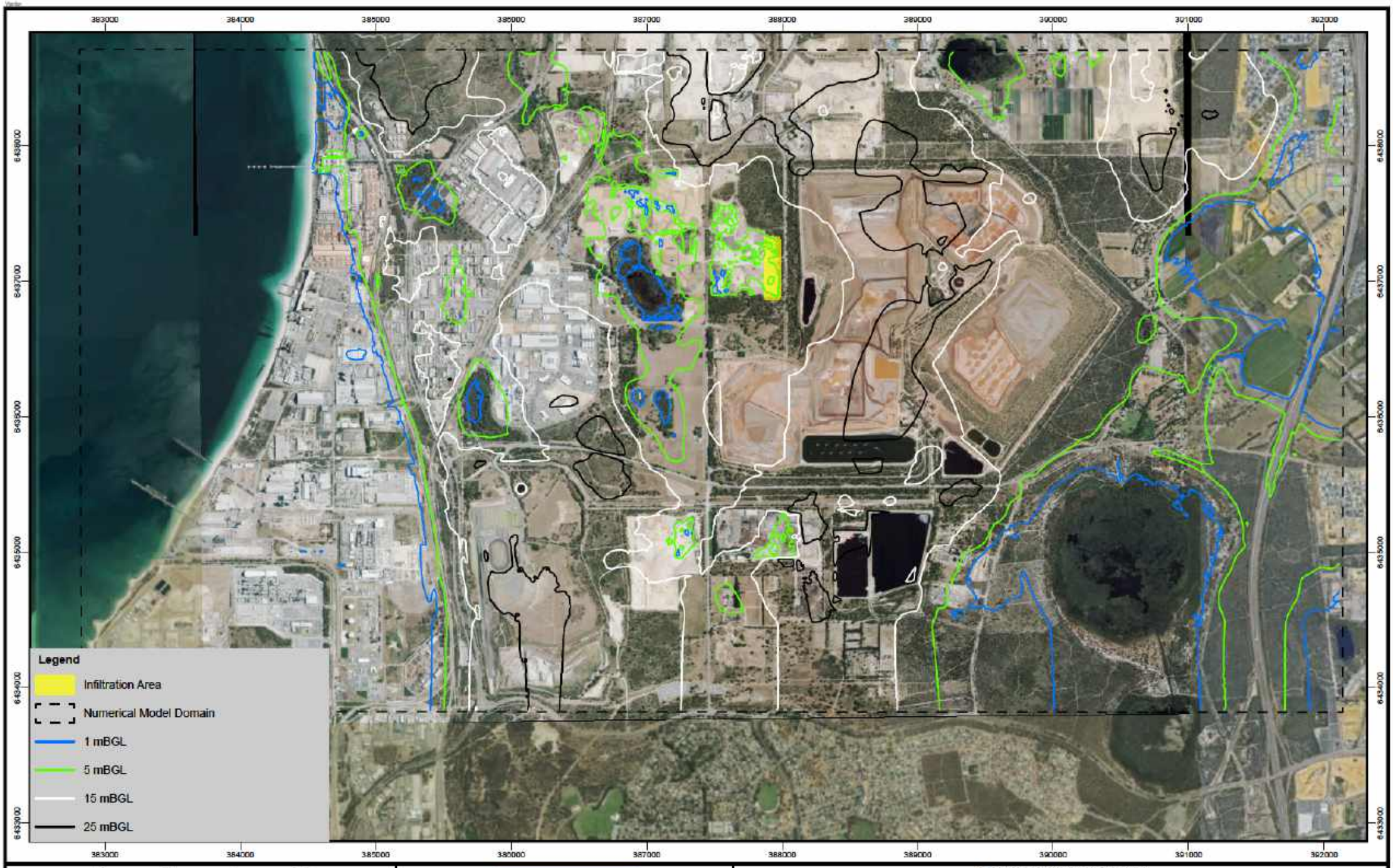
Figure 8-4 Baseline Groundwater Levels (mAHD)

Drawing #: Figure 8-4 Baseline GW mAHD

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

Path: L:\akvis\EApprovals\EA1P0037\Projects\EA1P0037\EA1P0037.aprx



N

0 0.5 1 1.5

km

Scale: 1:35,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-5 Baseline Groundwater Levels (mBGL)

Drawing #: Figure 8-5 Baseline GW mBGL

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

8.4.4 Baseline Groundwater Quality in the Tamala Limestone

EHS defined the background concentrations for 109 analytes in the Tamala Limestone via statistical analysis of the results from four rounds of groundwater sampling (October/November 2024; January/February 2025; April/May 2025; and July/August 2025).

The locations of bores used to determine background water quality are shown on Figure 8-6. Monitoring bores were selected based on location, the absence of contamination sources and, if available, previous sampling results that confirmed groundwater was not impacted by Alcoa's activities. Quantitative outlier assessment resulted in the exclusion of two of ten bores in the Tamala Limestone, which are not shown on Figure 8-6.

EHS defined the upper bound of variation for each analyte by calculating the Upper Prediction Limit (UPL) using statistical methods in US EPA guidance (US EPA 2009). An upper prediction limit is a threshold, calculated from sampling data, that estimates the maximum value expected for future observations within a specified confidence level. Or in other words, a value that answers the question: *Given the data we have, what is the highest value we can reasonably expect in the next sample, with X% confidence?*

Whenever a prediction limit is used in monitoring, the likelihood of a false positive (the UPL being exceeded in the absence of an impact) increases with the number of water samples and analytes being tested. As recommended by the US EPA, EHS calculated UPLs based on a 99% confidence or a 1 in 100 chance of a false positive. Also, in accordance with US EPA recommendations, the MMP (Appendix 2) implements a retesting strategy. Resampling of bores where an exceedance has occurred will either verify the exceedance or disconfirm it thereby avoiding false positives (US EPA 2009, page 18-2).

The UPLs for the Tamala Limestone are referred to as the Background UPL in the CORA and in this document. The Background UPL is the expected maximum concentration of each analyte in the Tamala Limestone and is used to represent background water quality in the CORA.

The Installation of monitoring bores is progressing, and additional water samples are being taken. Prior to commencement of infiltration, UPLs will be reviewed against baseline data and recalculated. These revised UPLs are referred to as Baseline UPLs in the CORA and MMP. Once available the Baseline UPL will replace the Background UPL as a measure of background water quality.

A detailed description of the methods used to calculate UPLs (EHS 2025b) is included as Appendix D of the CORA (Appendix 1). Note that in Appendix D of the CORA, background concentrations were also defined for the Ascot Formation and Bassendean / Gnangara Sand as multiple water projects were under consideration at the time.

The Background UPLs for the analytes in the Primary Water Quality Suite are in Table 8-2.

Table 8-2: Tamala Limestone Background UPLs

Parameter		Units	Background UPL
General Parameters	pH	-	8.1
	TDS	mg/L	1,093
	Alkalinity	mg/L as $CaCO_3$	295
	Hardness	mg/L as $CaCO_3$	1,000
Major Cations	Calcium	mg/L	350
	Magnesium	mg/L	40
	Sodium	mg/L	129
	Potassium	mg/L	10.1
Major Anions	Chloride	mg/L	222
	Fluoride	mg/L	0.41
	Sulphate	mg/L	640
	Nitrate	mg/L	47.4
Metals	Aluminium	mg/L	0.04
	Arsenic	mg/L	0.03
	Boron	mg/L	0.13
	Gallium	mg/L	0.002
	Molybdenum	mg/L	0.007
	Nickel	mg/L	0.002
	Selenium	mg/L	0.004
	Tin	mg/L	0.001
	Vanadium	mg/L	0.009

Source: EHS (2025b, Table 4-1)

Alcoa

Kwinana Infiltration Project

Figure 8-6 Bores Used in Background Dataset

Drawing #: Figure 8-6 Background Bores

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

8.4.5 Potential Impacts

Potential changes to hydrogeology are discussed under the headings below. The effect and significance of these changes vary and depend on the receptors that may be affected. For example, mounding above predicted limits will not impact third-party groundwater abstraction bores; however, may impact wetlands. The effects of groundwater impacts are accordingly discussed for individual receptors in subsequent sections of this document.

8.4.5.1 Dissolution of the Tamala Limestone

Treated water is expected to be very pure and may cause dissolution of carbonate minerals in the aquifer rock matrix. Any dissolution may also result in mobilisation of metals and a decline in groundwater quality. In the long term, dissolution may cause sinkholes and other geotechnical risks.

EHS undertook geochemical modelling of potential dissolution of the Tamala Limestone from infiltration[3], which indicated a potential dissolution rate of ~0.1g/L which is~350 tonnes of limestone per year for a 3.5 GL/year discharge.

EHS noted that the dissolution risk of infiltration into galleries is inherently lower than if reinjection bores were used as treated water discharged into galleries will dissolve limestone constituents in the formerly unsaturated zone of the formation and naturally equilibrate prior to sinking to the significantly more permeable base of the Tamala Limestone. This could be compensated for by the periodic replenishment of crushed limestone at the base of each gallery.

The EHS assessment was informed by leach testing undertaken by the Alcoa Centre of Excellence on 13 drill core samples from Area O using hardened and unhardened permeate (obtained from pilot plant testing for the WTP) as the leaching solution. The results for calcium are in Table 8-3 below. These show that:

- The calcium content of unhardened permeate is low (as expected after RO treatment).
- Hardening with milk of lime increases the starting calcium content to ~30 mg/L.
- Unhardened leachates had increases in calcium content of 100 – 160 mg/L.
- Hardened leachates generally remained close to 30 mg/L showing that hardening suppressed additional leaching of calcium.

Table 8-3: Effect of Hardening on Calcium Dissolution

Sample	Leach Test Results (mg/L Ca)		Calcium Dissolution (mg/L Ca)[2]		
	Unhardened Permeate (L1)	Hardened Permeate (L2)	L1 - Blank	L2 - Blank	Net Decrease[3]
BH-01-0120	146	38	146	8	-138
BH-01-0710	158	34	158	4	-154
BH-01-1180	135	29	135	-1	-135
BH-01-2190	131	31	130	1	-130
BH-01-2880	133	31	133	1	-132
BH-01-2970	105	29	105	-1	-106

[3] See Section 5.3 of the CORA (Appendix 1) for an overview of geochemical modelling. The detailed assessment is provided as Appendix F of the CORA.

Sample	Leach Test Results (mg/L Ca)		Calcium Dissolution (mg/L Ca)[2]		
	Unhardened Permeate (L1)	Hardened Permeate (L2)	L1 - Blank	L2 - Blank	Net Decrease[3]
BH-01-3330	140	34	140	4	-137
BH-01-4050	123	34	122	4	-119
BH-02-0970	141	34	140	4	-136
BH-02-1240	17	30	16	0	-17
BH-02-1290	15	30	15	0	-15
BH-02-2460	124	29	124	-1	-124
BH-02-2900	56	60	56	30	-26
Blanks[1]	**0**	**30**	-	-	-

[1] Blanks are the unhardened and hardened permeate used as the leaching solution.

[2] Calcium dissolution from rock sample calculated by subtracting [Ca] in the leaching solution from [Ca] the leachate.

[3] The reduction in Ca dissolution due to hardening of the permeate.

In order to prevent dissolution, the Project includes a mineralisation system, where treated water will be hardened prior to discharge. The precise dose rate to be prevent dissolution will be calculated from the results of commissioning testing of the permeate (See Section 9.1.1)

As water will be mineralised prior to discharge, the risk of dissolution of the Tamala Limestone is low. Alcoa may also periodically place crushed limestone into the base of galleries as part of general maintenance activities. While not intended as the primary dissolution control, this will further mitigate dissolution risk.

8.4.5.2 Calcification and Clogging of the Tamala Limestone

Mineralisation of treated water may cause calcification and clogging of the aquifer if the dose rate is too high and water becomes saturated with calcium. If calcification occurs, aquifer permeability will be reduced, decreasing the efficiency of infiltration and causing mounding above predicted limits.

Calcification will be prevented by ensuring that that treated water is not overdosed with calcium in the mineralisation plant. The optimum dose rate to suppress dissolution, while avoiding calcification will be calculated from commissioning test results on treated water prior to infiltration. Once calculated, continuous monitoring of the pH and EC of treated and mineralised water will indicate whether water may be saturated with calcium. If these indicate calcium saturation, the dose rate in the mineralisation plant can be adjusted.

As the mineralisation dose rate will be calculated and set below calcium saturation; and calcium saturation can be inferred and rectified from continuous pH and EC monitoring of the discharge, the risk of calcification is considered low.

8.4.5.3 Groundwater Mounding

Predicted groundwater mounding caused by infiltration is shown on Figure 8-8. Due to the high permeability of the Tamala Limestone, the degree of mounding caused by infiltration is small (0.3 m after ~800 m) and less than natural seasonal variation (0.5m to 1.0m) within a short distance from the Infiltration Area.

The groundwater mound will develop at the same rate as the particle tracking (see below). Modelling indicates it will take ~1 year for the groundwater mound to reach the western edge of Area O; ~2 years to reach Long Swamp; and ~9 years to reach the refinery. The monitoring program for the Project (see Section 9.2) has been designed to detect and address mounding above predicted limits prior to receptors.

Downgradient of the infiltration Area, mounding will cause an increase in flux. Upgradient, mounding will decrease the hydraulic gradient and flux, but (apart from in the immediate vicinity of the Infiltration Area) will not reverse it.

Due to the small increase in groundwater levels from infiltration, the change in depth to water is also small. This is shown on Figure 8-8.

8.4.5.4 Infiltration Flow Paths

Particle tracking by EHS predicts that infiltrated water will flow west-northwest towards the refinery and Cockburn Sound (Figure 8-7). In this document and in the CORA the area where infiltrated water is expected to travel is termed the Water Quality Impact Zone (WQIZ). For simplicity, the WQIZ is shown as a single area, rather than as individual particle tracks on other figures.

Infiltrated water is expected to take ~1 year to reach the western edge of Area O; ~2 years to reach Long Swamp; and ~9 years to reach the refinery. In addition to measures to ensure that infiltrated water meets quality criteria, the monitoring program for the Project (see Section 9) includes analysis of water quality inside Area O, so that attenuation rates can be confirmed or actions taken prior to water reaching receptors.

N

0 1

km

Scale: 1:30,000

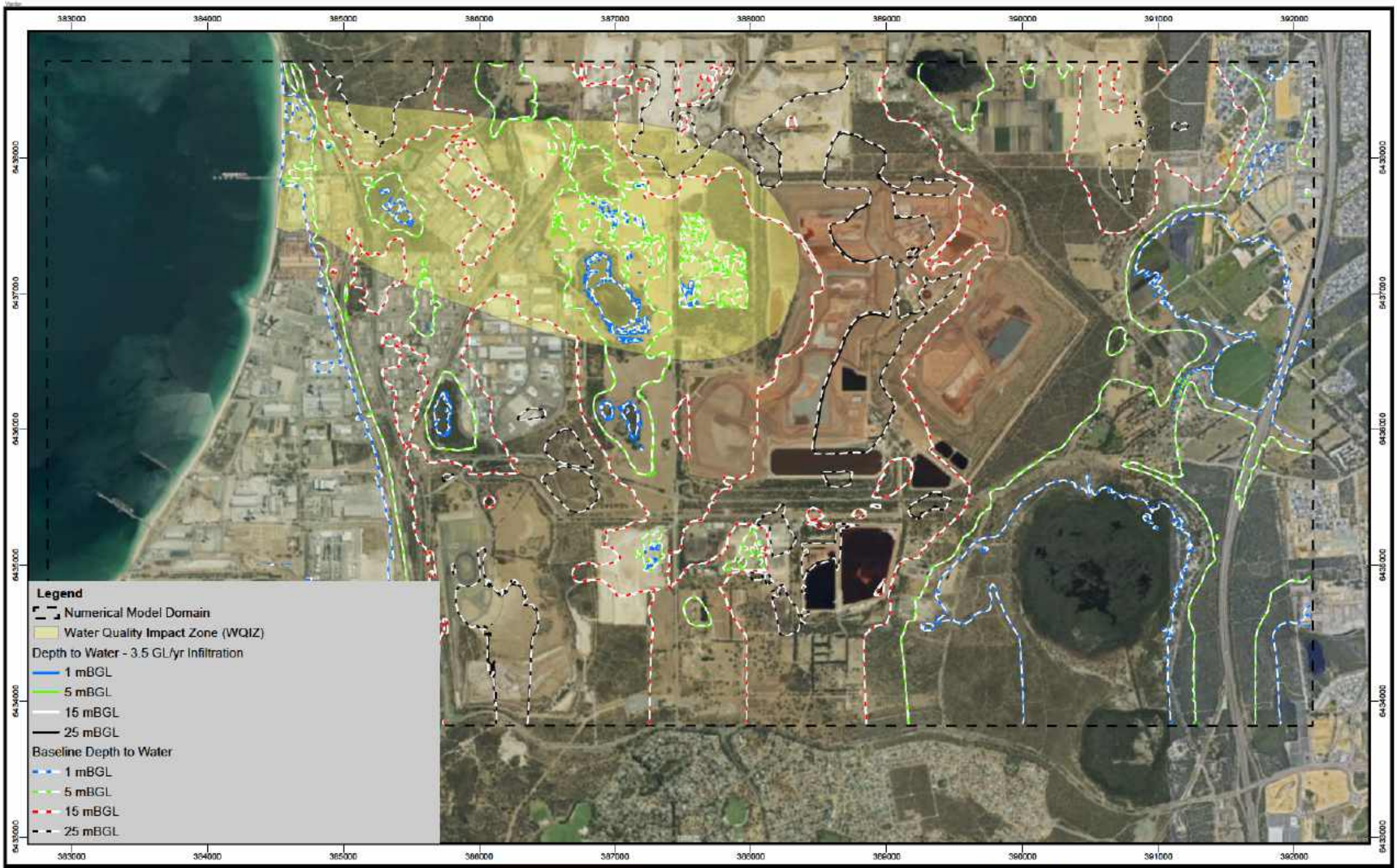
GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-7 Groundwater Impacts - 3.5 GL Per Year Infiltration

Drawing #: Figure 8-7 Groundwater Impact			Author: smita	
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026	



N

0 1

km

Scale: 1:35,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-8 Change in Depth to Water - 3.5 GL Per Year Infiltration

Drawing #: Figure 8-8 Change in Depth to

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

Path: L:\data\EApprovals\EA1P0037\Projects\EA1P0037EA1P0037.aprx

8.4.5.5 Water Quality Impacts

In the CORA, EHS assessed potential water quality impacts by comparing the anticipated quality of treated water (See Section 6.3) to Background UPLs and relevant guideline values for down-gradient receptors (referred to collectively as Tier 1 screening criteria). If the concentration is below Tier 1 criteria or below the Background UPL then the environmental risk is low.

Tier 1 screening criteria are:

- Non-Potable Use Guidelines (DoH 2014) (NPUG) – relevant to current and future industrial uses of groundwater in Kwinana.
- Guidelines for short-term irrigation (ANZEEC & ARMCANZ 2000b) – relevant to market gardens, which are not present down-gradient of the Infiltration Area.
- Australian and New Zealand Guidelines (ANZG 2018) for the protection of 95% of species in freshwater (95% ANZGs) – relevant for slightly to moderately disturbed ecosystems and used to assess potential impacts to Long Swamp.
- Moderate Ecological Protection Criteria for Cockburn Sound (EHS 2025c) – specific criteria developed to protect Cockburn Sound.

Although not used as screening criteria, the Australian Drinking Water Guidelines (AWDGs) (NHMRC & NRMMC 2011) are also provided for context.

Table 8-4 compares infiltrated water to Background UPLs and Tier 1 screening criteria. This shows that infiltrated water:

- meets NPUG criteria.
- Is equal to or exceeds the Background UPL for 10 analytes. Of these ten:
    - Boron, fluoride, gallium, nickel, sodium and tin are within all Tier 1 screening criteria and are not considered further.
    - Aluminium and Selenium are at or above guideline values for Cockburn Sound.
    - Aluminium, Molybdenum and Vanadium exceed 95% ANZGs.

Table 8-4: Infiltration Water Quality

Parameter	Units	Maximum Concentration in Treated Water	Background UPL[1]	Tier 1 Screening Criteria				Drinking Water[6]
				Non-Potable Water[2]	Short-term Irrigation[3]	95% ANZG[4]	Cockburn Sound[5]	
Aluminium	mg/L	0.15	**0.04**	0.2	20	**0.055**	**0.086**	0.2
Arsenic	mg/L	0.01	0.03	0.1	2	0.013	0.017	0.01
Boron	mg/L	0.9	**0.13**	40	-	0.94	5.1	4
Calcium	mg/L	50	350	-	-	-	-	-
Chloride	mg/L	17.5	222	250	-	-	-	250
Fluoride	mg/L	0.5	**0.41**	15	2	1.7	-	1.5
Gallium	mg/L	0.005	**0.002**	-	-	-	1.1	-
Magnesium	mg/L	5	40	-	-	-	-	-
Molybdenum	mg/L	0.09	**0.007**	0.5	**0.05**	**0.034**	6.2	**0.05**
Nickel	mg/L	0.002	0.002	0.2	2	0.011	0.2	0.02
Nitrate	mg/L	2	47.4	500	-	29	121.6	-
Potassium	mg/L	1.2	10.1	-	-	-	-	-
Selenium	mg/L	0.01	**0.004**	0.1	0.05	0.011	0.01	**0.004**
Sodium	mg/L	150	**129**	-	-	-	-	180
Sulfate	mg/L	50	640	1000	-	-	-	250
TDS	mg/L	600	1,093	-	-	-	-	600
Tin	mg/L	0.002	**0.001**	-	-	-	-	-
Vanadium	mg/L	0.01	**0.009**	-	0.5	**0.006**	0.16	-

Concentration in permeate is equal to guideline value

Concentration in permeate exceeds guideline value

[1] Upper Prediction Limit (UPL) for groundwater in the Tamala Limestone (EHS 2025b).

[2] Non-potable use guidelines (DoH 2014).

[3] Guidelines for short term irrigation water (ANZEEC & ARMCANZ 2000b).

[4] Guidelines for the protection of 95% of species in moderately disturbed freshwater ecosystems (ANZG 2018).

[5] Moderate Ecological Protection Criteria for Cockburn Sound (EHS 2025c).

[6] Australian Guidelines for Drinking Water Quality (NHMRC & NRMMC 2011). * denotes aesthetic guideline values; otherwise health guideline values are provided.

As substances move through soil and groundwater, physical, chemical, and biological processes can cause concentrations of dissolved constituents to attenuate, for example by mixing and dilution; oxidation and degradation; precipitation; or adsorption.

As infiltrated water meets NPUG guidelines, attenuation is not required to protect third-party groundwater use. The nearest receptor where attenuation is required, is Long Swamp ~750m downgradient, where the more stringent 95% ANZGs apply.

EHS used the BIOSCREEN modelling tool to calculate a Dilution Attenuation Factor (DAF)[4] after 750 m. Dilution and mixing was the only attenuation process considered in the BIOSCREEN model and all other attenuating chemical and biological processes were assumed not to occur. A DAF of 2.78 is expected within 750 m. Additional attenuation would occur for other receptors that are further away.

Table 8-5 compares expected water quality after 750 m to the Background UPL and Tier 1 screening criteria. Expected water quality in this table has been calculated by dividing the Maximum Concentration in Treated Water in Table 8-4 by the DAF of 2.78. This shows that all analytes:

- Are within the Background UPL except Aluminium, Boron and Molybdenum.
- Are within all Tier 1 Screening criteria.

As treated water meets NPUG criteria when discharged and is within the Background UPL or all Tier 1 criteria after 750 m (the nearest receptor where attenuation is required), water quality impacts to receptors are unlikely. In addition, the monitoring program in Section 9:

- includes measures to ensure treated water meets the required quality criteria.
- Applies the same quality criteria required to protect Long Swamp to the R3 Delineation Bores which are ~450 m from the Infiltration Area. This will allow attenuation rates to be confirmed, or trigger additional measures to protect water quality prior to water reaching receptors.

[4] See Section 6.1.3.1 of the CORA for a description of the DAF calculation and BIOSCREEN modelling.

Alcoa

Table 8-5: Expected Water Quality after 750 m (DAF of 2.78)

Parameter	Units	Expected Water Quality[1]	Background UPL[2]	Tier 1 Screening Criteria				Drinking Water[7]
				Non-Potable Water[3]	Short-term Irrigation[4]	95% ANZG[5]	Cockburn Sound[6]	
Aluminium	mg/L	0.054	**0.04**	0.2	20	0.055	0.086	0.2
Arsenic	mg/L	0.004	0.03	0.1	2	0.013	0.017	0.01
Boron	mg/L	0.324	**0.13**	40	-	0.94	5.1	4
Calcium	mg/L	18.0	350	-	-	-	-	-
Chloride	mg/L	6.3	222	250	-	-	-	250
Fluoride	mg/L	0.180	0.41	15	2	1.7	-	1.5
Gallium	mg/L	0.002	0.002	-	-	-	1.1	-
Magnesium	mg/L	1.8	40	-	-	-	-	-
Molybdenum	mg/L	0.032	**0.007**	0.5	0.05	0.034	6.2	0.05
Nickel	mg/L	0.001	0.002	0.2	2	0.011	0.2	0.02
Nitrate	mg/L	0.719	47.4	500	-	29	121.6	-
Potassium	mg/L	0.432	10.1	-	-	-	-	-
Selenium	mg/L	0.004	0.004	0.1	0.05	0.011	0.01	0.004
Sodium	mg/L	54.0	129	-	-	-	-	180
Sulfate	mg/L	18.0	640	1000	-	-	-	250
TDS	mg/L	215.8	1093	-	-	-	-	600
Tin	mg/L	0.001	0.001	-	-	-	-	-
Vanadium	mg/L	0.004	0.009	-	0.5	0.006	0.16	-
	Concentration exceeds guideline value after attenuation							

[1] Concentration expected after 750 m. Calculated by dividing the permeate quality by the DAF of 2.78.

[2] Upper Prediction Limit (UPL) for groundwater in the Tamala Limestone (EHS 2025b).

[3] Non-potable use guidelines (DoH 2014).

[4] Guidelines for short term irrigation water (ANZEEC & ARMCANZ 2000b).

[5] Guidelines for the protection of 95% of species in moderately disturbed freshwater ecosystems (ANZG 2018).

[6] Moderate Ecological Protection Criteria for Cockburn Sound (EHS 2025c).

[7] Australian Guidelines for Drinking Water Quality (NHMRC & NRMMC 2011). *denotes aesthetic guideline values; otherwise health guideline values are provided.

8.4.5.6 Changes in Flux

EHS modelled the following fluxes to inform environmental impact assessment:

A. Hydraulic flux under or around Long Swamp in the Tamala Limestone.
B. Hydraulic flux through the Long Swamp Sediments.
C. Loss of water via evapotranspiration from Long Swamp.
D. Hydraulic flux under the refinery from the Tamala Limestone into the Safety Bay Sands where the mapped alkaline plume is located.
E. Residual Baseflow to Long Swamp (difference between baseflow input and evapotranspiration).

Modelled changes in flux at various infiltration rates are provided in Table 8-6 with the desired maximum infiltration rate of 3.5 GL/year highlighted light blue. An illustration of modelled fluxes is in Figure 8-9.

An increase in flux may impact the water balance and water quality of wetlands and mobilise existing down-gradient land and groundwater contamination. The flux changes modelled are minor and these impacts are not anticipated to be significant; however potential flux impacts are considered on a receptor-specific basis in the CORA and in this document. Flux and other impacts to wetlands are presented in Section 8.8 and impacts to/from contaminated land in Section 8.9.

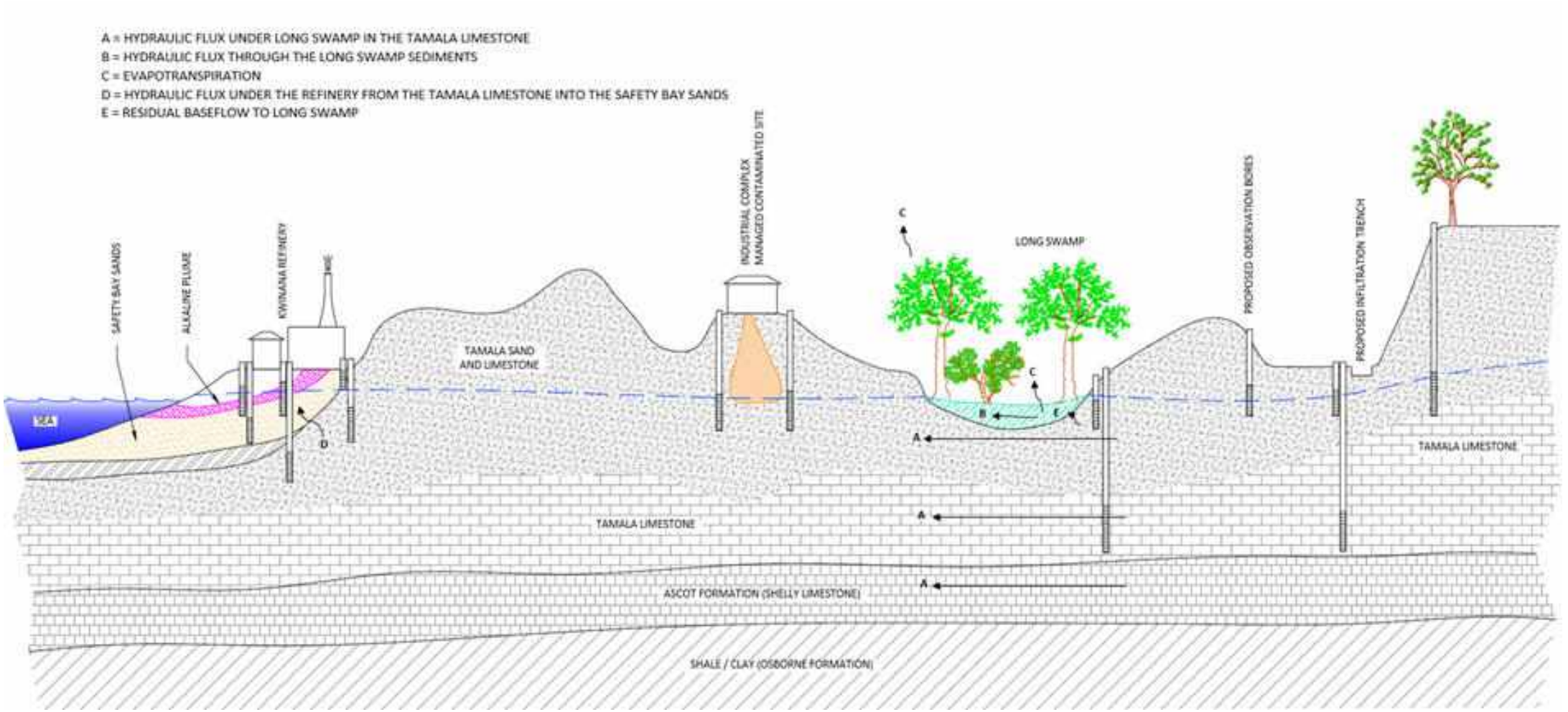
Alcoa

Table 8-6: Groundwater Flux at Various Infiltration Rates

Infiltration Rate		Flux Under or Around Long Swamp in the TL	Flux Through Long Swamp Sediments	Flux leaving Long Swamp as ET	Residual Baseflow to Long Swamp	Flux from TL to the SBS and Refinery Plume Area	Flux Beneath the SBS in the TL Towards CS
(GL/yr)	(kL/day)	(kL/day)	(kL/day)	(kL/day)	(kL/day)	(kL/day)	(kL/day)
Baseline	**0.0**	**-**	**380.3**	**380.4**	**-0.1**	**20.6**	**16,404.0**
0.5	1,369.9	+981.8	+7.8	+7.7	+0.1	+0.8	+705.7
1.0	2,739.7	+2,343.5	+15.9	+15.7	+0.2	+1.6	+1,441.1
1.5	4,109.6	+3,705.3	+24.1	+23.7	+0.3	+2.4	+2,172.8
2.0	5,479.5	+5,067.1	+32.1	+31.6	+0.5	+3.2	+2,899.4
2.5	6,849.3	+6,428.8	+40.3	+39.7	+0.6	+4.0	+3,636.9
3.0	8,219.2	+7,790.5	+48.4	+47.6	+0.8	+4.8	+4,368.4
3.5	**9,589.0**	**+9,152.2**	**+56.5**	**+55.6**	**+0.9**	**+5.6**	**+5,095.2**
4.0	10,958.9	+10,514.0	+64.7	+63.5	+1.1	+6.4	+5,824.0

TL = Tamala Limestone; SBS = Safety Bay Sands; CS – Cockburn Sound; ET = evapotranspiration

Source: Table 6-4 of CORA (Appendix 1)



Source: Figure 4-1 of EHS (2025a)

Drawing #: Figure 8-9 Illustration of Modelled

Date: 24/03/2026 | Rev: A | A4

Author: smita

Date Printed: 24/03/2026

Kwinana Infiltration Project

Figure 8-9 Illustration of Modelled Flow Dynamics

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

8.5 Public Drinking Water Source Areas

Public Drinking Water Source Areas (PDWSAs) are shown in Figure 8-10. None of the Alcoa Kwinana landholdings are in or up-gradient of a PDWSA. The closest PDWSA is the Jandakot Underground Water Pollution Control Area which is ~5 km east and upgradient of the Infiltration Area. Infiltrated water will flow away from the PDWSA towards the coast. Impacts are not anticipated as there is no plausible impact pathway (See Table 3-14 of the CORA in Appendix 1).

8.6 Beneficial Use of Groundwater

The proposed infiltration galleries are in the Valley sub-area of the Cockburn Groundwater Area (DWER 2021). As there is a municipal supply, groundwater abstraction in the Kwinana Industrial Area is unlikely to be for potable or recreational use and is likely to be for industrial or irrigation purposes. Review of recent aerial imagery indicates there are no market gardens down-gradient of the Infiltration Area.

Review of the Water Register shows there are adjacent and down-gradient groundwater licences over industrial premises, which are shown in Figure 8-11. Licences inside the WQIZ have the potential to receive infiltrated water and are listed in Table 8-7. In future, DWER may also grant licences in other areas downgradient of the Infiltration Area and potential impacts to beneficial use are not limited to present day- groundwater licences.

Outside of the WQIZ, the small quantum of mounding is not expected to impact groundwater users. Mounding may result in an increase in abstraction bore yield, but this is not likely to be noticed.

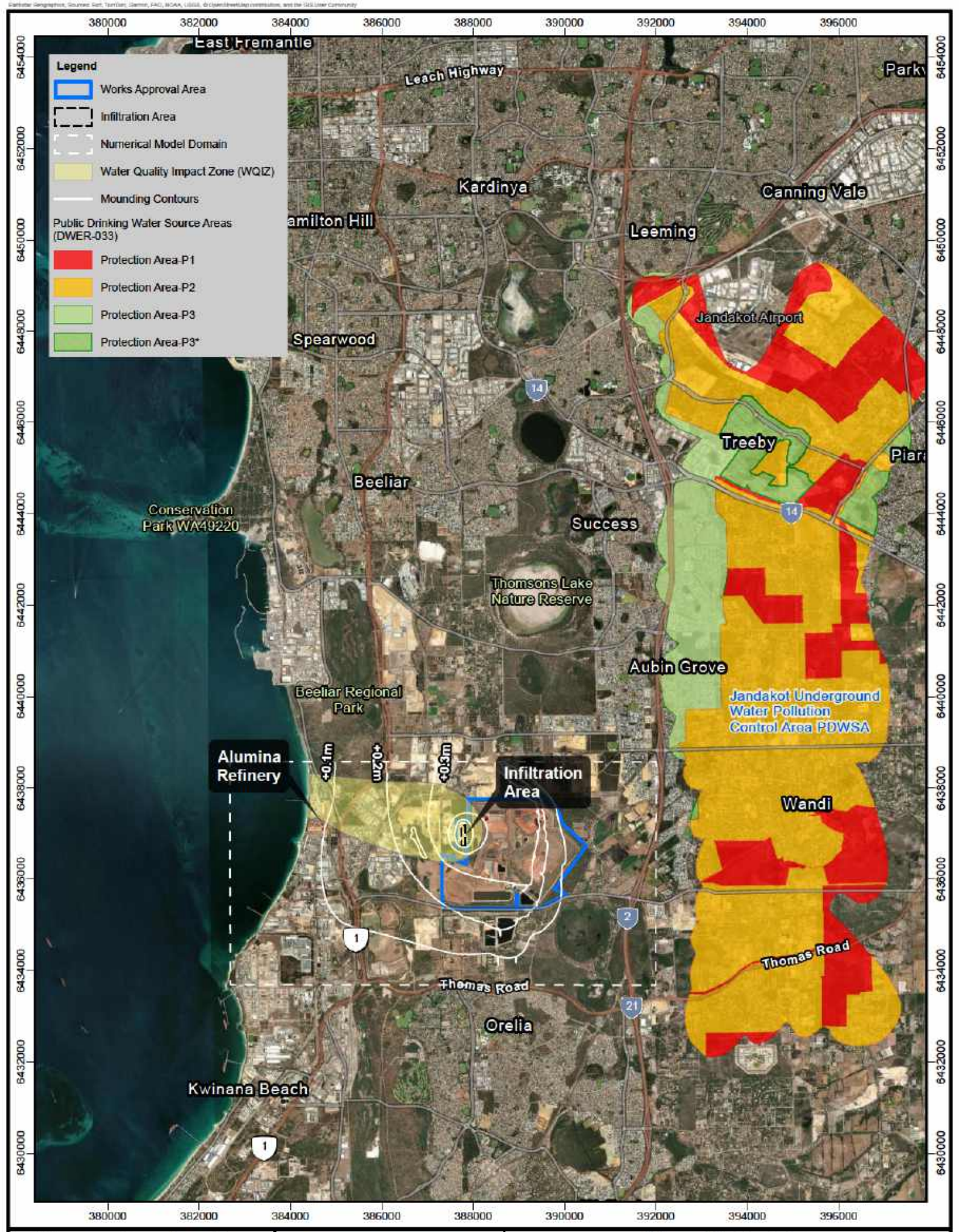
As infiltrated water meets non-potable use guidelines (See Section 8.4.5.5) and meets the Australian Drinking Water Guidelines for all analytes in the primary water quality suite except Molybdenum and Selenium, current and future industrial groundwater use is not expected to be impacted.

In addition to monitoring the quality of infiltrated water, a network of environmental monitoring bores is proposed that considers beneficial groundwater use. This is described in Section 9.

Table 8-7: Downgradient Groundwater Licences

GWL	Allocation (kL)
50465	97,000
54280	15,000
78116	600,000
212353	200,000
176089	5000
51052	23,000
Total	**940,000**

Alcoa sent a letter to each licence holder in Table 8-7. A copy of this letter is included as Appendix 5. No responses were received.



N

0 1 2

km

Scale: 1:100,000

AGD 1984 AMG Zone 50

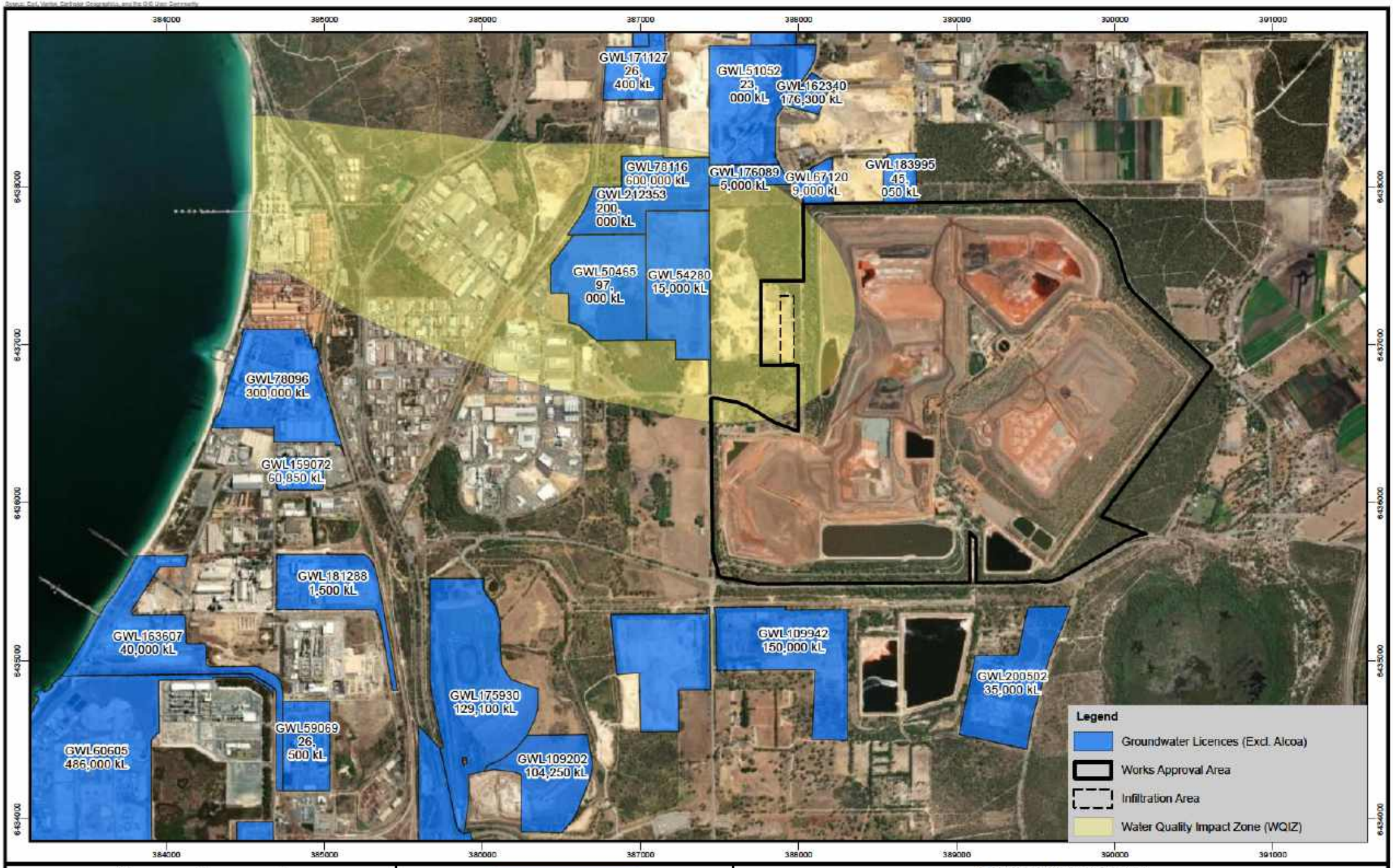
Alcoa

Kwinana Infiltration Project

Figure 8-10 PDWSAs

Drawing #: Figure 8-10 PDWSAs			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx



N

0 0.5 1

km

Scale: 1:30,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-11 Groundwater Licences

Drawing #: Figure 8-11 GWLs

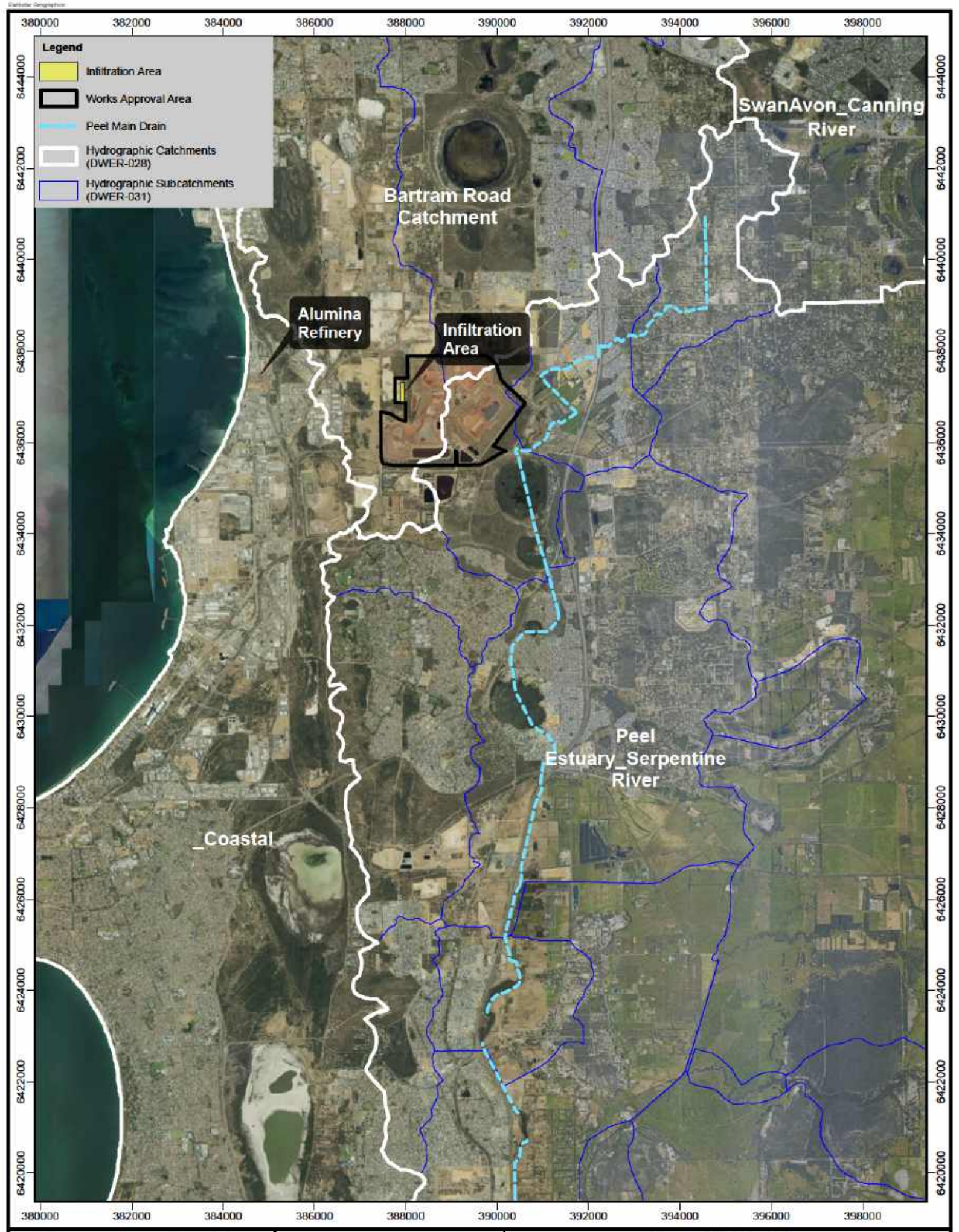
Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

8.7 Hydrology

DWER catchment mapping is shown on Figure 8-12. The Works Approval Area is in the Bartram Road and Peel Estuary-Serpentine River catchments of the Murray River Basin. The Infiltration Area is in the Bartram Road catchment, down gradient of the Peel Estuary-Serpentine River Catchment.

Hydrology impacts were not considered in the CORA as there are no defined rivers or creeks between the infiltration galleries and Cockburn Sound. The infiltration gallery is at the base of an excavated quarry, below the natural ground level and the pipeline will be constructed in previously disturbed areas. No watercourses or wetlands will be directly impacted and significant impacts to hydrology are not anticipated.



N

0 1 2

km

Scale: 1:100,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-12 Catchments

Drawing #: Figure 8-12 Catchments			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

8.8 Wetlands

Wetlands in Western Australia are classified according to landform and water longevity as described in Table 8-8 and illustrated in Figure 8-13. Definitions of assigned management categories are in Table 8-9.

Table 8-8: Wetland Types

Water Longevity	Landform				
	Basin	Flat	Channel	Slope	Highland
Permanently inundated	Lake	-	River	-	-
Seasonally inundated	Sumpland	Floodplain	Creek	-	-
Intermittent inundation	Playa	Barlkarra	Wadi	-	-
Seasonally waterlogged	Dampland	Palusplain	Trough	Paluslope	Palusmont

Source: (Hill, et al. 1996, page 37)

Table 8-9: Management Categories and Objectives

Management Category	Definition	Category Objective
Conservation	Wetlands with high conservation value for both natural or human use.	To preserve wetland (natural) attributes and functions.
Resource Enhancement	Wetlands with moderate natural and human use attributes that can be restored or enhanced.	To restore wetlands through maintenance and enhancement of wetland functions and attributes.
Multiple Use	Wetlands that score poorly on both natural and human use attributes.	To use, develop, and manage wetlands in the context of water, town, and environmental planning.

Source: (EPA 2008)

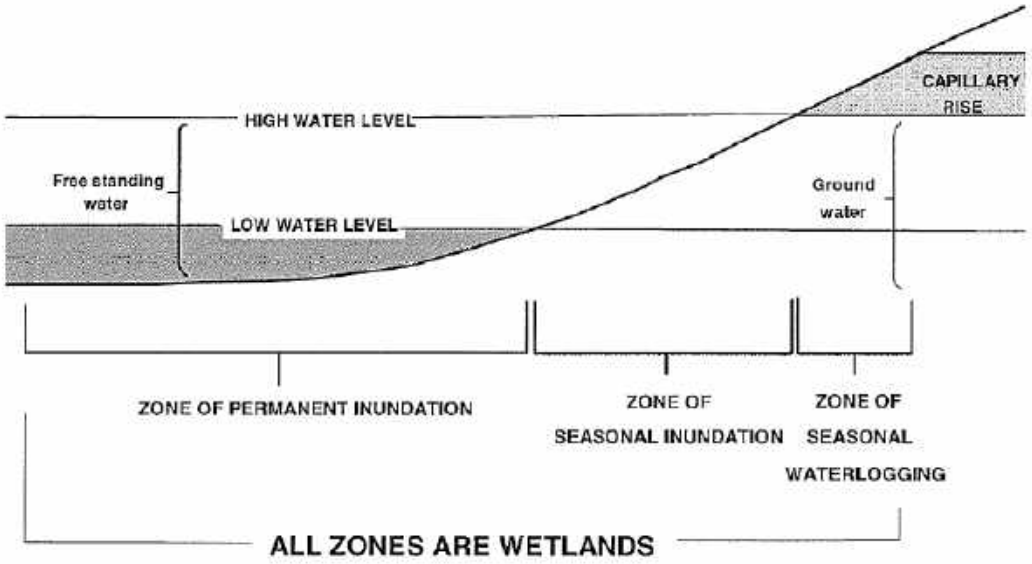
Wetlands near the Prescribed Premises are shown in Figure 8-14. All the wetlands near the Prescribed Premises are either lakes, sumplands or damplands. Impact pathways to wetlands were considered in Table 3-14 of the CORA which identified down-gradient wetlands where a plausible impact pathway exists:

- Long Swamp, a Conservation Category sumpland.
- Hendy Road Swamp West, a Multiple Use dampland.
- Hendy Road Swamp East, a Resource Enhancement dampland.
- Unnamed 1, a Resource Enhancement sumpland.
- Conway Road Swamp, a Resource Enhancement dampland.

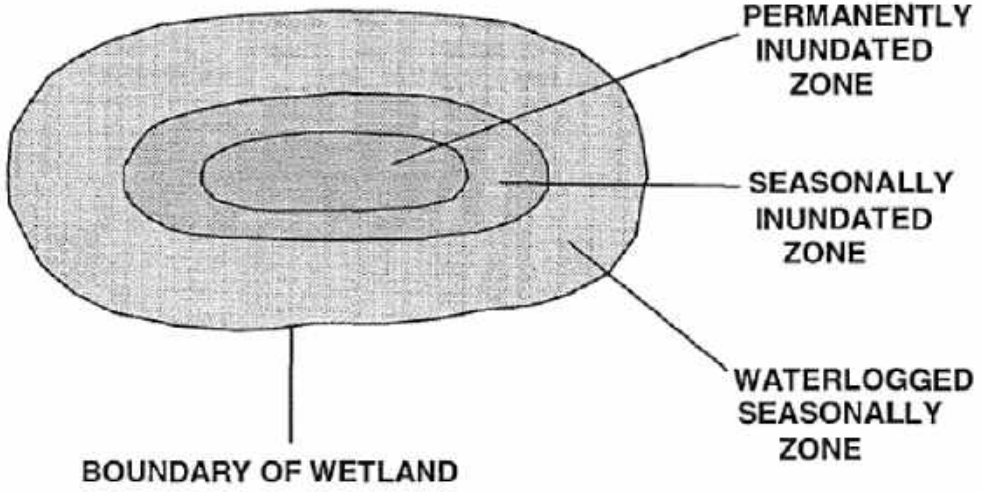
Down-gradient wetlands are shown in Figure 8-15 and impacts to each of these are discussed under the subheadings below. There are no wetlands in the Works Approval Area and no direct disturbance is proposed. Indirect impacts from infiltration considered in the CORA are:

- Mounding and surface expression of groundwater causing a decline in vegetation health or vegetation death via waterlogging and/or salinisation
- A decline in groundwater quality, which may impact freshwater ecology if infiltrated water expresses into a lake or sumpland and/or impact wetland vegetation if poor quality water reaches the root zone.

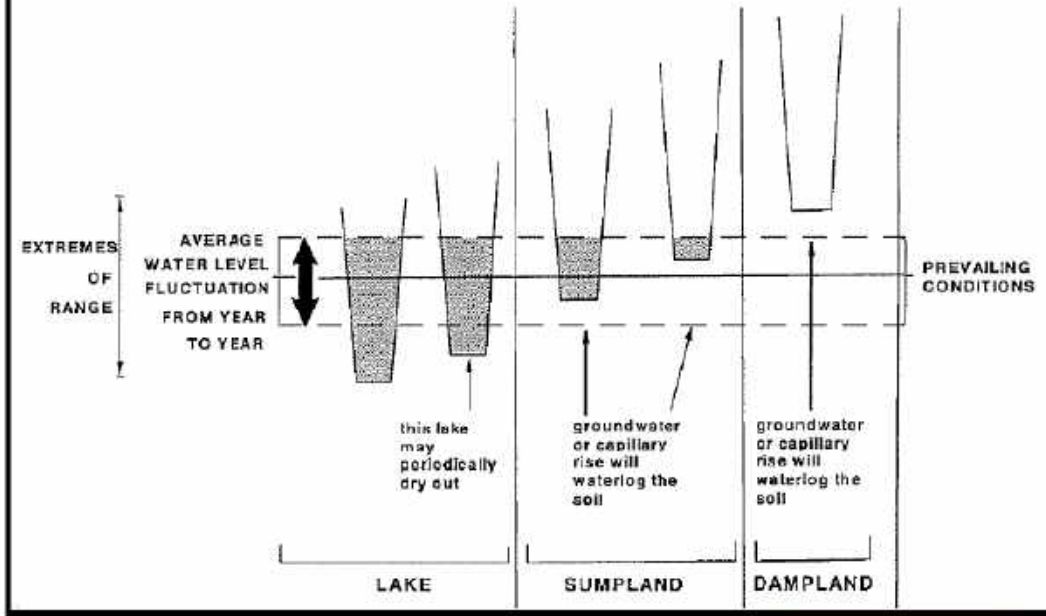
Zones of a Wetland (Cross Section):



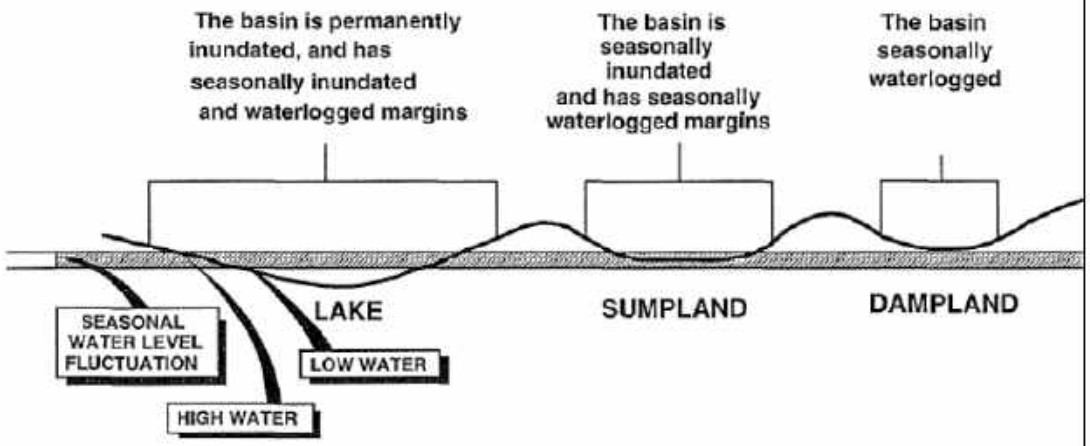
Zones of a Wetland:



Average and Extreme Variation:



Wetland Types:



Source: Figures 2.2; 2.3 and 2.5 of Hill *et al.* (1996)

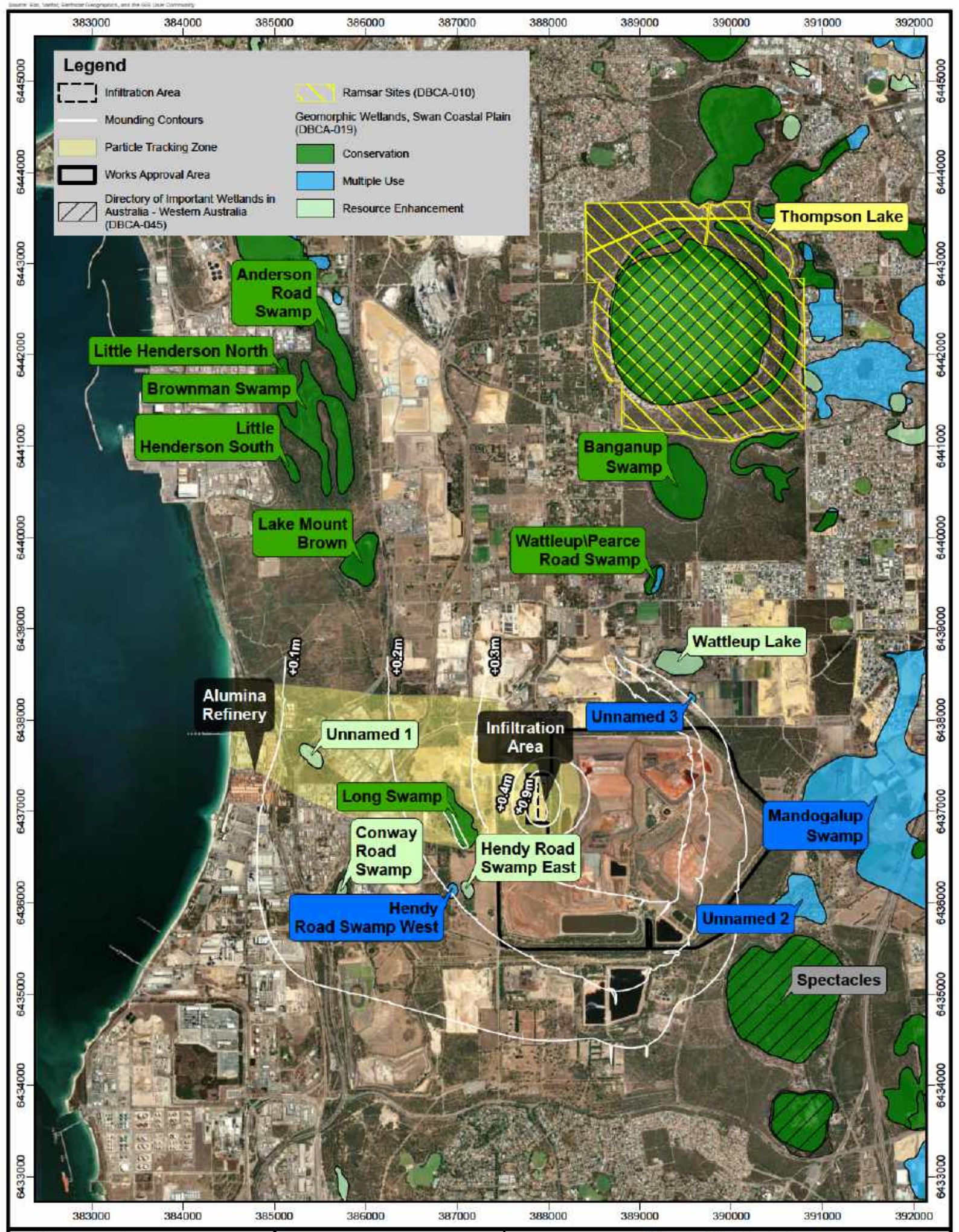
Alcoa

Kwinana Infiltration Project

Figure 8-13 - Wetland Classification

Drawing #: Figure 8-13 - Wetland Classification			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\assets\Approved\EA\P0037\Projects\EA1P0037EA1P0587.aprx



N

0 1

km

Scale: 1:50,000

GDA2020 MGA Zone 50

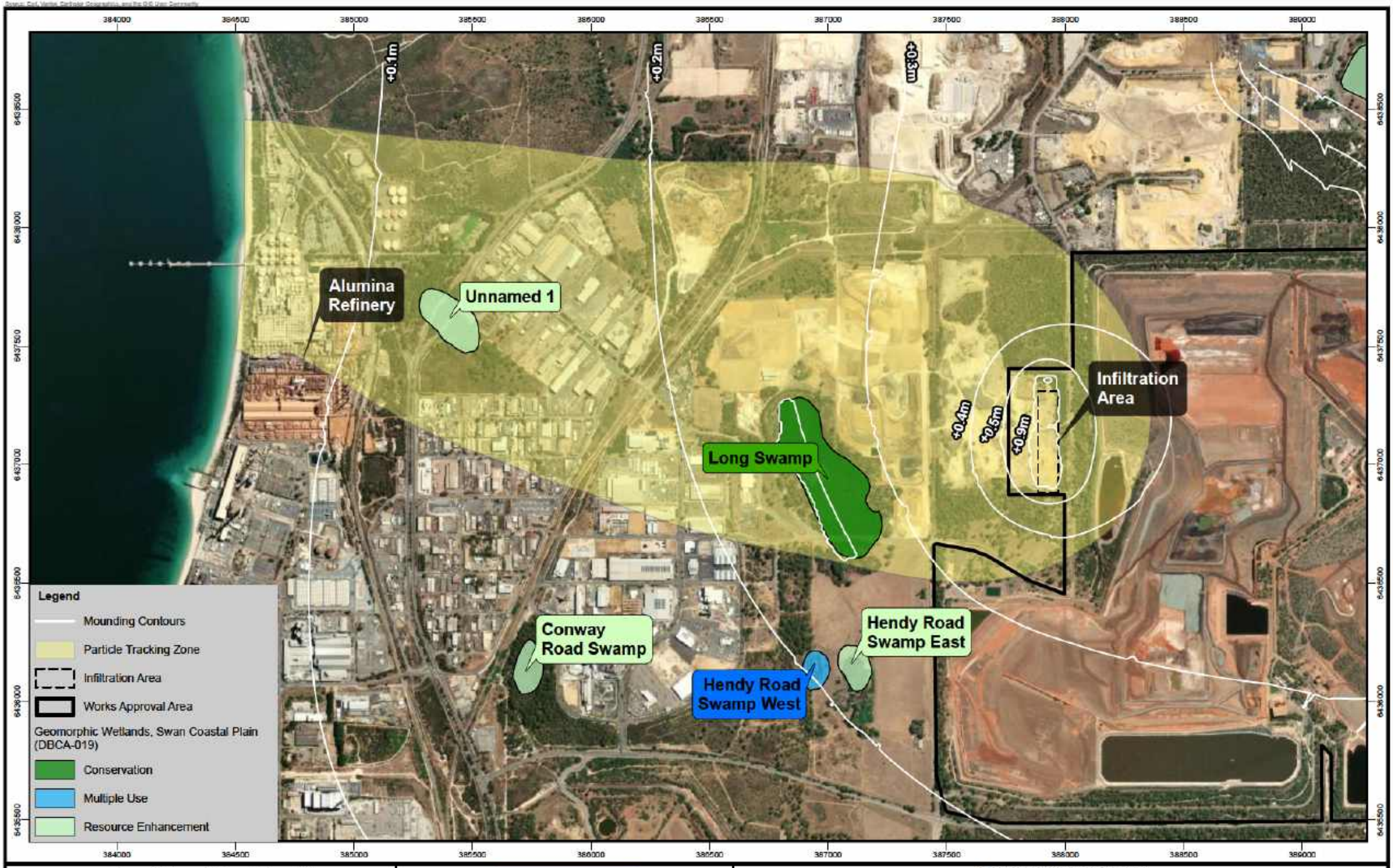
Alcoa

Kwinana Infiltration Project

Figure 8-14 Wetlands

Drawing #: Figure 8-14 Wetlands			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx



N

0 200 400 600 800

m

Scale: 1:20,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-15 Downgradient Wetlands

Drawing #: Figure 8-15 Downgradient			Author: smita	
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026	

8.8.1 Long Swamp

Long Swamp is a conservation category sumpland located at the junction of Hope Valley Road and McLaren Avenue ~750 m down-gradient of the Infiltration Area. The wetland is currently not accessible to the public and is on private land; land held by the WA Planning Commission; Development WA; and private landowners. The wetland area of Long Swamp in the geomorphic wetlands database (DBCA-019) is ~14.66 ha.

Due to the conservation status of the wetland and its proximity to the infiltration area, Long Swamp was one of the key receptors considered in the CORA (Appendix 1) and MMP (Appendix 2). The CORA includes a conceptual hydrogeological model for Long Swamp that, in addition to groundwater modelling, was supported by:

- Lidar data.
- Analysis of historical aerial imagery.
- Soil and water sampling.
- A Flora and Vegetation Assessment by MBS Environmental (MBS 2026a).

The hydrogeological conceptualisation of Long Swamp is detailed in Section 5.6 of the CORA (Appendix 1) and numerical model predictions relevant to Long Swamp in Section 5.7.3.1 of the CORA.

The CORA assessed the potential risk of mounding to wetland and upland vegetation. Separately to the CORA, Alcoa commissioned MBS Environmental to assess the risk of groundwater mounding to each vegetation type (MBS 2026b). This memo complements the findings of the CORA and is attached as Appendix 4.

Minimisation of impacts to Long Swamp was the driving factor for the selection of Area O rather than Area N (Location 2 in Figure 7-1) as the site for the infiltration galleries.

8.8.1.1 Flora and Vegetation

MBS Environmental (MBS) undertook a reconnaissance flora and vegetation survey of Long Swamp on 19 September 2025. The survey report (MBS 2026a) is attached as Appendix 3. Unless otherwise referenced, the text is this section is from this report.

The area around Long Swamp was settled in the 1880s with extensive clearing of the fertile and moist soils around the wetland for horticulture. This included modification of the landform to construct irrigation channels into adjacent land. Market gardens and other rural land uses, including grazing continued for over 100 years and extractive operations on surrounding land started in the 1970s. Rubbish dumping is a long-standing issue and soil, garden and construction wastes were noted in the survey. Under the latest structure plan, the surrounds of Long Swamp will become an industrial area, and the wetland is earmarked for protection in a reserve.

The following were recorded in the survey:

- 93 flora species, 65% of which were weeds. This includes six declared weeds one of which (Bridal Creeper) is a weed of national significance. Arum Lily and Bridal Creeper were common and had nearly 100% cover in places.
- Other recorded weeds included several species that have a high ecological impact and/or rapid rate of spread.
- Total weed cover ranged from under 5% in MrGt vegetation to nearly 100% in cleared and previously disturbed areas.
- No threatened or priority species were recorded and none are considered likely to occur.

- 11 species, including one threatened species possibly occur. None of the species rated as possible to occur are deep rooted species that are potentially sensitive to groundwater mounding (MBS 2026a, page 23).
- Five wetland vegetation units, four dryland units (outside of the wetland area); one unit for planted vegetation; and one for pasture were identified. The dryland, planted and pasture units are collectively considered as Upland Units in the CORA and this supporting document.
- All upland units have been largely historically cleared and are degraded to completely degraded or cleared.
- Planted and remnant Tuarts were noted in upland vegetation units (which are in degraded condition). The presence of the Priority Ecological Community (PEC) Tuart Woodlands of the Swan Coastal plain (Priority 3) was rated as possible. This is listed as a Threatened Ecological Community (TEC) under the EPBC Act.
- Wetland units ranged from degraded to very good.
- Wetland units occur in bands around the central open area (mapped as Open Water) which is inundated in winter and spring. This is surrounded by a band of dead or dying melaleuca and then a band of melaleuca vegetation in degraded to very good- excellent condition.
- The extent of dead and dying Melaleucas has increased over time to cover a larger portion of the central wetland areas.
- The area of Open Water and the band of dead melaleuca are likely to support a samphire community when dry.
- Although not accessible to the public, dumping of construction wastes, soil and garden wastes has been a long standing issue and was noted during the survey.

Vegetation types are described in Table 8-10 and shown on Figure 8-16. Vegetation condition is described in Table 8-11 and shown on Figure 8-17.

Table 8-10: Long Swamp Vegetation Types

Code	Description	Area (ha)
Wetland Communities:		
MrGT	*Melaleuca rhaphiophylla* woodland to open forest and low woodland to low open forest, over *Gahnia trifida* open sedgeland to closed sedgeland, at times over *Machaerina juncea* very open to closed sedgeland. Located in areas of seasonal flooding. Condition: Completely Degraded to Very Good - Excellent.	7.56
MrJa	*Melaleuca rhaphiophylla* Woodland to Open Forest and Low woodland to Low open forest, over **Juncus acutus* open sedgeland to closed sedgeland (at times with scattered *Gahnia trifida*) in areas subject to seasonal flooding. This is a more degraded form of MrGt in previously disturbed areas and *Gahnia trifida* has been largely replaced by *Juncus acutus*. Condition: Degraded.	1.40
Mr_dead	Low woodland to open woodland of dead or dying *Melaleuca rhaphiophylla* in areas subject to extended seasonal flooding. Condition: Degraded.	3.59

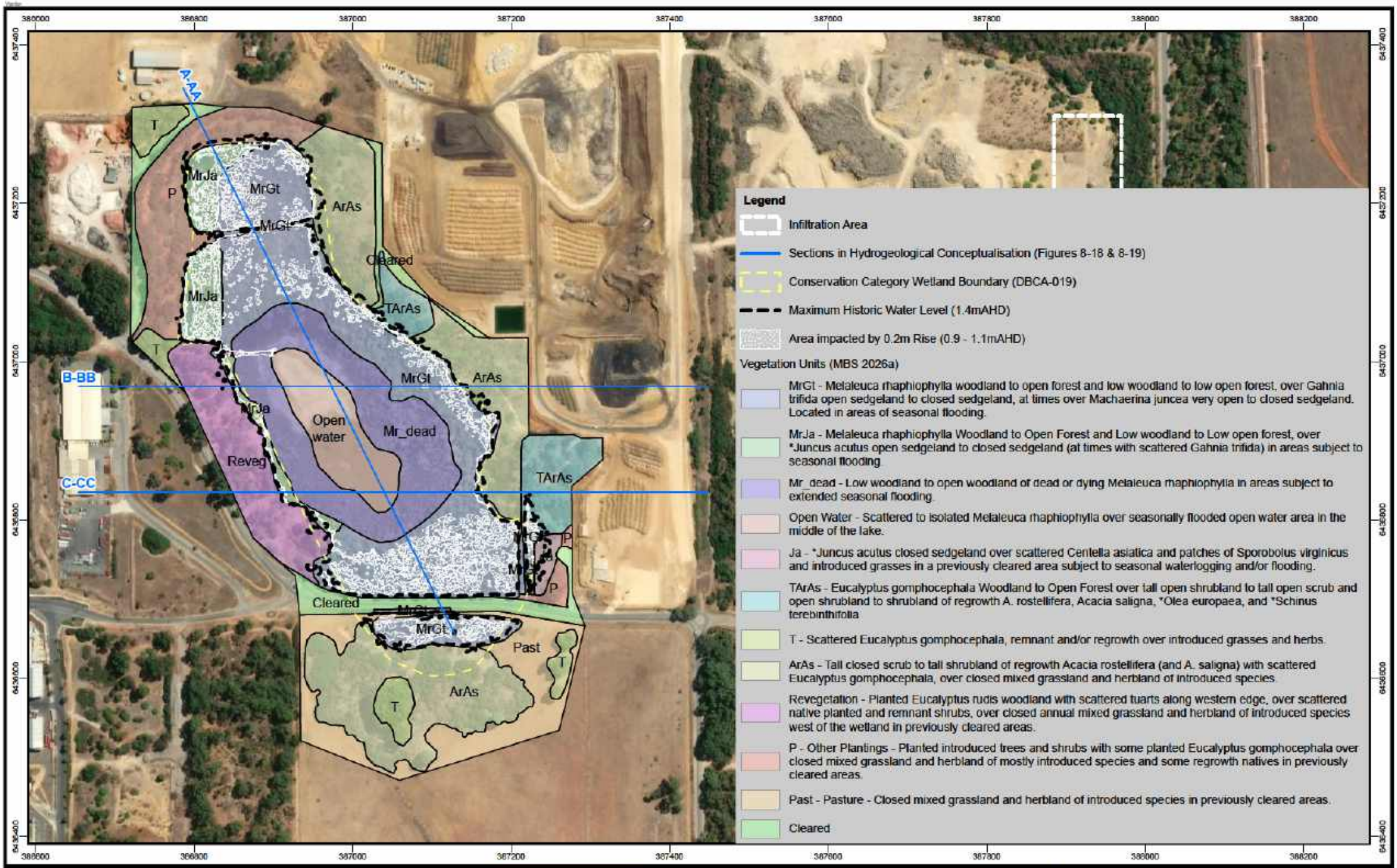
Code	Description	Area (ha)
Ja	**Juncus acutus* closed sedgeland over scattered *Centella asiatica* and patches of *Sporobolus virginicus* and introduced grasses in a previously cleared area subject to seasonal waterlogging and/or flooding. Condition: Completely Degraded.	0.18
Open Water	Scattered to isolated *Melaleuca rhaphiophylla* over seasonally flooded open water area in the middle of the lake. Based on aerial photographs and Weston (2005), this area may seasonally support species such as *Suaeda australis*, *Tecticornia pergranulata*, and *Wilsonia backhousei*; however, these species were not observed during the survey due to area being flooded. Condition: Degraded.	1.48
Upland Communities		
TArAs	*Eucalyptus gomphocephala* Woodland to Open Forest over tall open shrubland to tall open scrub and open shrubland to shrubland of regrowth *A. rostellifera*, *Acacia saligna*, **Olea europaea*, and **Schinus terebinthifolia* over closed mixed grassland and herbland of introduced species. Condition: Degraded - Completely Degraded.	1.35
T	Scattered *Eucalyptus gomphocephala*, remnant and/or regrowth over introduced grasses and herbs. Condition: Degraded to Completely Degraded.	0.96
ArAs	Tall closed scrub to tall shrubland of regrowth *Acacia rostellifera* (and *A. saligna*) with scattered *Eucalyptus gomphocephala*, over closed mixed grassland and herbland of introduced species. Condition: Degraded-Completely Degraded.	6.06
Revegetation	Planted *Eucalyptus rudis* woodland with scattered tuarts along western edge, over scattered native planted and remnant shrubs, over closed annual mixed grassland and herbland of introduced species west of the wetland in previously cleared areas. The revegetation plantings were undertaken in approximately 2010. Condition: Completely Degraded.	1.98
Other Plantings	Planted introduced trees and shrubs with some planted *Eucalyptus gomphocephala* over closed mixed grassland and herbland of mostly introduced species and some regrowth natives in previously cleared areas. Condition: Completely Degraded.	2.23
Pasture	Closed mixed grassland and herbland of introduced species in previously cleared areas. Condition: Not applicable (cleared).	2.14
Cleared	Roads, tracks, and other areas void of vegetation. Condition: Not applicable (cleared).	1.59
Total		**30.52**

Source: Table 13 of Appendix 3 (MBS 2026a)

Table 8-11: Vegetation Condition

Condition	Area (ha)	%
Very Good - Excellent	6.58	21.5
Good	0	0
Degraded	7.64	25.0
Degraded - Completely Degraded	7.43	24.3
Completely Degraded	5.17	16.9
Cleared	3.73	12.2
Total	**30.55**	**100.0**

Source: Table 14 of Appendix 3 (MBS 2026a)



N

0 100 200

m

Scale: 1:6,000

GDA2020 MGA Zone 50

Alcoa

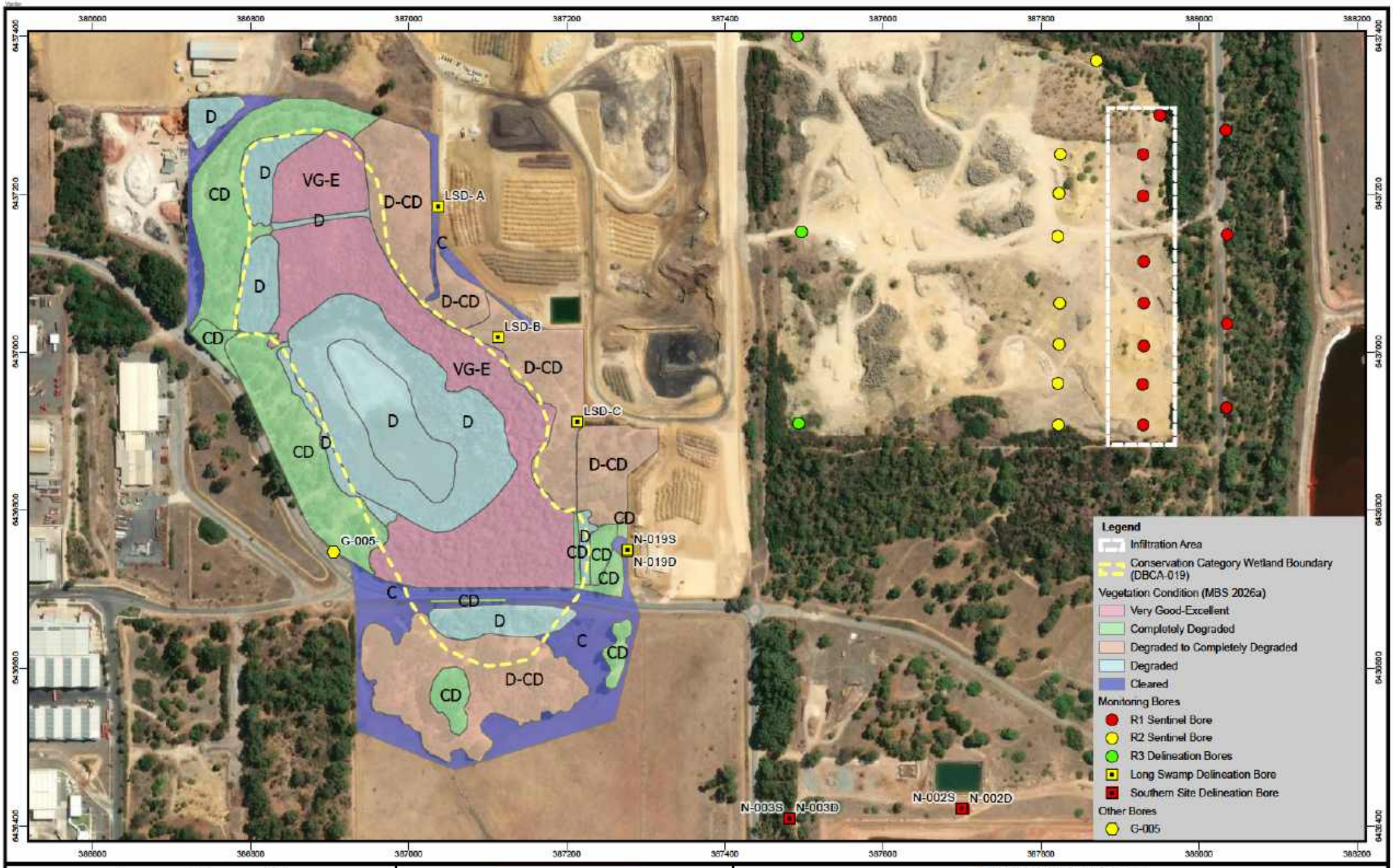
Kwinana Infiltration Project

Figure 8-16 Long Swamp Vegetation Types

Drawing #: Figure 8-16 Long Swamp

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026



N

0 100 200

m

Scale: 1:6,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-17 Long Swamp Vegetation Condition

Drawing #: Figure 8-17 Long Swamp Veg

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

Path: L:\data\EApprovals\EA1P0037\Projects\EA1P0037EA1P0037.aprx

8.8.1.2 Hydrogeology

The hydrogeological conceptualisation of Long Swamp, developed by EHS is shown in Figure 8-18 and Figure 8-19 and described in Section 5.6 of the CORA (Appendix 1).

Long Swamp is a basin feature with a basement and banks of stiff and silty clays with low permeability. The clays limit connectivity with the underlying Tamala Limestone and the water balance is dominated by precipitation and surface water inflows. As a sumpland feature, Long Swamp functions as a throughflow system when the surrounding water table is high and a sink when the water table is low.

The base of the wetland is ~0.1 mAHD. Typical seasonal variation in surface water ranges from dry (0.1m AHD) to a high water level between 0.5 and 0.9 mAHD. Above 0.9mAHD capillary rise is unlikely to impact vegetation due to the steep sides of the swamp where elevation rapidly increases from 1 mAHD to 2 mAHD and the vadose zone is larger than the extinction depth. Surface water has been recorded as high as 1.4 mAHD in very wet years (1978 and 2009). In the cooler and wetter parts of the year, surface water in Long Swamp is often 0.2m to 0.4m higher than groundwater, which prevents further expression of groundwater into the wetland basin.

8.8.1.3 Changes in Flux

Long Swamp is inside the WQIZ (Figure 8-15) and may receive infiltrated water. Increases in flux modelled by EHS are presented in Table 8-12. At an infiltration rate of 3.5 GL/year, an additional 0.9 kL/day on average or 344.4 kL/year is expected to enter Long Swamp which is:

- 1.7% of modelled evapotranspiration from the Long Swamp sediments.
- ~0.4% of the 88,093 kL/year average annual precipitation into the wetland.
- ~0.6% of the 56,287 kL/year annual evaporation.

Note that due to the hydraulic head in the gallery and increasing permeability with depth in the Tamala Limestone, most infiltrated water is expected to flow underneath, rather than through wetland systems and a significant portion of any increase in flux to Long Swamp is likely to consist of natural groundwater rather than infiltrated water.

Table 8-12: Tamala Limestone to Long Swamp Mass Increase

Supply Rate		Flux leaving Long Swamp as ET		Residual Flux to Long Swamp		% Residual Mass Flux contribution as proportion of ET
(GL/yr)	(kL/yr)	(kL/yr)	kL/day	(kL/yr)	kL/day	%
0.0	0	138,856	**380.4**			0.0%
0.5	500,000	2,817.00	+7.7	38.3	+0.1	1.4%
1.0	1,000,000	5,739.90	+15.7	79.1	+0.2	1.4%
1.5	1,500,050	8,651.70	+23.7	127.2	+0.3	1.5%
2.0	2,000,000	11,547.70	+31.6	177	+0.5	1.5%
2.5	2,500,000	14,477.40	+39.7	228.8	+0.6	1.6%
3.0	3,000,000	17,389.50	+47.6	283	+0.8	1.6%
3.5	**3,500,000**	**20,287.80**	**+55.6**	**344.4**	**+0.9**	**1.7%**
4.0	4,000,000	23,187.80	+63.5	414.1	+1.1	1.8%

Source: EHS (2026a, Table 6-4 and Table 6-7).

8.8.1.4 Groundwater mounding

Numerical model predictions are that, under infiltration:

- Groundwater levels in the Tamala Limestone around Long Swamp will rise by ~0.27 m.
- This will cause an ~0.17 m rise in groundwater in the Long Swamp sediments. The rise is lower than in the Tamala Limestone due to the lower permeability of the clays.
- As evaporation rates are much greater than incoming baseflow, surface water levels and the zone of seasonal waterlogging are not expected to change. The increase in hydraulic gradient is expected to result in 0.9 kL/day of additional flux to Long Swamp or 1.7% of evapotranspiration (See Table 8-12).

Mounding in the Tamala Limestone is shown on Figure 8-15 and discussed in Section 8.8.1.3.

Although a change in water levels at Long Swamp is not predicted, an increase in surface water levels of 0.2 m or approximately equal to the modelled rise in the Long Swamp sediments, was conservatively assumed in the risk assessment. This corresponds to a change in the normal seasonal high water level from 0.9 mAHD to 1.1 mAHD.

The area impacted by a transient 0.2 m rise in surface water is shown on the conceptual model in Figure 8-18 and Figure 8-19 and on the vegetation map in Figure 8-16. This area, between 0.9 mAHD and 1.1 mAHD, is almost entirely within wetland vegetation units that can tolerate periodic waterlogging. Note that inundation of this area:

- Would not occur every year as 0.9 mAHD is the upper limit of normal seasonal variation and is not reached every year.
- If it does occur, would occur for a short period, likely at the end of the wet season.

The area inundated in very wet years where water levels as high as 1.4 m have been recorded is also shown on the figures. The area inundated in very wet years is also largely confined to wetland vegetation units and is similar to the boundary between wetland and upland vegetation units. Vegetation inside this area is already subject to occasional waterlogging.

As any rise in the seasonal water level of Long Swamp (if it occurs) will impact wetland vegetation units, which are already tolerant to seasonal waterlogging and waterlogging of upland units is not expected to occur, EHS concluded that significant impacts to wetland or upland vegetation units were not anticipated.

The EHS assessment in the CORA considered the potential impact to Wetland and Upland Vegetation broadly. MBS Environmental considered the potential impact to each vegetation unit identified. The MBS assessment confirmed the findings of the CORA and predicted that the risk to each vegetation unit was low as:

- ~98% of the area of additional inundation associated with a 20 cm water level increase comprises wetland vegetation which is tolerant to an increase in water levels.
- the areas of dryland vegetation at the wetland interface contain vegetation adapted to transitional conditions.

MBS concluded that the nature and scale of impacts would be negligible to minor. MBS also noted the importance of maintaining the drying period for the wetland; and that this is not expected to significantly change.

A copy of the assessment (MBS 2026b) is provided in Appendix 4.

Alcoa

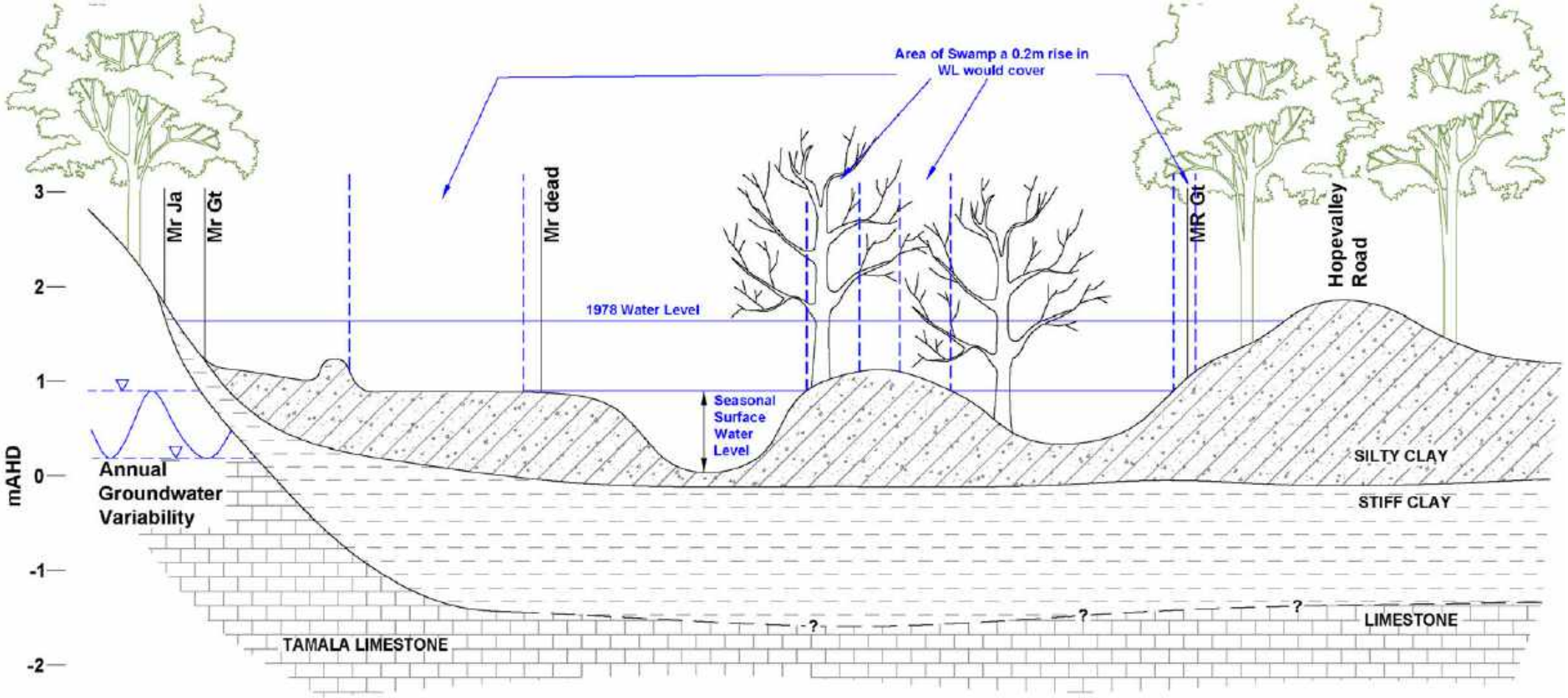
Table 8-13: Long Swamp Vegetation Characteristics and Vegetation Sensitivity to Groundwater Level Increase

Vegetation Units	Dominant Species	Dominant species characteristics	Sensitivity to water level increase
Wetland Units:			
MrGt MrJa	*Melaleuca rhaphiophylla*	Tree to 10 m high. Able to tolerate periodic inundation for several months of the year, but prefers waterlogged sites.	Unlikely to be sensitive to the proposed minor water level increase as the species present are adapted to wet conditions that vary seasonally and annually.
	Gahnia trifida	Sedge to 1.5 m high. Found in seasonally wet, well drained but often saline sandy soils	
	Machaerina juncea	Up to 1.2m high. May be found in seasonally waterlogged to partially inundated areas which have fresh to brackish or seasonally saline water. Prefers a fairly constant water level but tolerates seasonal fluctuations up to approximately half a metre	
	Machaerina articulata	Up to 2.5m high. Prefers longer periods of flooding (up to 0.7m deep) and wetter soils throughout the year	
Ja	**Juncus acutus*	introduced species tolerant of waterlogging and salinity.	
Mr_dead Open Water	*Melaleuca rhaphiophylla*	As above.	Well adapted to wetland conditions and prolonged seasonal inundation, Unlikely to be sensitive to the minor proposed increase in water levels.
	Suaeda australis	perennial shrub up to 1 m high. Occurs on saline soil around estuaries and winter-wet depressions	
	Tecticornia pergranulata	Succulent shrub up to 0.5 m high. Mostly located on the boundaries of salt lakes and salty swamps. Tolerates high salinity levels and flooding	
	Wilsonia backhousei	Creeping, mat-forming perennial, herb to 0.15m high. Occurs on lake edges, salt marshes, and seasonally wet flats. Tolerates a range of salinity levels and can recover after protracted immersion	

Vegetation Units	Dominant Species	Dominant species characteristics	Sensitivity to water level increase
Upland Units:			
TArAs ArAs T	*Eucalyptus gomphocephala*	Tree up to 40 m high. Dryland species however has been recorded adjacent to wetlands and has been shown to have some tolerance to waterlogging. Sensitive to salinity. During the survey it was opportunistically observed that the size and density of tuarts generally increased with increasing distance from water's edge.	Vegetation units are outside the current area of seasonal flooding, apart from small sections along the wetland interface. Lower lying parts are likely to experience seasonally waterlogged soils. Vegetation type is sensitive to flooding (particularly extended flooding); however, the modelled minor increase in water level would only impact areas that are already at the wetland interface, containing vegetation adapted to transitional conditions The nature and scale of impacts would be negligible to minor. Areas higher up the slope would not be impacted by flooding. The minor change to groundwater levels is unlikely to adversely impact dryland vegetation up the embankment.
	Acacia rostellifera	Dense shrub or tree, 1-6 m high. It occurs mainly on consolidated sand dunes and is generally considered a dryland species. No data was found regarding tolerance to waterlogging, however it was observed fringing the edges of the flooded area at Long Swamp.	
	Acacia saligna	Shrub or tree up to 1.5-6(-9) m high. It occurs in variety of habitats and has been recorded along creeks and rivers.	
Reveg	*Eucalyptus rudis*	Tree up to 25 m high. Common species fringing winter-wet depressions, lakes and watercourses. Tolerates prolonged periods of flooding and is usually found in waterlogged areas. Sensitive to salinity	Revegetation is outside the current area of seasonal flooding, apart from small sections that flood along the wetland interface. Revegetation is very sparse and dominated by *E. rudis* that is adapted to flooding. The modelled minor increase in water levels is unlikely to adversely impact environmental values of the revegetation areas

Vegetation Units	Dominant Species	Dominant species characteristics	Sensitivity to water level increase
Other plantings	Introduced species and some *Eucalyptus gomphocephala*.	As above for *Eucalyptus gomphocephala*.	Vegetation unit is outside the current area of seasonal flooding, apart from small sections that flood along the wetland interface Tuarts within this unit are sufficiently far from the wetland and higher up the embankment for there to be no adverse impacts from minor increase in water level. The modelled minor increase in water levels could result in seasonal flooding of some introduced species, however only in an area that is already subject to some flooding/waterlogging at the wetland interface. The nature and scale of impacts would be negligible to minor and limited to introduced species. The area slopes up relatively steeply and therefore modelled minor water level increase is unlikely to impact the vast majority of the vegetation unit.
Pasture	Introduced species.	-	This vegetation unit is outside the current area of seasonal flooding, apart from small sections that flood along the wetland interface. The modelled minor increase in water levels could result in seasonal flooding of some introduced species, however only in an area that is already subject to some flooding/waterlogging at the wetland interface. The nature and scale of impacts would be negligible to minor and limited to introduced species.

Source: Summarised from Table 1 of MBS (2026b) – attached as Appendix 4.



Classification	Main Vegetation	Comment (Suspectability to waterlogging / Vegetation health
Mr Ja	Melaleuca rhaphilophylla:	Tolerant to minor raises in groundwater level
Mr Gt	Gahnia trifida; Machaerina Junce:	Found in seasonally waterlogged to partially inundated areas
Mr dead	Melaleuca rhaphilophylla:	Able to tolerate inundation for several months
	Suaeda austalis:	Unlikely to be sensitive to minor increases to groundwater
	tecticornia Pergranulata:	Tolerates high salinity and flooding
	Wilsonia backhorse ei:	Tolerates high salinity and flooding
Mr ArAs	Eucalyptus gomphocephala to open forest over tall shrubland:	Vegetation type is sensitive to groundwater level increases, particularly increased waterlogging or flooding, however minor, short-term seasonal changes may not result in significant adverse impacts.

EHS Support

FIGURE 5-10
SOIL SECTION

INFILTRATION AQUIFER INJECTION ASSESSMENT

DRAWN BY:	MDO	DATE DRAWN:	11/2025
REVIEWED BY:	CS	DATE REVIEWED:	11/2025
SCALE:	- NTS -	PLOT DATE:	02/2026
PROJECT NO.:		PTY.06199	

Source: Figure 5-10 of EHS (2026a)

Drawing #: Figure 8-18 Long Swamp

Date: 24/03/2026 | Rev: A | A4

Alcoa

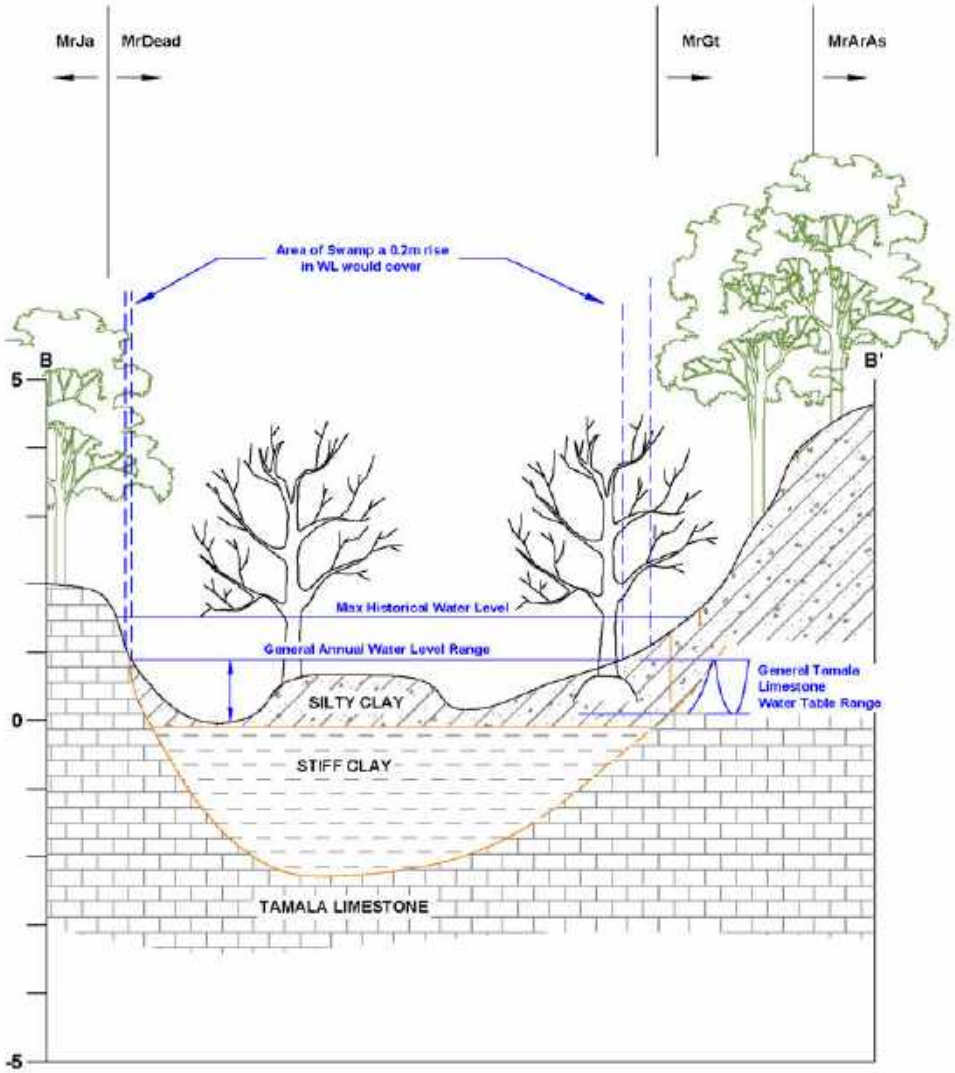
Author: smita

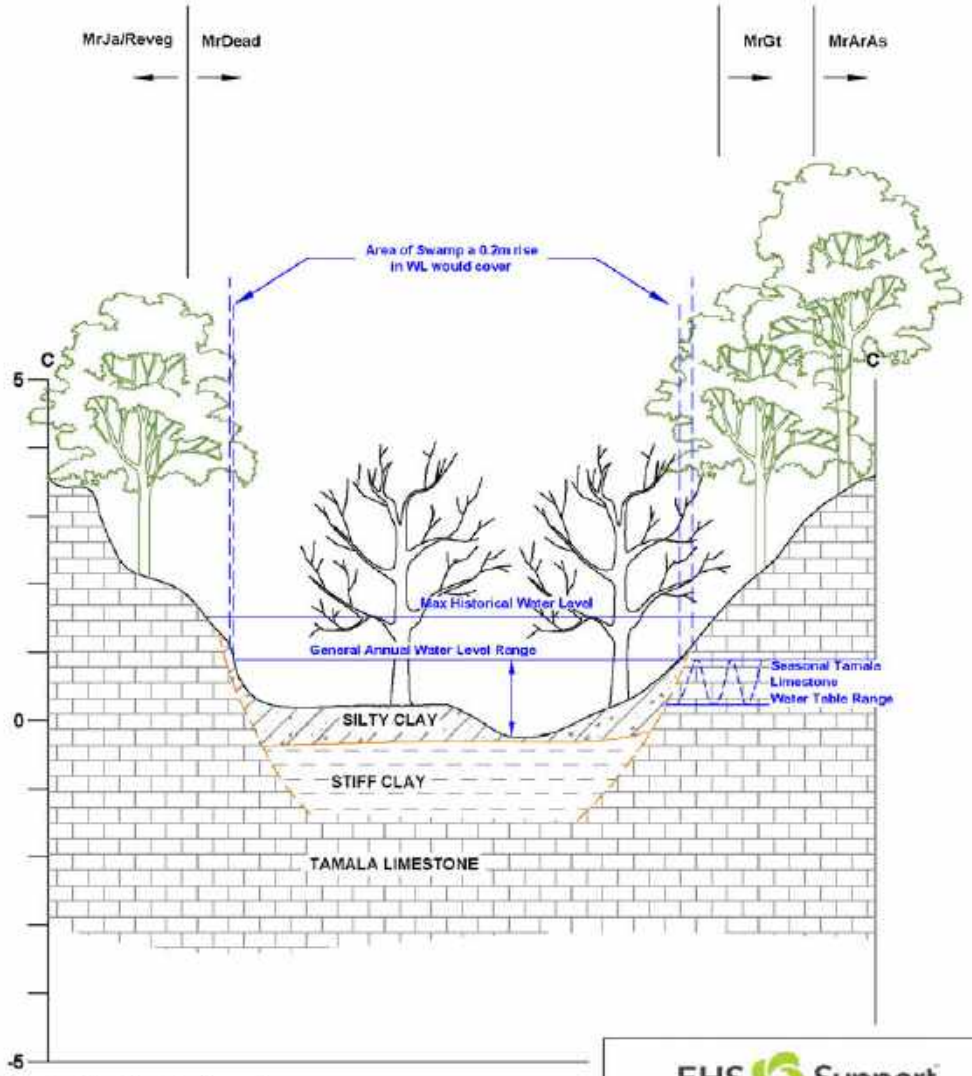
Date Printed: 24/03/2026

Kwinana Infiltration Project

Figure 8-18 Long Swamp Conceptual Model (Longitudinal)

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx





Classification	Main Vegetation	Comment (Suspectability to waterlogging / Vegetation health
Mr Ja	Melaleuca rhaphilophylla;	Tolerant to minor raises in groundwater level
Mr Gt	Gahnia trifida; Machaerina Junce;	Found in seasonally waterlogged to partially inundated areas
Mr dead	Melaleuca rhaphilophylla;	Able to tolerate inundation for several months
	Suaeda australis;	Unlikely to be sensitive to minor increases to groundwater
	tecticornia Pergranulata;	Tolerates high salinity and flooding
	Wilsonia backhorse ei;	Tolerates high salinity and flooding
Mr ArAs	Eucalyptus gomphocephala to open forest over tall shrubland;	Vegetation type is sensitive to groundwater level increases, particularly increased waterlogging or flooding, however minor, short-term seasonal changes may not result in significant adverse impacts.

EHS Support

FIGURE 5-11
SOIL SECTION

INFILTRATION AQUIFER INJECTION ASSESSMENT

DRAWN BY:	MDO	DATE DRAWN:	11/2025
REVIEWED BY:	CS	DATE REVIEWED:	11/2025
SCALE:	- NTS -	PLOT DATE:	02/2026
PROJECT NO.:		PTY 06199	

Source: Figure 5-11 of EHS (2026a)

Drawing #: Figure 8-19 Long Swamp

Date: 24/03/2026 | Rev: A | A4

Alcoa

Author: smita

Date Printed: 24/03/2026

Kwinana Infiltration Project

Figure 8-19 Long Swamp Conceptual Model (Lateral)

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

8.8.1.5 Water Quality

Surface water quality in Long Swamp and adjacent monitoring bores in the Tamala Limestone is summarised in Table 8-14. The locations of bores G-005 and N019S/D are shown on Figure 8-17.

Surface water is brackish (~4,500 mg/L TDS) and more saline than the surrounding groundwater in the Tamala Limestone. Surface water concentrations of aluminium, boron and zinc exceed ANZG (2018) guidelines for the protection of 99% of species in freshwater (99% ANZGs). Concentrations of aluminium, copper, lead, mercury and zinc in groundwater exceed 99% ANZGs; and copper and aluminium in groundwater exceeds the 95% ANZGs.

Infiltration water quality in the galleries and after 750m of mixing and dilution (the distance between the galleries and Long Swamp) is compared to surface water in Long Swamp, adjacent groundwater in the Tamala Limestone, 95% ANZGs and the Background UPL in Table 8-15. Concentrations of Aluminium, Gallium, Molybdenum, Tin and Vanadium in infiltrated water exceed background and 95% ANZG values. After 750m, concentrations of all analytes in the primary water quality suite are expected to be within background or 95% ANZGs.

EHS concluded that water quality impacts at Long Swamp were unlikely as:

- The additional flux through the Long Swamp sediments and into the wetland is low.
- The quality of infiltrated water is expected to be within 95% ANZGs or background by the time infiltrated water reaches Long Swamp.

Both EHS and MBS also noted that any contribution from the Tamala Limestone to surface water in Long Swamp is likely to have a dilutionary effect and may partly ameliorate salinity in the wetland.

The water quality criteria in Table 8-15 have been applied as trigger criteria in the R3 Delineation bores, which are ~450 m downgradient of the Infiltration Area and ~300m upgradient from Long Swamp (See Section 9). Should monitoring detect an exceedance at these bores, attenuation can be confirmed or actions taken to prevent groundwater impacts.

Alcoa

Table 8-14: Long Swamp Baseline Water Quality

Analyte	Fraction	Unit	Exceeded Criteria	Groundwater (G-005 and N019S/D)			Long Swamp Surface Water		
				Range	Mean	Median	Range	Mean	Median
Aluminium	T	mg/L	**Both:** ANZG 99% Species Protection – Freshwater (0.027 mg/L) **Groundwater only:** ANZG 95% Species Protection – Freshwater (0.055 mg/L) and DWER NPUG (0.2 mg/L)	<0.01 - 0.87	0.27	0.16	0.03	0.03	0.03
Arsenic	T	mg/L	**Both:** NHMRC ADWG (0.01 mg/L)	0.0018 - 0.011	0.0049	0.0027	0.075 - 0.078	0.0763	0.0760
Boron	T	mg/L	**Surface water only:** ANZG 99% Species Protection – Freshwater (0.34 mg/L)	0.024 - 0.09	0.047	0.041	0.38 - 0.41	0.400	0.410
Chloride (As Cl)	T	mg/L	**Surface water only:** DWER Non-potable Use Guidelines (NPUG) (250 mg/L)	75 - 170	122	120	2530 - 2570	2553	2560
Copper	D	mg/L	**Groundwater only:** ANZG 99% Species Protection – Freshwater (0.001 mg/L) and ANZG 95% Species Protection – Freshwater (0.0014 mg/L)	<0.001 - 0.062	0.012	0.002	–	–	–
Copper	T	mg/L		<0.001 - 0.089	0.010	0.001	<0.001	–	–
Iron	T	mg/L	**Groundwater Only:** ANZECC Irrigation Long-Term Values (LTV; 0.2 mg/L) and DWER NPUG (0.3 mg/L)	0.077 - 2.2	0.76	0.43	0.15	0.15	0.15
Lead	T	mg/L	**Groundwater only:** ANZG 99% Species Protection – Freshwater (0.001 mg/L)	<0.001 - 0.002	0.001	0.001	<0.001	–	–
Manganese	D	mg/L	**Groundwater only:** NHMRC ADWG (0.1 mg/L) and ANZECC Irrigation LTV (0.2 mg/L)	<0.001 - 0.27	0.072	0.004	–	–	–
Manganese	T	mg/L		0.0022 - 0.32	0.133	0.096	0.004 - 0.012	0.007	0.005
Mercury	T	µg/L	**Groundwater only:** ANZG 99% Species Protection – Freshwater (0.06 µg/L)	0.05 - 0.067	0.05	0.05	–	–	–
Perfluorooctane sulfonic acid (PFOS)	T	µg/L	**Groundwater only:** NEMP 3.0 - Freshwater 99% Species Protection (0.00023 µg/L)	<0.0002 - 0.00066	0.0003	0.0002	NS	NS	NS
Phosphorus	T	mg/L	**Groundwater only:** ANZECC Irrigation LTV (0.05 mg/L)	<0.05 - 0.059	0.051	0.050	–	–	–
Total Dissolved Solids	T	mg/L	**Surface water only:** ANZECC Stock Water (2,000 mg/L)	360 - 730	571	600	4460 - 4830	4640	4630
Zinc	D	mg/L	**Both:** ANZG 99% Species Protection – Freshwater (0.0024 mg/L)	<0.001 - 0.0079	0.0029	0.0019	–	–	–
Zinc	T	mg/L		0.0011 - 0.0067	0.0033	0.0028	<0.005 - 0.006	0.0053	0.0050

Source: Table 5-5 of CORA (Appendix 1); T = Total; D = Dissolved; NS = Not sampled

Alcoa

Table 8-15: Quality of Infiltrated Water and Long Swamp

Parameter	Unit	Infiltrated Water		Baseline			95% ANZG
		Quality at Galleries	Expected Quality after 750m	Long Swamp Surface Water (August 2025)	Adjacent Tamala Limestone[1]	Back-ground UPL	
Aluminium	mg/L	0.15	0.054	0.03	<0.01	0.04	0.055
Arsenic	mg/L	0.01	0.004	0.062 – 0.078	<0.001 – 0.0021	0.03	0.013
Boron	mg/L	0.9	0.324	0.38 – 0.48	0.027 – 0.071	0.13	0.94
Calcium	mg/L	50	18.0	74 – 76	83 – 120	350	-
Chloride	mg/L	17.5	6.3	2530 - 2570	75 – 130	222	-
Fluoride	mg/L	0.5	0.180	0.2	<0.1 – 0.12	0.41	1.7
Gallium	mg/L	0.005	0.002	NA	<0.001	0.002	-
Magnesium	mg/L	5	1.8	139 – 141	9.9 – 12	40	-
Molybdenum	mg/L	0.09	0.032	<0.001	<0.001 – 0.0014	0.007	0.034
Nickel	mg/L	0.002	0.001	0.005 – 0.006	<0.001	0.002	0.011
Nitrate	mg/L	2	0.719		11 – 24	47.4	29
Potassium	mg/L	1.2	0.432	53 – 54	2.8 – 11	10.1	-
Selenium	mg/L	0.01	0.004	<0.001 – <0.01	0.0012 – 0.0018	0.004	0.011
Sodium	mg/L	150	54.0	1460 – 1480	38 – 83	129	-
Sulfate	mg/L	50	18.0	415	33 - 95	640	-
TDS	mg/L	600	215.8	4460 - 4830	360 – 610	1093	-
Tin	mg/L	0.002	0.001	NA	<0.001	0.001	-
Vanadium	mg/L	0.01	0.004	0.0016 – <0.01	<0.001	0.009	0.006
	Concentration at galleries or after 750m exceeds baseline or 95% ANZGs						

[1] Groundwater quality in bores G-005 and N 019S, slotted in the Tamala Limestone adjacent to Long Swamp

8.8.2 Other Downgradient Wetlands

Other downgradient wetlands included in the CORA are Hendy Road Swamp East, Hendy Road Swamp West, Unnamed 1 and Conway Road Swamp. All these wetlands are further away from the Infiltration Area than Long Swamp and have lower conservation statuses. Locations are shown in Figure 8-15

EHS considered potential impacts to these wetlands in Section 5.7.3 of the CORA.

In terms of potential water quality impacts:

- Conway Road Swamp, Hendy Road Swamp East and Hendy Road Swamp West are outside of the WQIZ and water quality impacts are not anticipated.
- Unnamed 1 may receive infiltrated water; however it is further down-gradient than Long Swamp and measures to prevent water quality impacts to Long Swamp will also protect this wetland.

Mounding impacts are also not anticipated as water is expected to remain within 0.5m of the surface. EHS expected that, in a similar manner to Long Swamp, a smaller quantum of groundwater rise would occur in the wetland sediments than in the surrounding Tamala Limestone with any increase in flux a minor component of evapotranspiration. EHS concluded that significant mounding impacts that may warrant further investigation of these wetlands are not anticipated.

For completeness a description of each wetland is included below.

8.8.3 Hendy Road Swamp East

Hendy Road Swamp East is a resource enhancement dampland on private land surrounded by grass paddock (Figure 8-15). The wetland is ~1.1 km southwest of the Infiltration area and ~450 m south of Long Swamp and outside of the WQIZ.

Landgate aerial imagery shows that Hendy Road Swamp West was mostly cleared for market gardening in the 1950s. Assessment by Weston (2005) determined that vegetation was mostly completely degraded. Melaleuca-dominated vegetation in the south was in good to degraded condition and surrounding upland vegetation degraded to completely degraded. A request to access the property for further assessment of wetlands was not obliged.

8.8.4 Hendy Road Swamp West

Hendy Road Swamp West is a multiple use dampland ~1.2 km southwest of the Infiltration Area and ~450 m south of Long Swamp and outside of the WQIZ (Figure 8-15). Assessment by Weston (2005) determined that vegetation in the dampland was worse than completely degraded and almost devoid of native species, with most of the swamp a monoculture of the **Gomphocarpus fruticosus*.

Landgate aerial imagery shows that Hendy Road Swamp East was cleared by the 1950s and used for market gardening, with ongoing disturbance.

8.8.5 Unnamed 1

Unnamed 1 is a Resource Enhancement Sumpland ~2.5 km east of the infiltration area and inside the WQIZ (Figure 8-15). The dual carriageway Rockingham Road has been constructed through the wetland.

8.8.6 Conway Road Swamp

Conway Road Swamp is a Resource Enhancement dampland ~2.3 km west-southwest of the Infiltration Area and is outside of the WQIZ (Figure 8-15). Assessment by Weston (2005) was that wetland vegetation was in a completely degraded to very good condition; and by Biota (2024) was that wetland vegetation was in good condition with few weeds.

8.9 Contaminated Sites

8.9.1 Known Existing Land Contamination

The Infiltration Area is in the Kwinana Industrial Area where there are known contaminated sites. Alcoa held- contaminated sites are listed in Table 8-16 and third-party- contaminated sites in Table 8-17. The contamination sources included in the risk assessment are shown in Figure 8-20.

Alcoa implements a Groundwater Management and Monitoring Plan (GMMP) (Alcoa 2025), required under the *Contaminated Sites Act 2003* (Contaminated Sites Act) and Condition W1 of Environmental Licence L5245/1967/14. The GMMP sets monitoring and management requirements for the remediation program and related recovery bore abstraction rates.

Table 8-16: Alcoa Contaminated Sites

Property	Status	Contamination
Alcoa Kwinana Refinery	Contaminated - Remediation Required	Alkaline groundwater plumes that contain elevated concentrations of metals
Alcoa RSA ABC	Contaminated - Remediation Required	Alkaline groundwater plumes that contain elevated concentrations of metals
Alcoa RSA Main	Contaminated - Remediation Required	Alkaline groundwater plumes that contain elevated concentrations of metals
Alcoa Tank Farm	Possibly contaminated – investigation required	Alkaline groundwater plumes that contain elevated concentrations of metals

Table 8-17: Down-gradient and Cross-Gradient Third Party Contaminated Sites

Property	Status	Contamination
30 and 32 Macedonia St, Naval Base,	Contaminated-Restricted Use	Hydrocarbons in groundwater.
Lot 1 on Plan 24276 – Peron Quarry	Remediated for restricted use	Buried flyash; metals and ammonia in groundwater.
27 Weston St and a portion of Weston St Road Reserve, Naval Base	Remediated for restricted use	Hydrocarbons in groundwater
2 Barter Road and Barter Road Reserve, Naval Base	Remediated for restricted use	Hydrocarbons in soil and groundwater
Lot 3000 on Plan 46763 and Lot 22 Weston Street, Naval Base	Contaminated - Remediation Required	Hydrocarbons in soil and groundwater; coal ash, PFAS
18 Barter Road and Barter Road Reserve, Naval Base WA	Remediated for Restricted Use	Hydrocarbons in groundwater. Flyash has been removed.
143 McLaughlin Road, Postans, WA	Possibly contaminated – investigation required	Nutrients, metals and PFAS in groundwater

Property	Status	Contamination
Lot 2 on Deposited Plan 419343, Lot 301 on Plan 40776, Lot 302 on Plan 407762 and Lot 252 on Deposited Plan 415974	Contaminated-Restricted Use	Industrial slag and cinder
Lot 521 on Deposited Plan 300764	Awaiting Classification – site provided by DWER	Former power station
Lot 170 on Plan 300773	Awaiting Classification – site provided by DWER	Buried flyash

8.9.2 Unknown Existing Land Contamination

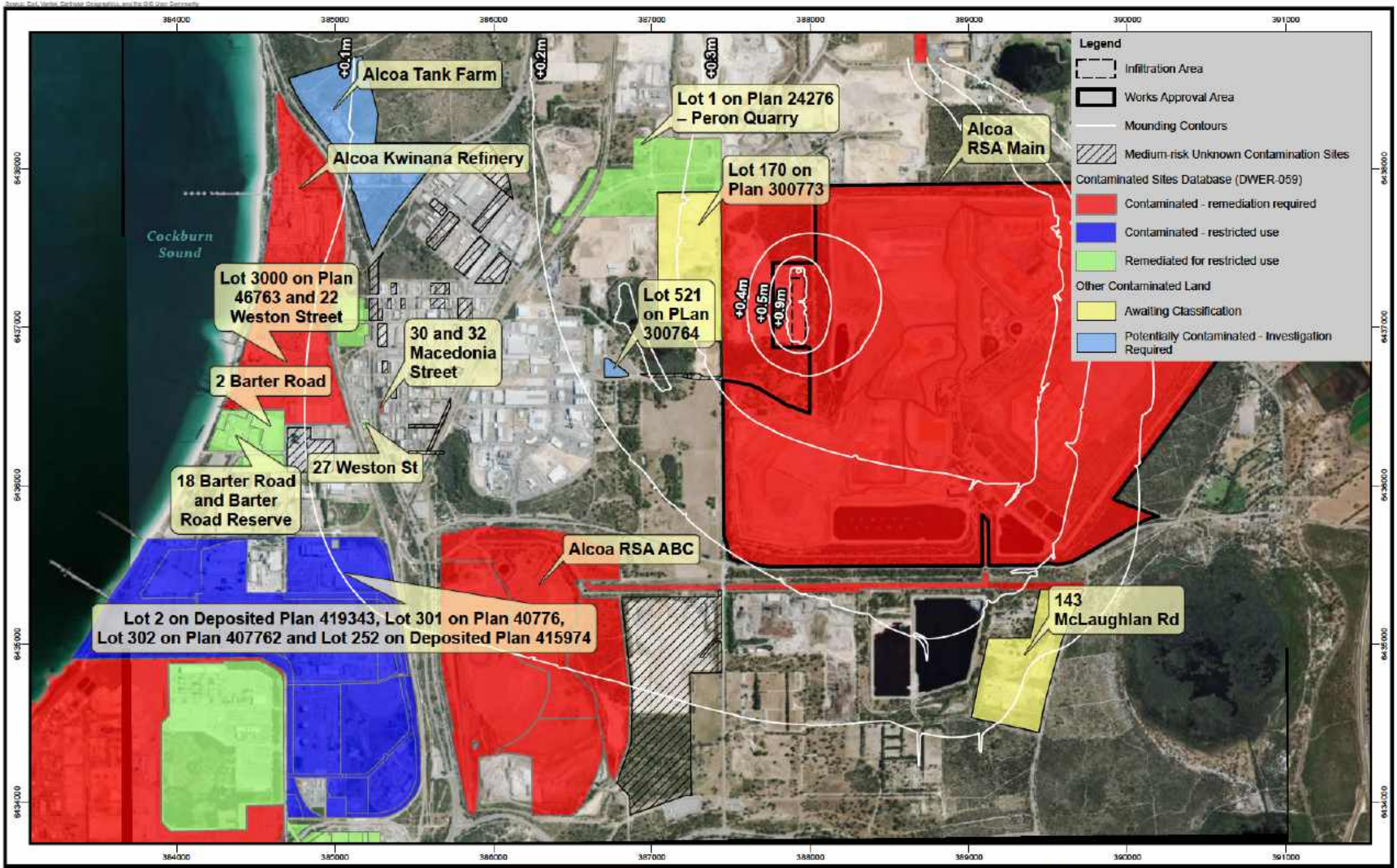
As the Project is in an industrial area, EHS also considered the potential for additional land contamination that does not appear on the contaminated sites register. To address this risk, EHS undertook a LotSearch review of down-gradient properties complemented by analysis of historical aerial imagery. LotSearch identifies sites on the Contaminated Sites Register that are not on the public register and lists potentially contaminating land uses.

EHS risk-assessed sites based on DWER guidance for potentially contaminating industries, activities and land uses (DWER 2021) and the age of the land use with older sites expected to have less regulation and duty of care. Low risk sites were not considered further. High and Medium risk sites were not considered further if they were outside of the Groundwater Mounding Area (identified as the area where groundwater mounding is predicted to be 10cm or less).

The outcomes of the assessment were that:

- Three high-risk sites identified in LotSearch were "mapped to road corridor". Analysis of aerial imagery since the 1960s indicates that these are not in the Groundwater Mounding Area and no further investigation is required.
- Several medium risk sites were identified in the Groundwater Mounding Area.
    - A low increase in flux is expected at these sites (associated with an ~10cm increase in hydraulic gradient over ~2 km) and EHS concluded that the risks of infiltration were low and no additional investigation was required.
    - These sites are shown as "Medium risk Unknown Contamination Sites in Figure 8-20.

The assessment does not definitively identify contaminated land, but rather identifies sites where contamination may be present based on activities that currently or historically occurred. Taking a precautionary approach, EHS have considered these sites in the CORA.



N

0 0.5 1

km

Scale: 1:30,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-20 Contaminated Sites

Drawing #: Figure 8-20 Contaminated Sites			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

8.9.3 Potential Impacts of Infiltration

Groundwater mounding and an increase in flux may mobilise and spread contamination. A particular concern noted by the contaminated sites branch of DWER during pre-application engagement is the risk of contamination at the Alcoa refinery entering Cockburn Sound.

EHS considered that the potential for mobilisation of contamination from known and unknown contaminated sites was rare to unlikely as:

- The degree of mounding and associated flux increases are minor.
- Flow paths avoid most known third-party contaminated sites and are primarily at depth.
- The MMP includes measures to detect mounding above predicted levels and appropriate response actions.

The operation of environmental recovery borefields at the refinery and RSA ABC can be increased if required to prevent migration into Cockburn Sound.

Additional detail on flux increases and risks is provided in the CORA. The CORA and MMP were provided to the Contaminated Sites Auditor, and a Mandatory Auditors Report has been submitted to the Contaminated Sites Branch of DWER. The Auditor was satisfied that:

- The infiltration project as described may be implemented without undue risk associated with existing contaminated sites (known or potentially present).
- The monitoring and management measures described are capable of ensuring any potential risk that may manifest in this regard can be identified and may be addressed in a timely manner.

8.10 Flora and Vegetation

Note that indirect impacts to flora and vegetation around down-gradient wetlands are considered in Section 8.8 and are not considered further in this section.

On the Alcoa landholdings, no threatened or priority flora species have been identified in previous flora and vegetation assessments around Area O (Ecologia 2021, PGV 2022a, PGV 2022b).

The following vegetation types at Area O and other areas of RSA Main have been identified as Threatened Ecological Communities (TECs) listed under the *Biodiversity Conservation Act 2018* or Priority Ecological Communities (PECs):

- SCP26a (*Melaleuca huegelii – Melaleuca systena* shrublands on limestone ridges (Melaleuca TEC).
- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain (Tuart PEC) - Priority 3.
- Banksia woodlands of the Swan Coastal Plain (Banksia PEC) – Priority 3.

Both Tuart PEC and Banksia PEC are listed as TECs under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). At RSA Main, most Tuarts have been intentionally planted in historically disturbed areas.

There is one downgradient Bush Forever Site (Bush Forever Site 346) partly inside the WQIZ, ~2.3 to ~3.5 km east-northeast of the Infiltration Area.

Bush Forever Sites, TECs and PECs are shown on Figure 8-21 as well as wetland vegetation, the WQIZ and modelled depth to water under 3.5 GL/year infiltration. Analysis of aerial imagery indicates that downgradient of the Infiltration Area, large areas have been cleared of native vegetation or otherwise historically disturbed.

The Project does not include direct impacts to vegetation as no additional disturbance is proposed. The Infiltration Area is in the base of an excavated quarry, and the pipeline will be constructed in previously disturbed areas. Potential indirect impacts to vegetation include:

- Mounding causing waterlogging and a decline in vegetation health.
- Poor water quality causing a decline in vegetation heath where vegetation is accessing the water.

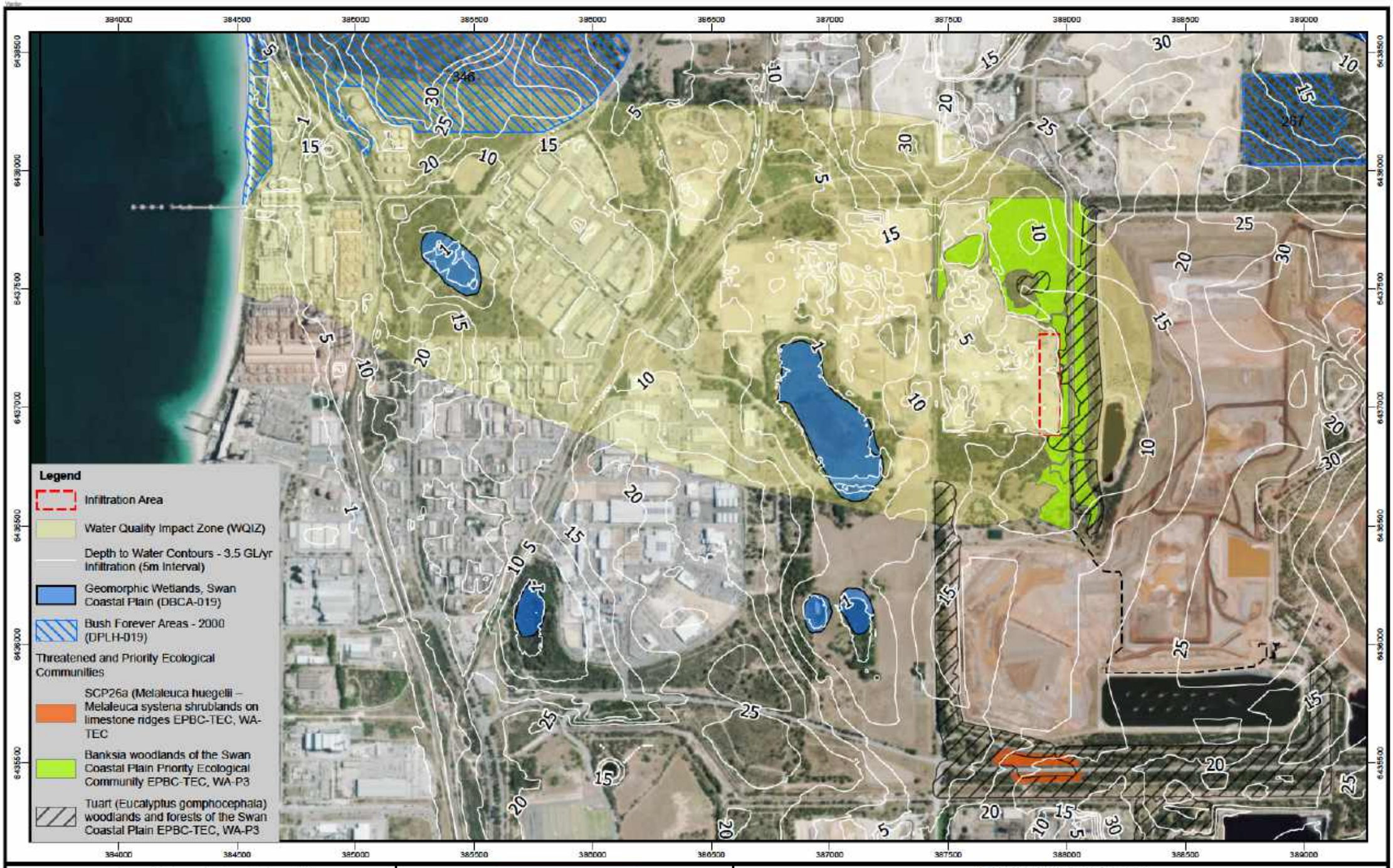
Beyond the immediate vicinity of the Infiltration Area, which is devoid of native vegetation, the change in depth to water is small (See Figure 8-8 in Section 8.4.5.1) and within natural seasonal variation. Due to the small change in water levels, mounding impacts are unlikely.

Areas where groundwater is shallow and close to the surface (<1 m) are associated with wetlands. Outside of wetland areas, deep rooted species inside the WQIZ may access the groundwater and water quality impacts are possible if poor quality water is infiltrated. As water will be treated prior to infiltration, water quality impacts are considered unlikely.

Impacts to Melaleuca TEC are not anticipated as the TEC is upgradient of the Infiltration Area with modelled depth to groundwater of 15 – 20 mAHD. The TEC will not receive infiltrated water.

Banksia PEC and Tuart PEC around Area O are inside the WQIZ. Impacts are unlikely due to the depth to water. Should vegetation access the groundwater in places, impacts are not anticipated due to treatment prior to infiltration.

Modelled depth to water in areas of Bush Forever Site 346 that are inside the WQIZ is 15 - >30 mBGL. This vegetation is unlikely to be accessing the groundwater due to the depth to the water table. Depth to water in a small area between the refinery and the coast is ~1 mBGL. This area is immediately adjacent to Cockburn Sound where groundwater is impacted by seawater and unlikely to be accessed by vegetation. As vegetation in Bush Forever Site 346 is unlikely to be accessing the groundwater, water quality impacts are not anticipated.



N

0 200 400 600 800

m

Scale: 1:20,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-21 Vegetation

Drawing #: Figure 8-21 Vegetation

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026

8.11 Terrestrial Fauna

Conservation significant species that may occur in and around the Alcoa landholdings are listed in Table 8-18. A similar species composition is anticipated in down-gradient areas.

Table 8-18: Conservation Significant Species

Species Name	Common name	EPBC Act	BC Act	Priority	Likelihood
Calyptorhynchus latirostris	Carnaby's cockatoo	EN	EN		**Likely**
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU		**Likely**
Falco peregrinus	Peregrin Falcon		OS		**Possible**
Dasyurus geoffroii	Chuditch	VU	VU		**Possible**
Isoodon fusciventer	Quenda			P4	**Likely**
Phascogale tapoatafa wambenger	South-western brush-tailed phascogale		CD		**Possible**
Notamacropus irma	Western brush wallaby			P4	**Possible**
Falsistrellus mackenziei	Western false pipistrelle			P4	**Possible**
Neelaps calonotos	Black-striped snake			P3	**Possible**
Lerista lineata	Perth slider			P3	**Likely**
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider			P3	**Possible**

Source: Ecologia (2021)

Fauna may ingest infiltrated water in the gallery or drown. To mitigate this risk:

- Water is treated prior to discharge and is unlikely to present a health risk to fauna.
- The gallery will be fenced to exclude non-volant fauna.
- The sides of the gallery will be sloped to allow fauna egress.

No direct impacts to fauna habitat are proposed and significant indirect impacts to habitat, namely wetlands (Section 8.8) and vegetation (Section 8.10) are not anticipated.

8.12 Subterranean Fauna

Subterranean fauna live in cavities underground and include stygofauna, which live in groundwater and troglofauna which live above the water table.

The Tamala Limestone is a shallow, freshwater aquifer with karsts, fractures and cavities and is likely to host stygofauna and troglofauna.

Significant impacts to troglofauna are unlikely as the quarry in Area O has already been excavated and the small amount of mounding will not cause significant loss of habitat.

No dewatering is proposed for the Project, and the project will not result in loss of habitat for stygofauna. The risk of water quality impacts to stygofauna downgradient of the infiltration site is low due to treatment of water prior to discharge.

The Tamala Limestone is a regionally extensive aquifer (See Figure 8-2) and the flat water table between RSA Main and the coast indicates high habitat connectivity. As habitat is extensive and highly connected, it is unlikely that any species is confined to the Infiltration Area or WQIZ and the Project is unlikely to change the conservation status of any species, should local impacts occur.

8.13 Heritage

Aboriginal Heritage Sites (DPLH-099; DPLH-100), Local Heritage Sites (DPLH-008) and State Registered Heritage Sites (DPLH-006) are shown in Figure 8-22.

No direct disturbance to heritage sites is proposed and direct impacts are unlikely.

8.14 Soils

Project infrastructure will be located on previously disturbed areas where soils have historically been disturbed. No additional disturbance to soils is proposed.

Acid sulfate soils (ASS) are known to occur on the swan coastal plain. These soils typically form under waterlogged conditions such as those in or near wetlands, where a lack of oxygen prevents oxidation of iron sulfides in the soil profile.

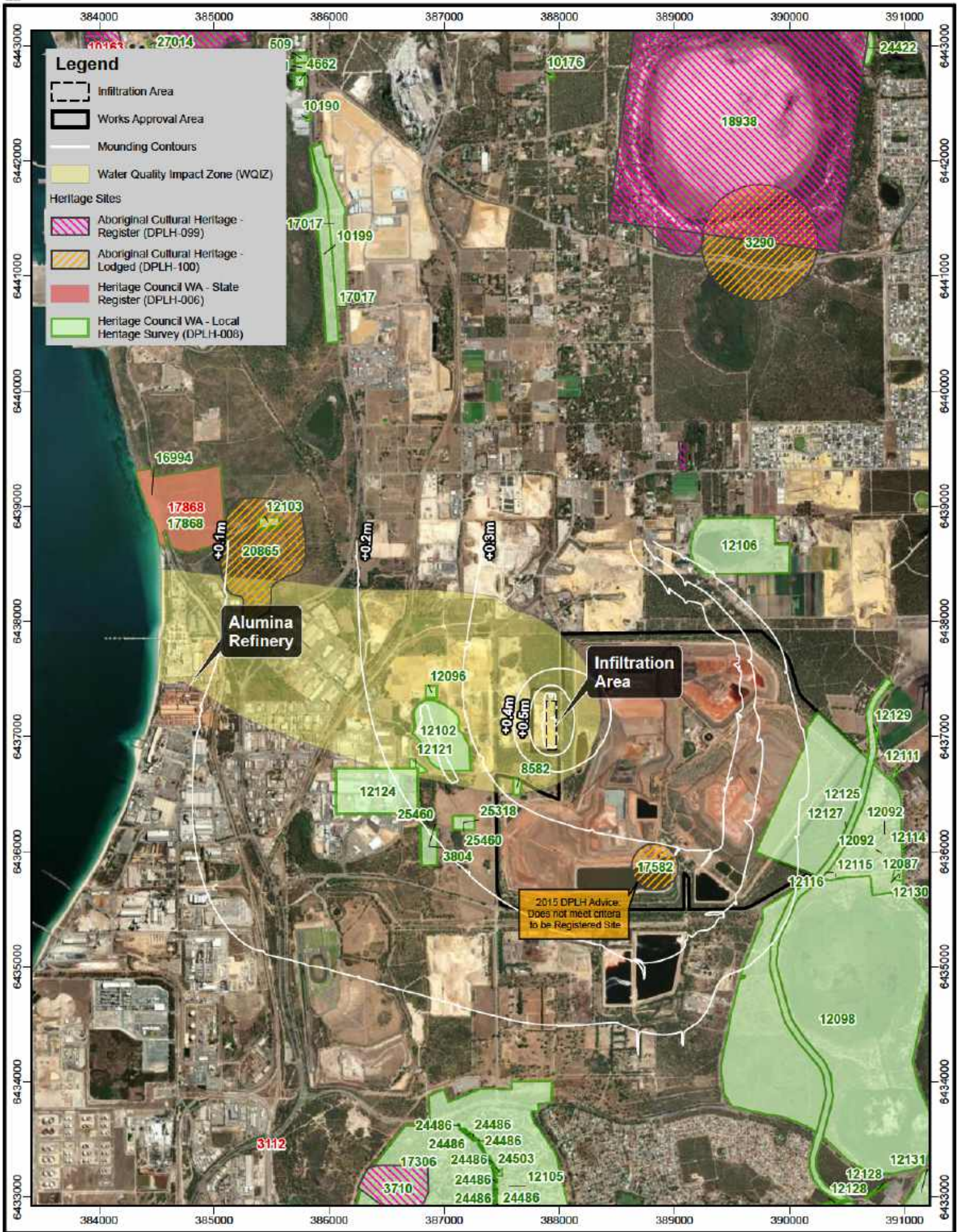
Acid sulphate soil risk mapping is shown on Figure 8-23. Although Long Swamp is identified as high risk for ASS, no ASS was identified in soil samples taken by EHS (See Section 5.6.4.1 of CORA).

As no drawdown or dewatering or handling of ASS is proposed, ASS impacts are unlikely.

8.15 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are shown in Figure 8-24. The ESAs present downgradient of the infiltration area are associated with defined wetlands (Long Swamp) or bush forever sites.

Significant impacts to ESAs are not anticipated and have been addressed in other sections of this supporting document (Section 8.8.1 for Long Swamp and Section 8.10 for Bush Forever Sites).



N

0 0.5 1

km

Scale: 1:40,000

GDA2020 MGA Zone 50

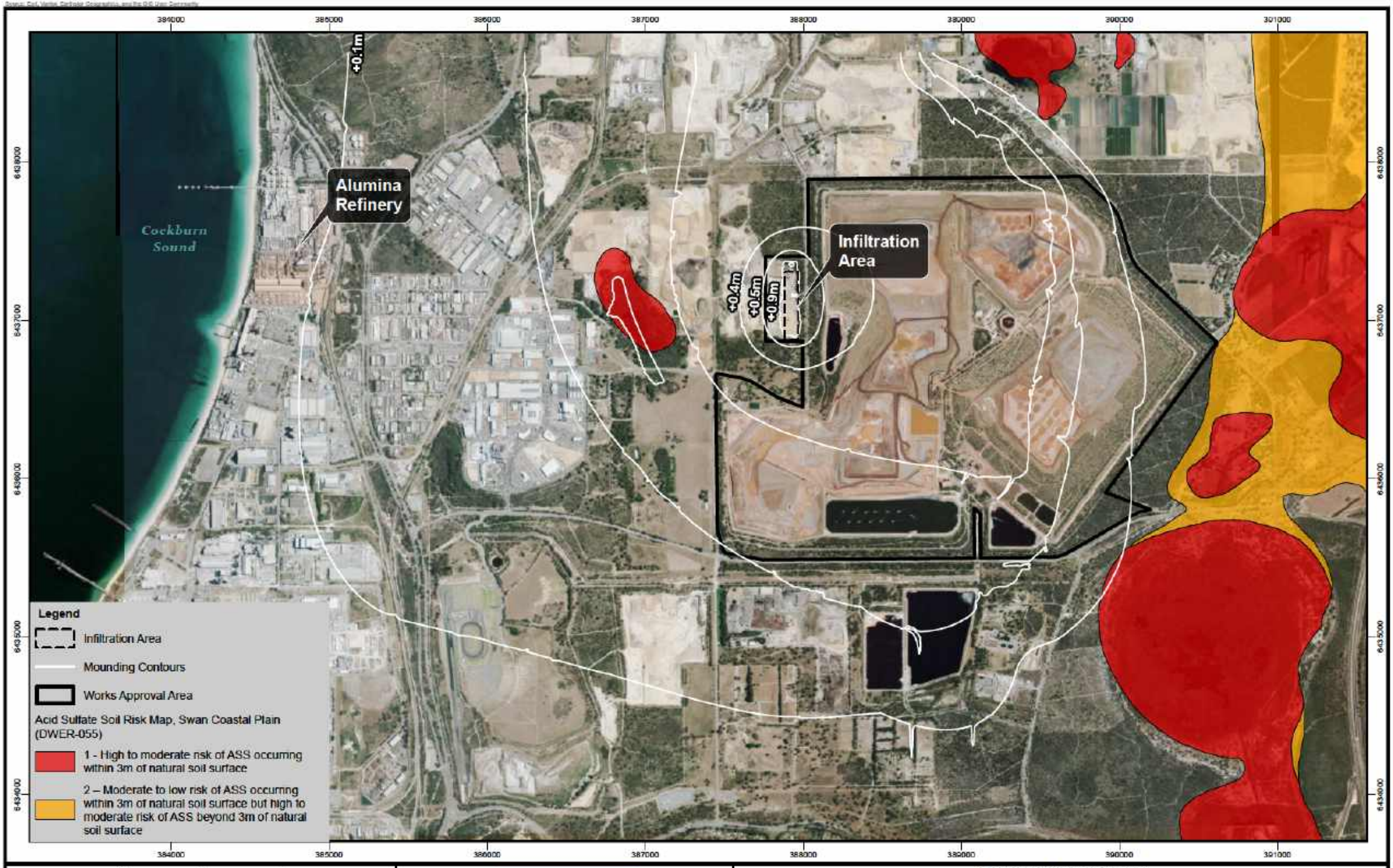
Alcoa

Kwinana Infiltration Project

Figure 8-22 Heritage

Drawing #: Figure 8-22 Heritage			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx



N

0 0.5 1

km

Scale: 1:30,000

GDA2020 MGA Zone 50

Alcoa

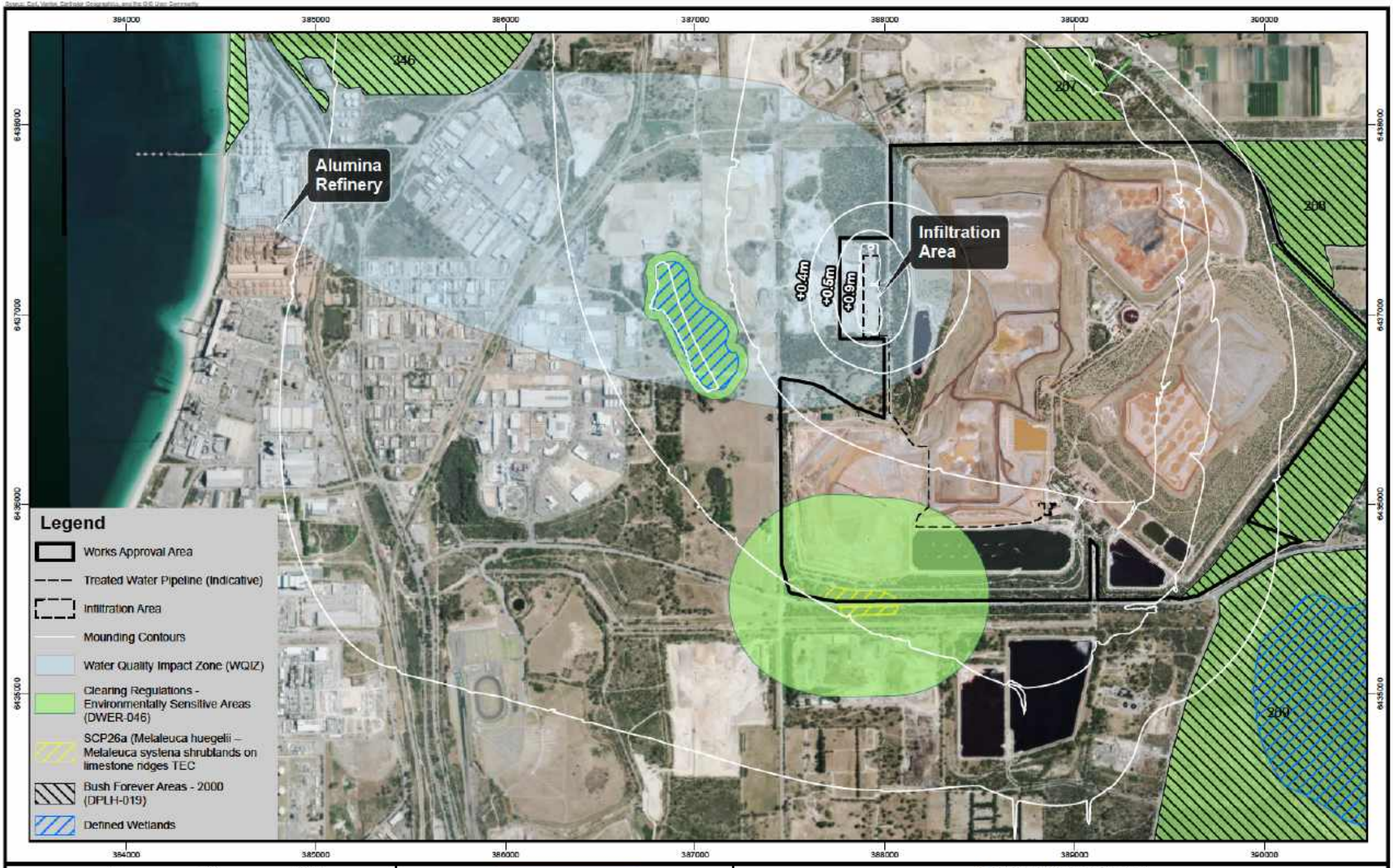
Kwinana Infiltration Project

Figure 8-23 Acid Sulphate Soils

Drawing #: Figure 8-23 Acid Sulfate Soils

Author: smita

Date: 24/03/2026 | Rev: A | A4 | Date Printed: 24/03/2026



N

0 500 1,000

Meters

Scale: 1:25,000

GDA2020 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 8-24 Environmentally Sensitive Areas

Drawing #: Figure 8-24 ESAs			Author: smita	
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026	

9. Monitoring

The MMP attached as Appendix 2 details a comprehensive adaptive monitoring and management program, developed to ensure that mounding and water quality impacts to key receptors are detected in a timely manner so that appropriate actions can be taken to avoid significant impacts.

EHS developed the MMP based on the receptors identified where plausible impact pathways exist, and the primary risks identified (See Table 9-1). The key controls in the MMP are:

- Ensuring that infiltrated water meets specification.
- Ensuring that groundwater mounding does not exceed predicted levels.
- Ensuring that infiltration does not cause a decline in groundwater quality at receptors.

The Infiltration Area is inside a quarry that has been excavated below natural ground level and where there are no receptors in the immediate area. As it will take ~12 months for infiltrated water to laterally migrate beyond Area O, EHS developed the MMP to include early warning sentinel bores inside the quarry, where there are no receptors and a set of delineation bores at the property boundary. Should water level or water quality impacts be detected in these bores, timely action can be taken to avoid significant impacts to downgradient receptors.

Key measures in the MMP are described under the headings below and are detailed in Sections 3 and 4 of the MMP (Appendix 2).

Table 9-1: Receptors and Primary Risks

Receptors with Plausible Pathways	Primary Risks	Measures in MMP
• Cockburn Sound • Long Swamp • Other multiple use and resource enhancement wetlands • Subterranean Fauna • Third-party groundwater users	• Degrading water quality within the aquifer	• Discharge to meet specification • Mounding to remain within predicted limits at contaminated sites • Monitoring of water quality
	• Increasing groundwater levels	• Mounding to remain within predicted limits.
	• Changing the aquifer and increasing its permeability	• Mineralisation of water prior to discharge.

Source: Section 7.1 of CORA (Appendix 1)

9.1 Treated Water Monitoring

9.1.1 Commissioning Testing

Commissioning testing is described in Table 9-2 and is more comprehensive than operational testing. The purpose of this testing is to confirm that each treatment plant is operating in accordance with design and that the Primary Water Quality Suite is suitable for ongoing monitoring. Water will not be discharged to infiltration galleries until commissioning testing is completed.

As treated water from the WTP and MVR Plants will be discharged directly to the ROWS Pond and the WTP will likely be commissioned prior to a works approval for infiltration being received (and therefore prior to construction of the mineralisation plant), water will be tested without being mineralised. Mineralisation is not required to demonstrate that COPCs can be removed from treated water.

If condensate from MVR plants is directed to the WTP for further RO treatment, then treated water will be considered permeate and commissioning testing will not be repeated.

The results of commissioning testing will also be used to determine:

- An appropriate conversion factor to convert EC to TDS.
- The appropriate dose rate for the mineralisation plant.

Table 9-2: Commissioning Testing Prior to Infiltration and Mineralisation

Location[1]	Analytes		Frequency
WTP; MVR Plant	General parameters:	pH; TDS; EC; TSS; alkalinity, hardness	Daily for 14 days prior to infiltration of permeate
	Radionuclides	Gross alpha and gross beta	
	Cations	Ca; Mg; Na; K	
	Anions	Chloride; Sulphate	
	Major elements/metals:	Al, Fe, Mn, Si, Ti, Cyanide, Fluoride	
	Trace elements/metals:	Ag, As, Ba, Be, Bi, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Ge, Hf, Hg, Ho, In, La, Li, Lu, Mo, Nb, Nd, Ni, Pr, Pb, Rb, Re, Sb, Sc, Se, Sm, Sn, Sr, Ta, Tb, Te, Th, Ti, Tm, U, V, W, Y, Yb, Zn, Zr	
	Nutrients	Ammonia, Total Nitrogen, Nitrite, Nitrate, Total Kjeldahl Nitrogen, Total Phosphorus, Phosphate	
	Sulfur species:	Sulfur, Carbon disulfide, Sulphate, Sulphide, Sulphite, Thiosulphate	
	Carbon species	Total Carbon, Total Inorganic Carbon, Total Organic Carbon	
	PFAS	Standard 28 analytes	
	Pesticides	Organophosphorus pesticides, organochlorine pesticides, phenols, and nitrophenols	
	Other	Methane, NDMA, Boron, Iron (Fe2+ and Fe3+)	

[1] Water will be sampled prior to mineralisation

9.1.2 Operational Testing

Once commissioning testing is completed, infiltration will commence and monitoring of infiltrated water will be according to Table 9-3. This testing will be undertaken on the water that will be discharged into the infiltration gallery after mineralisation. During 180 days of time-limited operations under a works approval, up to ~1.75 GL of treated and mineralised water may be discharged. Once infiltration operates under Environmental Licence L5245/1967/14, up to 3.5 GL/year may be discharged.

The purpose of operational testing is to ensure that:

- The remineralisation plant is functioning as intended.
- Water discharged to infiltration galleries is within quality criteria.

These purposes are achieved via continuous monitoring of pH and EC as well as weekly water quality testing. Continuous EC monitoring will indicate that water treatment plants are functioning, and EC and pH monitoring will indicate whether calcium is being dosed correctly in the mineralisation plant. Both will be confirmed with weekly laboratory testing of the discharge. Further detail is provided in Section 9.3 .

Table 9-3: Ongoing Treated Water Monitoring

Parameter[1]	Method	Frequency
Volume Infiltrated	Flow meter	Recorded Weekly
pH	Inline Sensor	Continuous
EC	Inline Sensor	Continuous
Primary Water Quality Suite[2]	Spot Sample	Weekly

[1] Water will be sampled after mineralisation, which is the last treatment stage prior to discharge.

[2] See Table 6-3 for the Primary Water Quality Suite

9.2 Groundwater Monitoring

A network of new and existing monitoring bores is proposed for the Project. The bores are described in Table 9-4; listed in the proposed monitoring schedule in Table 9-6; and shown on Figure 9-1 and Figure 9-2. Monitoring bores are broadly grouped into sentinel bores within Area O and sets of delineation bores at receptors.

Shallow bores are typically screened 3m from 0.5m above to 2.5m below the water table and deep bores screened for 3m in the basal portion of the aquifer. Note that as new bores are being installed there may be some variation between proposed and as-constructed locations. In particular:

- Development WA and WAPC are reviewing bore locations at Long Swamp to ensure that these do not conflict with planned developments including a high-pressure sewage pipeline and a walkway. Existing bores may be suitable for use.
- Alcoa is in discussion with Synergy to access existing monitoring bores at Peron Quarry. Should access be granted then the proposed Peron Quarry bores will not be installed, but suitable existing bores on the Synergy property will be used instead.

Table 9-4: Monitoring Bores

Purpose	Number	Purpose
R1 Sentinel Bores	12 x new shallow bores	Early warning hydraulics
R2 Sentinel Bores	9 x new pairs of shallow and deep bores	Early warning hydraulics Analysis of vertical migration and lateral attenuation
R3 Delineation Bores	5 x new pairs of shallow and deep bores	Early warning hydraulics Water Quality at Alcoa property boundary
Long Swamp Delineation Bores	1 x existing pair of shallow and deep bores 3 x new shallow bores	Water quality and hydraulics at receptors
Northern Site Delineation Bores	1 x existing pair of existing shallow and deep bores	
Southern Site Delineation Bores	3 x existing pairs of shallow and deep bores	
Peron Quarry Delineation Bores	3 x new shallow bores	
Other Unknown Contaminated Sites Delineation Bores	3 x pairs of existing shallow and deep bores	
RSA ABC Plume Delineation Bore	2 x pairs of existing shallow and deep bores	

N

0 0.25 0.5 1
km

Scale: 1:16,000
GDA 1994 MGA Zone 50

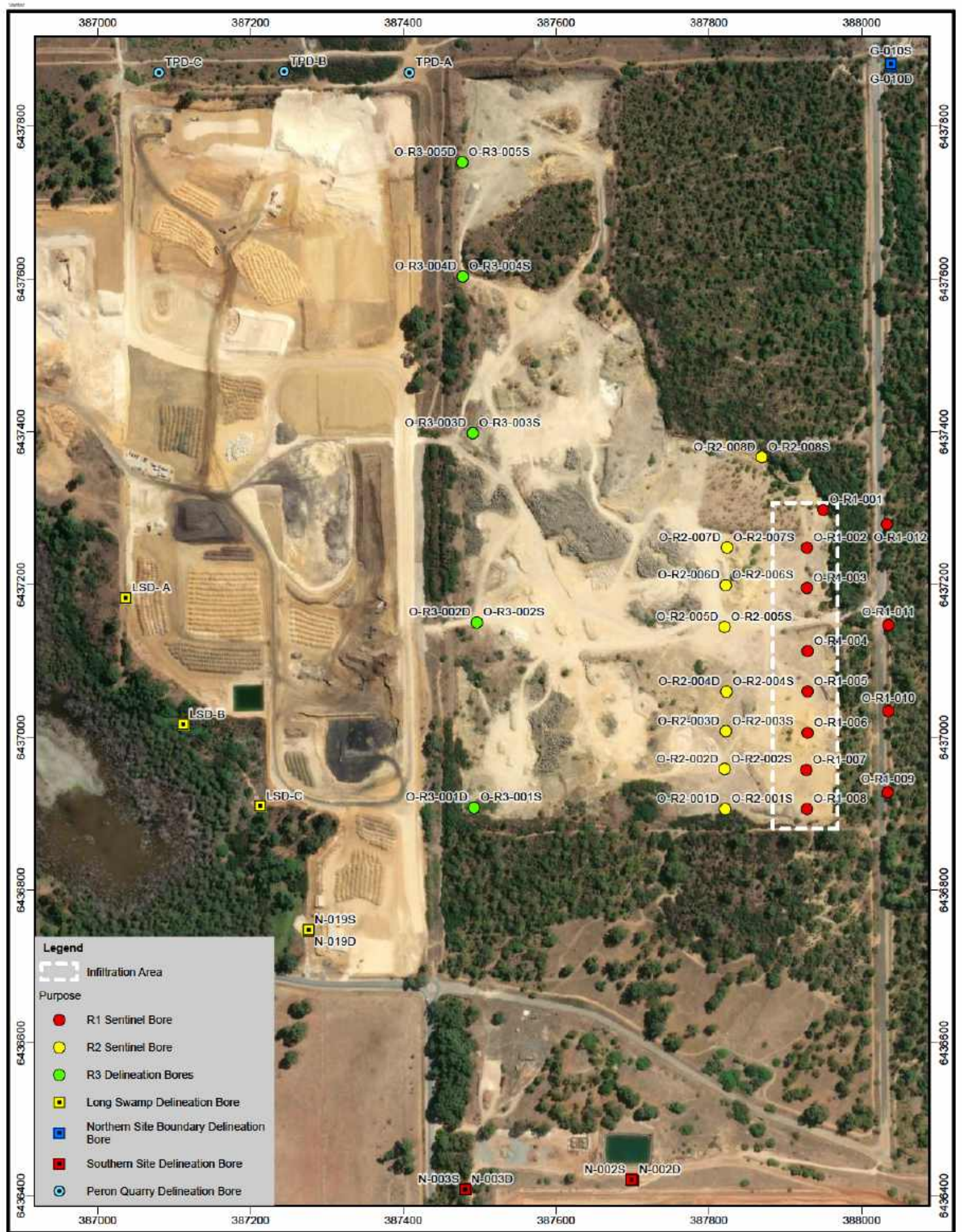
Alcoa

Kwinana Infiltration Project

Figure 9-1 Monitoring Bores

Drawing #: Figure 9-1 - All bores			Author: smita
Date: 24/03/2026	Rev: X	A3	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx



N

0 200

m

Scale: 1:6,000

GDA 1994 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 9-2 Area O Monitoring Bores

Drawing #: Figure 9-2 Area O Bores			Author: smita
Date: 24/03/2026	Rev: A	A4	Date Printed: 24/03/2026

Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

9.2.1 Baseline Monitoring

Baseline groundwater sampling to characterise water quality at receptors will be according to Table 9-5. The results will be incorporated into the existing background dataset and used to calculate Baseline UPLs, which will be applied as trigger criteria (See Section 9.3).

Baseline monitoring is currently being undertaken with the aim of obtaining 4 – 6 months of additional data from monitoring bores. It has commenced for existing bores and will commence shortly after construction of any new bores. Once infiltration commences, baseline monitoring will cease and operational monitoring will start.

Table 9-5: Baseline Groundwater Monitoring

Location	Parameters	Frequency
All monitoring bores	• Standing Water Level	Monthly
All bores and Long Swamp Surface Water (if present)	• pH, EC, TDS • Anions: Cl, SO_4, fluoride, alkalinity, hardness (total, carbonate and bicarbonate) • Cations: Ca, Mg, Na, K • Nutrients (ammonia, phosphate, phosphorus, nitrate, nitrite, ammonia, total N). • Metals Screen (Ag, Al, As, B, Ba, Be, Cd, Cr, Co, Cu, Fe, Ga, Li, Pb, Mn, Hg, Mo, Ni, Sb, Se, Sn, Sr, Th, Ti, U, V, Zn). • Other: silica, cyanide, ferrous iron • PFAS: Standard 12 analytes	

9.2.2 Operational Groundwater Monitoring

The proposed monitoring schedule is in Table 9-6. The primary water quality suite is provided in Table 6-3.

Table 9-6: Proposed Groundwater Monitoring Schedule

Purpose	Bores	Standing Water Level[1]	Water Quality[2]
R1 Sentinel Bores	O-R1-001; O-R1-003; O-R1-004; O-R1-008; O-R1-009; O-R1-006; O-R1-011	Hourly	-
	O-R1-002; O-R1-005; O-R1-007; O-R1-010; O-R1-012	Monthly	
R2 Sentinel Bores	O-R2-002S; O-R2-004S; O-R2-006S; O-R2-007D; O-R2-007S	Hourly	Hourly: EC Monthly: Na, pH and EC
	O-R2-001D; O-R2-001S; O-R2-002D; O-R2-003D; O-R2-003S; O-R2-004D; O-R2-005D; O-R2-005S; O-R2-006D; O-R2-008D; O-R2-008S; O-R2-009D; O-R2-009S	Monthly	Monthly: Na, pH and EC
R3 Delineation Bores	O-R3-002S; O-R3-004S;	Hourly	Quarterly: Primary Water Quality Suite
	O-R3-001D; O-R3-001S; O-R3-002D; O-R3-003D; O-R3-003S; O-R3-004D; O-R3-005D; O-R3-005S	Quarterly	

Purpose	Bores	Standing Water Level[1]	Water Quality[2]
Long Swamp Delineation Bores	N-019S	Hourly	Annual: Primary Water Quality Suite
	LSD-A; LSD-B; LSD-C; N-019D	Quarterly	
Northern Site Delineation Bores	G-010D; G-010S	Quarterly	Annual: Primary Water Quality Suite
Southern Site Delineation Bores	N-002D; N-002S; N-003D; N-003S; N-004D; N004S	Quarterly	Annual: Primary Water Quality Suite
Peron Quarry Delineation Bores	TPD-A; TPD-B; TPD-C	Quarterly	Annual: Primary Water Quality Suite
Other Unknown Contaminated Sites Delineation Bores	B2051D; B2051S; B2056D; B2056S; B2061D; B2061S	Quarterly	Annual: Primary Water Quality Suite
RSA ABC Plume Delineation Bore	B2057D; B2057S; B2062D; B2062S	Quarterly	Annual: Primary Water Quality Suite
Refinery Plume Delineation Bore	B2052D; B2052S; KW027D; KW027S; KW068I; KW068S	Quarterly	Annual: Primary Water Quality Suite
Upgradient Baseline	D-051D; D-051S; D-059D; D-059S; F-153D; F-153S; F-159D; F-159S	Quarterly	Annual: Primary Water Quality Suite

1 Pressure transducers installed for hourly readings (to be uploaded daily); monthly and quarterly readings are by manual gauging

2 EC loggers installed for hourly readings (to be uploaded daily); samples will taken for laboratory and field analysis for other sampling frequencies

The groundwater level monitoring in Table 9-6 is illustrated on Figure 9-3. The primary method of water level monitoring is pressure transducers in select R1, R2 and R3 bores adjacent to the Infiltration Area and one bore at Long Swamp ~750 m west.

If hourly transducer data indicates that mounding is within, or below predicted amounts, then mounding impacts at other receptors are unlikely. Monthly and quarterly water level monitoring at other bores will complement transducer data.

There are no receptors within Area O that may be impacted by groundwater mounding or changes in water quality. The purpose of water level monitoring in the R1 and R2 sentinel bores is to provide early warning of mounding above predicted levels and inform the operation of the galleries. Any excess mounding can likely be addressed by spreading or moving the active area of the infiltration galleries.

Water quality monitoring in R2 bores is for select key parameters (EC and the Na:EC Ratio) that show where infiltrated water is travelling in the Tamala Limestone. Comparison of these parameters with infiltrated water quality and background water quality will inform the level of lateral attenuation occurring which will inform potential water quality impacts at receptors. Comparison of these parameters between shallow and deep bores will show the degree of vertical migration of infiltrated water in the aquifer.

Alcoa's intention is to operate the galleries in a manner that maximises vertical migration of water to the base of the Tamala Limestone where infiltrated water will bypass ecological receptors (wetlands and vegetation) that interact with the top of the aquifer. To maximise vertical migration, Alcoa will constrain the area of infiltration to the smallest area possible inside each gallery to maximise hydraulic head and force infiltrated water downwards. The active area will not be constrained to the point where overtopping becomes a risk, or groundwater mounding above predicted levels occurs.

N

0 0.25 0.5 1
km

Scale: 1:15,000
GDA 1994 MGA Zone 50

Alcoa

Kwinana Infiltration Project

Figure 9-3 Groundwater Level Monitoring

Drawing #: Figure 9-3 Water Level Monitoring			Author: smita	
Date: 24/03/2026	Rev: X	A3	Date Printed: 24/03/2026	Path: L:\users\EApprovals\EA1P0047\Projects\EA1P0047\EA1P0047.aprx

9.3 Triggers

The MMP is an adaptive management plan, where exceedances of specified levels “trigger’ response actions. There are no receptors in the Area O quarry, and EHS separated the triggers into operational considerations at the R1 and R2 sentinel bores, which inform management of the galleries; and compliance triggers to protect receptors.

The operational triggers in Table 9-7 are preventative in that they provide early warning of groundwater mounding above predicted levels; and informative in that water quality monitoring in shallow and deep R2 Sentinel Bores will indicate the degree of lateral attenuation and vertical migration of infiltrated water in the Tamala Limestone. To the extent that it does not cause mounding beyond predicted levels or cause galleries to overtop, the operational intent is to confine water as much as possible within gallery to maximise hydraulic head and vertical migration to the base of the Tamala Limestone. The degree of lateral attenuation will also inform potential risks to down-gradient receptors.

Compliance triggers are in Table 9-8. These prevent the infiltration of off-spec water via automatic bypass to the ROWS pond if continuous EC monitoring detects an exceedance; and manual cessation of infiltration prior to the 30-day weighted average of other analytes being exceeded.

It is expected to take ~1 year for infiltrated water to reach the R3 delineation bores and then an additional year to reach the closest ecological receptor (Long Swamp) and changes in water levels will progress at the same rate. Compliance triggers applied at the R3 bores are a key component of the MMP.

The compliance triggers for water quality applied at the R3 delineation bores match the levels required to protect receptors, which are further down-gradient. Should water quality exceed criteria in R3 Bores, an increase in monitoring frequency at potentially impacted down-gradient receptors is triggered as well as investigative and mitigative actions to ensure receptors are protected.

Similarly, if mounding above predicted levels is detected in the R3 bores, then an increase in monitoring frequency at receptors is triggered as well as mitigative actions to reduce mounding to within predicted limits. Compliance triggers are also applied for other downgradient receptors.

Alcoa notes that:

- The WTP is under construction and no permeate has been produced.
- Baseline data is limited for several groundwater bores which have either been recently installed or have not been historically sampled or gauged.

For the above reasons, certain triggers are not available and will be provided prior to the commencement of infiltration:

- Commissioning testing of permeate from the WTP will determine:
    - An appropriate conversion factor for TDS and EC.
    - The required dosing rate in the mineralisation plant; high enough to prevent dissolution of the Tamala Limestone and low enough to prevent calcification.
- The results of baseline groundwater monitoring will be incorporated into the existing dataset and used to further refine baseline water levels and Baseline UPLs.

Infiltrated water and groundwater will be sampled for the Primary Water Quality Suite (described in Section 6.3.3). Some of the analytes in this suite were included for informational purposes and no trigger is proposed for these. For clarity and completeness, the Primary Water Quality Suite is replicated in Table 9-9 with the trigger values for water quality in infiltrated water and groundwater.

As additional data will continue to be collected before and after commencement of infiltration, Alcoa anticipates that the monitoring schedule and triggers may be reviewed when the Project transitions to operating under Environmental Licence L5245/1967/14.

Alcoa

Table 9-7: Operational Considerations

Location	Indicator	Actions	Purpose
Infiltrated Water	Post-mineralisation pH and EC indicates calcium saturation	• Reduce dosing rate at mineralisation plant and/or adjust pH	Prevent precipitation of calcium and clogging of aquifer
	Weekly testing indicates hardness does not meet the criteria to prevent dissolution	• Adjust dosing rate at mineralisation plant • Retest to confirm hardness is within specified range	Prevent dissolution of Tamala Limestone
Infiltration Trench	Calcification evident in trench	• Reduce dosing rate at mineralisation plant in 5 mg/L $CaCO_3$eq increments • Manually break up calcified areas inside trench	Avoid calcification in the infiltration trench
	Water is not contained within infiltration gallery	• Spread infiltration over a wider area or move to a different section of gallery.	To ensure infiltration trenches do not overtop.
R1 Sentinel Bores with Pressure Transducers (O-R1-001, O-R1-003, O-R1-004, O-R1-006, O-R1-008, O-R1-009, O-R1-011)	30-day average groundwater level within 0.2m of surface in at least one monitoring bore	• Manual gauging to validate transducer data. • Review climatic and regional water level data to determine if the mounding is within the natural variability of groundwater level fluctuation. • Review hydraulic data from R2 Sentinel Bores and R3 Delineation Bores and confirm if groundwater mounding (if present) is within predicted bounds. • If required after the data review, within 30 days define appropriate response measures such as spreading infiltration water further across the trench length and/or reduce infiltration rates and/or bypass to ROWS Pond and/or modifications to lime dosing (if clogging is an issue)	Early warning to prevent mounding above predicted levels at receptors. Measure infiltration efficiency over time.

Location	Indicator	Actions	Purpose
R2 Sentinel Bores with Pressure Transducers (O-R2-002S, O-R2-004S, O-R2-006S, O-R2-007S, O-R2-007D)	• 30-day average groundwater level within 0.5m of surface in at least one monitoring bore with a pressure transducer.	• Manual gauging of all R2 Sentinel Bores to validate pressure transducer data and provide a spatial understanding of groundwater levels. • Review climatic and regional water level data to determine if the mounding is within the natural variability of groundwater level fluctuation. • Review hydraulic data from R3 Delineation Bores and confirm if groundwater mounding (if present) is within predicted bounds. • If required after the data review, within 30 days define appropriate response measures such as spreading infiltration water further across the trench length and/or reduce infiltration rates and/or modifications to the infiltration trench depth and configuration.	• Early warning to prevent mounding above predicted levels at receptors. • Measure infiltration efficiency over time
R2 Sentinel Bores with Pressure Transducers (O-R2-002S, O-R2-004S, O-R2-006S, O-R2-007S, O-R2-007D)	• Comparison of EC changes in shallow and deep screened monitoring bores. No set action.	• Complete a review of water quality data from both the shallow and deep screened bores on a quarterly frequency to assess vertical migration and to inform changes or optimisation of the operation of the infiltration trenches. • Compare water quality to baseline and to infiltrated water quality on a quarterly basis and estimate the magnitude of mixing and dilution (or lateral attenuation) that is occurring and whether it is consistent with expectations (model results). • If water quality changes are evident in shallow screened monitoring bores and not consistent with expectations, constrain the infiltration area within galleries to maximise hydraulic head and encourage vertical migration of water (to the extent that this does not cause overtopping or mounding).	• To improve understanding of vertical migration • Characterise the magnitude of mixing and dilution
R2 Sentinel Bores O-R2-001S, O-R2-001D, O-R2-002S, O-R2-002D, O-R2-003S, O-R2-003D, O-R2-004S, O-R2-004D, O-R2-005S, O-R2-005D, O-R2-006S, O-R2-006D, O-R2-007S, O-R2-007D; O-R2-008S, O-R2-008D)	• Comparison of changes in Na:EC ratio in shallow and deep screened monitoring bores. No set action level specified		

Source: Table 4-1 of MMP (Appendix 2)

Alcoa

Table 9-8: Compliance Triggers

Location	Trigger	Action	Purpose
Infiltrated Water	• EC of treated water after mineralisation exceeds 925 µS/cm.	• Treated water automatically directed to the ROWS pond and will not be infiltrated. • Investigate and resolve potential causes in the Water Treatment Plant(s). • Resume infiltration once EC is within the required specification.	• To demonstrate that water treatment is effective and to ensure that off-spec water is not infiltrated, protecting all receptors
	• Weekly sampling results exceed compliance criteria *Compliance criteria for infiltrated water are in Table 9-9	• Resample to confirm water quality results • Forecast to determine when the 30-day flow-weighted average will exceed specification. • Notify regulator with forecast results if water quality is not improved. • Investigate and resolve potential causes in the Water Treatment Plant(s). • Review internal testing from each Water Treatment Plant. If reason for exceedance can be isolated to a particular treatment plant, consider bypassing that plant to the ROWS Pond. • Resample after corrective actions taken to confirm water quality meets compliance criteria. • If water is still not within compliance criteria, stop infiltration prior to 30-day flow weighted average concentrations exceeding compliance criteria. • Investigate and resolve potential causes in Water Treatment Plant(s). • Resume infiltration once water quality meets specification.	• To demonstrate that water treatment is effective and to ensure that off-spec water is not infiltrated, protecting all receptors
	• 30-day flow weighted average concentrations of primary water quality parameters exceeds compliance criteria *Compliance criteria for infiltrated water are in Table 9-9	• Cease infiltration (for example, bypass to ROWS Pond) • Investigate and resolve potential causes in water treatment plant(s) • Resample after corrective actions taken to confirm water meets compliance criteria. • Resume infiltration once water quality meets specification.	• To demonstrate that water treatment is effective and to ensure that off-spec water is not infiltrated, protecting all receptors

Location	Trigger	Action	Purpose
R3 Delineation Bores with Pressure Transducers (O-R3-001S, O-R3-001D	• 30-day moving average groundwater level 0.5m above baseline in at least one monitoring bore • Interim trigger (applicable for first 12 months of operation). Baseline calculated using available monitoring data at the time infiltration commenced. • Proposed Future Trigger: Baseline revised over a longer time period. Time period to be decided based on review of water levels in R1 and R2 bores and climate data. Note that it will take over 12 months after commencement for any mounding to reach R3 bores.	• Manual gauging to validate pressure transducer data • Review of water levels in R1 and R2 Sentinel Bores and regional groundwater level data to determine if infiltration is the cause, or if water levels are within natural variability. • Increase frequency of manually measuring the standing groundwater levels in down-gradient delineation bores by receptors to monthly (note there are water level triggers for these bores below) • Move or spread infiltration within galleries to reduce mounding in monitoring bores with exceedance. • If required, reduce infiltration rate to reduce mounding in monitoring bores with exceedance. • Resume normal frequency of monitoring in down-gradient delineation bores once groundwater levels in R3 delineation bores are <0.5m above baseline. • If infiltration rate was slowed, incrementally increase rate once groundwater levels in R3 delineation bores are <0.5m above baseline.	• Early warning for mounding and associated flux increases higher than predicted at all downgradient receptors

Location	Trigger	Action	Purpose
R3 Delineation Bores (O-R3-001D; O-R3-001S; O-R3-002D; O-R3-002S O-R3-003D; O-R3-003S; O-R3-004D; O-R3-004S; O-R3-005D; O-R3-005S)	• Primary water quality parameters exceed Background UPL (and Baseline UPL once available) and one of: • 95% ANZG • NPUG • Cockburn Sound Criteria.	• Resample to validate results. • Identify potentially impacted down-gradient receptors based on Tier 1 criteria exceedances. • Evaluate attenuation between infiltration galleries and R3 Delineation Bores to predict concentrations once groundwater reaches receptor sites. • Review infiltration water quality and water quality in R1 and R2 bores to determine source of water quality change and whether infiltration is the cause. • Assess potential pathways to receptors based on whether exceedance is in shallow or deep screened R3 Delineation Bores (for example, an exceedance in deep bores is less likely to impact wetland receptors than an exceedance in shallow bores as wetlands interact with the top of the surficial aquifer). • Increase frequency of water quality sampling at relevant down-gradient receptors to quarterly. • If analysis indicates that attenuation is insufficient to protect receptors, implement actions to improve water quality. For example, move or spread infiltration within galleries or reduce the infiltration rate. • Resume normal frequency of monitoring once water quality in R3 Delineation Bores is with trigger level.	• Early warning to prevent water quality impacts at down-gradient receptors

Location	Trigger	Action	Purpose
Long Swamp Delineation Bores (LSD-A; LSD-B; LSD-C; N-019S; N-019D)	• Water level above 1.5mAHD at N-019S. N-019S is the only existing monitoring bore adjacent to Long Swamp with long term groundwater level data. • Water level >0.3m above baseline in LSD-A, LSD-B, LSD-C Interim baseline is the maximum recorded water level prior to commencing infiltration Revised baseline is the maximum groundwater level calculated over a longer time period. Time period to be decided based on review of water levels in R1, R2 and R3 bores and climate data. Note that it will take over 24 months after commencement for any mounding to reach Long Swamp.	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Validate groundwater level data by manually gauging all Long Swamp Delineation Bores. • Review groundwater level data from surrounding groundwater monitoring bores and determine if mounding is within the natural variability of groundwater level fluctuations. • Measure the height of water in Long Swamp (if present) and collate regional groundwater and rainfall data • If surface water in Long Swamp is above 1.1m AHD, complete hydrogeological assessment to determine whether the water level is due to groundwater fluxes and if so evaluate potential risks to vegetation from mounding. This assessment may be supported by sampling Long Swamp and the Long Swamp Delineation Bores and subsequent analysis for the primary water quality suite. • Discuss findings with Regulator. • If impacts to Long Swamp are not observed and/or not associated with groundwater infiltration, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates; or seeking approval for reinjection bores	• Prevention of inundation and waterlogging of vegetation in Long Swamp above the predicted 1.1m AHD level (unrelated to climatic events)

Location	Trigger	Action	Purpose
Long Swamp Delineation Bores (LSD-A; LSD-B; LSD-C; N-019S; N-019D)	• Primary water quality parameters exceed Background UPL (and Baseline UPL once available) and 95% ANZG	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Validate water quality results by resampling Long Swamp Delineation Bores. • Measure the height of water in Long Swamp and collate regional groundwater and rainfall data (if present) • Review groundwater hydraulic and climate data and water quality data from R2 and R3 Sentinel Bores to determine the source of water quality change. Complete assessment to determine axis of concentration change and potential causation. • Complete hydrogeological assessment to evaluate potential risks to Long Swamp and confirm groundwater surface water interaction mechanisms. This assessment may be supported by sampling Long Swamp and subsequent analysis for the primary water quality suite. • Discuss findings with Regulator • If impacts to Long Swamp are not observed and/or not associated with groundwater infiltration, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include, from least to most intensive, do nothing, spreading infiltration water across the entire trench length, reducing infiltration rates, complete an ecological risks assessment (the most intensive actions may take longer than the 60 day anticipated time frame).	• To assess whether groundwater concentrations have the potential to impact water quality within Long Swamp (unrelated to climatic events such as evapo-concentration)

Location	Trigger	Action	Purpose
Peron Quarry Third Party Plume Delineation Bores (TPD-A; TPD-B-TPD-C)	• Standing water level >0.4m above baseline. Baseline is the maximum water level recorded during baseline period (time period to be determined based on climate factors) *Note that Alcoa is in talks with Synergy to use existing bores at Peron Quarry. If these existing bores are suitable, TPD A – C will not be installed. Suitable trigger levels based on bore location and baseline data will be determined prior to commencement of infiltration. The methodology to calculate the trigger level is to add 0.4 m to the maximum groundwater level recorded during the baseline period (time period to be determined based on climate factors).	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Manual gauging to Validate groundwater level data • Confirm that the groundwater level trigger has been exceeded. Determine if mounding is within the natural variability of groundwater level fluctuations. • Confirm if other anthropogenic activities may have influenced groundwater levels, such as third-party pumping or infiltration. • Complete hydrogeological assessment to evaluate potential risks to the Peron Quarry Plume. This assessment may include actions such as climatic analysis, third party groundwater operations review, groundwater gauging and sampling of other third party owned monitoring bores (cross gradient and downgradient of existing plume) and/or numerical modelling. • Discuss findings with Regulator. • If impacts to the Peron Quarry Third Party Plume are not observed, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates.	• Prevent mounding and associated flux above predicted levels at Peron Quarry

Location	Trigger	Action	Purpose
Southern Site Delineation Bores (N-002S/D, N-003S/D, N-004S/D)	• Groundwater levels exceed trigger level Trigger levels have been derived for the deeper screened bores as described below: • N-002D = 1.26 + 0.3 = 1.56 mAHD • N-003D = 1.26 + 0.3 = 1.56 mAHD • N-004D = 1.1 + 0.3 = 1.40 mAHD There is no baseline data for shallow bores. The methodology to calculate the trigger level at the shallow bores is to add 0.3 m to the maximum groundwater level recorded during the baseline period (time period to be determined based on climate factors).	• ***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Validate groundwater level data by manually gauging all Southern Site Delineation Bores. • Confirm that the groundwater level trigger has been exceeded. Determine if mounding is within the natural variability of groundwater level fluctuations. • Confirm if other anthropogenic activities may have influenced groundwater levels, such as third-party pumping or infiltration (i.e. from Water Corporation). • Increase frequency of groundwater level monitoring to monthly in RSA ABC Delineation Bores and Other Unknown Contaminated Sites Delineation Bores, which are down-gradient. • Complete hydrogeological assessment to evaluate potential risks to downgradient receptors. This assessment may include actions such as climatic analysis, third party groundwater operations review, groundwater gauging and sampling of other Alcoa monitoring bores (cross gradient and downgradient) and/or analytical/numerical modelling. • Discuss findings with Regulator. • If impacts on receptors are not observed, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates. • Once groundwater levels fall below trigger levels, increase infiltration rate and resume normal frequency of monitoring.	• Confirm that mounding and associated flux changes are within predicted levels • To assess water quality impacts on other potential surface water receptors

Location	Trigger	Action	Purpose
Southern Site Delineation Bores (N-002S/D, N-003S/D, N-004S/D)	• Primary water quality parameters exceed Background UPL (and Baseline UPL once available) and one of: • NPUG • Cockburn Sound Criteria.	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Confirm that primary water quality parameters exceed both the Background UPL and relevant Tier 1 screening criteria. • Validate water quality results by resampling Southern Site Delineation Bores. • Review groundwater hydraulic data and water quality data from R2 and R3 Sentinel Bores to determine the source of water quality change. Complete assessment to determine axis of concentration change and potential causation. • Identify potential downgradient receptors that may be at risk of impacts. • Complete hydrogeological assessment to evaluate potential risks to relevant receptors and confirm groundwater surface water interaction mechanisms. This assessment may be supported by sampling surface water receptors and subsequent analysis for the primary water quality suite. • Discuss findings with Regulator. • If impacts on receptors are not observed or predicted, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates and/or completing an ecological risks assessment.	• Prevention of water quality impacts at down-gradient receptors (Cockburn Sound and Groundwater Users) • To assess water quality impacts on other potential surface water receptors
Northern Site Boundary Delineation Bores (G-001S; G-001D)	• Standing water level >0.4m above baseline • Baseline is the maximum groundwater level recorded during the baseline period (time period to be determined based on climate factors).	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Validate groundwater level data by manually gauging all Northern Site Boundary Delineation Bores. • Confirm that the groundwater level trigger has been exceeded. Determine if mounding is within the natural variability of groundwater level fluctuations. • Confirm if other anthropogenic activities may have influenced groundwater levels, such as third-party pumping or infiltration. • Increase frequency of groundwater level monitoring at Peron Quarry Delineation Bores to monthly. • Implement action to lower groundwater level such as moving or spreading infiltration within galleries. • Once groundwater levels fall below trigger levels, resume normal frequency of monitoring.	• Confirm that mounding and associated flux changes are within predicted levels

Location	Trigger	Action	Purpose
Northern Site Boundary Delineation Bores (G-001S; G-001D)	• Primary water quality parameters exceed Background UPL (and Baseline UPL once available) and one of: • NPUG • Cockburn Sound Criteria	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Confirm that primary water quality parameters exceed both the Background UPL and relevant Tier 1 screening criteria. • Validate water quality results by resampling the Northern Site Boundary Delineation Bores. • Review groundwater hydraulic data and water quality data from R2 and R3 Sentinel Bores to determine the source of water quality change. Complete assessment to determine axis of concentration change and potential causation. • Identify potential downgradient receptors that may be at risk of impacts. • Complete hydrogeological assessment to evaluate potential risks to relevant receptors • Discuss findings with Regulator. • If impacts on receptors are not observed or predicted, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates.	• Prevention of water quality impacts at down-gradient receptors (Cockburn Sound and Groundwater Users)

Location	Trigger	Action	Purpose
Refinery Plume Delineation Bores (KW027S/D, KW068I, B2052S/D)	• Groundwater levels exceed: • 0.70 + 0.15 = 0.85 mAHD at KW027S • 0.73 + 0.15 = 0.88 mAHD at KW027D • 1.12 + 0.15 = 1.27 mAHD at KW068I • 0.92 + 0.15 = 1.07 mAHD at B2052S • 0.93 + 0.15 = 1.08 mAHD at B2052D These trigger levels have been calculated by adding 0.15 m to the maximum groundwater elevation recorded since 2016.	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Validate groundwater level data by manually gauging all Refinery Delineation Bores. • Confirm that the groundwater level trigger has been exceeded. Determine if mounding is within the natural variability of groundwater level fluctuations. • Confirm if other anthropogenic activities may have influenced groundwater levels, such as third-party infiltration and/or irrigation. • Gauge additional downgradient monitoring bores across the Refinery to assess gradient and flux changes. • Complete hydrogeological assessment to evaluate potential risks to Cockburn Sound from plume migration. This assessment may include actions such as climatic analysis, Alcoa groundwater operations review, groundwater gauging and sampling of other Alcoa monitoring bores (cross gradient and downgradient) and/or analytical/numerical modelling. • Discuss findings with Regulator. • If impacts on receptors are not observed, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates and/or increasing recovery of groundwater across the Refinery recovery bore network. • Once groundwater levels fall below trigger levels, increase infiltration rate (if reduced).	• Prevention of water quality impacts to Cockburn Sound due to plume migration

Location	Trigger	Action	Purpose
	• Primary water quality parameters exceed Background UPL (and Baseline UPL once available) and Cockburn Sound Criteria.	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Confirm that primary water quality parameters exceed both the Background UPL and relevant Tier 1 screening criteria. • Validate water quality results by resampling the Refinery Plume Delineation Bores. • Review groundwater hydraulic data and water quality data from existing upgradient/cross-gradient and downgradient Alcoa monitoring bores. Complete assessment to determine axis of concentration change and potential causation. • Complete hydrogeological assessment to evaluate potential risks to Cockburn Sound and confirm groundwater surface water interaction mechanisms. Other data gaps to be addressed include: • Are the changes in water quality in the Refinery Delineation Bores associated with upgradient infiltration activities (i.e. mounding observed and/or groundwater geochemistry changes are consistent with the infiltrated water) • Are there indicators of deleterious changes in water quality within the downgradient Refinery and foreshore area. • Are there other indicators of increases of contaminant flux to the marine environment • This assessment may be supported by sampling other monitoring bores and the marine environment (i.e. sampling downgradient bores to determine if the plume has migrated). • Discuss findings with Regulator. • If impacts to Cockburn Sound are not observed or predicted, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates and/or increasing recovery of groundwater across the Refinery recovery bore network. • Resume normal operations once groundwater quality is within trigger criteria.	• Prevent water quality impacts to Cockburn Sound

Location	Trigger	Action	Purpose
RSA ABC Plume Delineation Bores (B2057S; B2057D; B2062S; B2062D)	• Groundwater level exceeds: • 1.02 + 0.15 = 1.17 mAHD at B2057S. • 1.03 + 0.15 = 1.18 mAHD at B2057D. • 1.28 + 0.15 = 1.43 mAHD at B2062S. • 1.14 + 0.15 = 1.29 mAHD at B2062D. • These trigger levels have been calculated by adding 0.15 m to the maximum groundwater elevation recorded since 2016.	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Validate groundwater level data by manually gauging all RSA ABC Delineation Bores. • Confirm that the groundwater level trigger has been exceeded. Determine if mounding is within the natural variability of groundwater level fluctuations. • Confirm if other anthropogenic activities may have influenced groundwater levels, such as third-party pumping or infiltration. • Complete hydrogeological assessment to evaluate potential risks to downgradient receptors and determine whether flux changes will cause plume migration. This assessment may include actions such as climatic analysis, third party groundwater operations review, groundwater gauging and sampling of other Alcoa monitoring bores (cross gradient and downgradient) and/or analytical/numerical assessment. • Discuss findings with Regulator. • If impacts on receptors are not observed, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates and/or implementing changes in recovery bore operations at RSA ABC. • Once groundwater levels fall below trigger levels, resume normal operations.	• Prevent mounding and associated flux above predicted levels at RSA ABC that may cause to plume migration

Location	Trigger	Action	Purpose
RSA ABC Plume Delineation Bores (B2057S; B2057D)	• Primary water quality parameters exceed Background UPL (and Baseline UPL once available) and one of: • NPUG • Cockburn Sound Criteria.	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Confirm that primary water quality parameters exceed both the Background UPL and relevant Tier 1 screening criteria. • Validate water quality results by resampling the RSA ABC Plume Delineation Bores. • Identify potential downgradient receptors that may be at risk of impacts. • Review groundwater hydraulic data and water quality data from existing upgradient/cross-gradient and downgradient Alcoa monitoring bores. Complete assessment to determine axis of concentration change and potential causation. Assess hydraulic changes (i.e., mounding) and determine if flux change can potentially cause plume migration. • Complete hydrogeological assessment to evaluate potential risks to relevant receptors. This assessment may be supported by sampling additional monitoring bores for the primary water quality suite and increasing the frequency of sampling of the RSA ABC Plume Delineation Bores. • Discuss findings with Regulator • If impacts on receptors are not observed or predicted, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates and/or implementing changes in recovery bore operations at RSA ABC. • Resume normal operations once groundwater quality is within trigger criteria.	• To evaluate whether the existing plume may migrate and impact downgradient receptors

Location	Trigger	Action	Purpose
Other Unknown Contaminated Sites Delineation Bores (B2051S/D, B2055S/D, B2061S/D)	• Groundwater levels exceed: • 1.15 + 0.15 = 1.3 mAHD at B2051S • 1.13 + 0.15 = 1.28 mAHD at B2051D • 1.14 + 0.15 = 1.29 mAHD at B2056S • 1.07 + 0.15 = 1.22 mAHD at B2056D • 1.10 + 0.15 = 1.25 mAHD at B2061S • 1.05 + 0.15 = 1.20 mAHD at B2061D • These trigger levels have been calculated by adding 0.15 m to the maximum groundwater elevation recorded since 2016.	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Validate groundwater level data by manually gauging all Other Unknown Contaminated Sites Delineation Bores. • Confirm that the groundwater level trigger has been exceeded. Determine if mounding is within the natural variability of groundwater level fluctuations. • Confirm if other anthropogenic activities may have influenced groundwater levels, such as third-party pumping or infiltration. • Complete hydrogeological assessment to evaluate potential risks to downgradient receptors and determine whether flux changes will cause plume migration. This assessment may include actions such as climatic analysis, third party groundwater operations review, groundwater gauging and sampling of other monitoring bores (cross gradient and downgradient) and/or analytical/numerical modelling. • Discuss findings with Regulator. • If impacts on receptors are not observed, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates. • Once groundwater levels fall below trigger levels, increase infiltration rate (if reduced).	• Prevent mounding and associated flux above predicted levels at Unknown contaminated sites may cause plume(s) to migrate (if present)

Location	Trigger	Action	Purpose
Other Unknown Contaminated Sites Delineation Bores (B2051S/D, B2055S/D, B2061S/D)	• Primary water quality parameters exceed Background UPL (and Baseline UPL once available) and one of: • NPUG • Cockburn Sound Criteria.	***Determine the potential for unacceptable risk by completion of the following systematic steps (within 60 days of notification)*** • Confirm that primary water quality parameters exceed both the Background UPL and relevant Tier 1 screening criteria. • Validate water quality results by resampling the Delineation Bores. • Identify potential downgradient receptors that may be at risk of impacts. • Review groundwater hydraulic data and water quality data from existing upgradient/cross-gradient and downgradient monitoring bores. Complete assessment to determine axis of concentration change and potential causation. Assess hydraulic changes (i.e., mounding) and determine if flux change can potentially cause plume migration. • Complete hydrogeological assessment to evaluate potential risks to relevant receptors. This assessment may be supported by sampling additional monitoring bores for the primary water quality suite and increasing the frequency of sampling of the Delineation Bores. • Discuss findings with Regulator • If impacts on receptors are not observed or predicted, continue at current infiltration rate. • If impacts are observed or predicted based on the assessment, implement actions following Regulator discussion. These actions may include spreading infiltration water across the entire trench length and/or reducing infiltration rates. • Resume normal operations once groundwater quality is within trigger criteria.	• To evaluate whether unknown contamination may migrate and impact downgradient receptors, such as existing groundwater users or Cockburn Sound

Source: Table 4-2 of MMP (Appendix 2)

Alcoa

Table 9-9: Compliance Criteria for Infiltrated Water and Groundwater Quality Triggers

Primary Water Quality Suite Parameters		Units	Compliance Criteria for Infiltrated Water	Groundwater Triggers				
				Background UPL**	Tier 1 Screening Criteria			
					NPUG	Irrigation	95% ANZG	Cockburn Sound
General Parameters	pH	pH unit-	6-5 - 8.5	No trigger applied				
	TDS	mg/L	600	1,093	NC	NC	NC	NC
	Alkalinity	mg/L as $CaCO_3$	No trigger applied	No trigger applied				
	Hardness	mg/L as $CaCO_3$	*	No trigger applied				
Major Cations	Calcium	mg/L	*	350	NC	NC	NC	NC
	Magnesium	mg/L	5.0	40	NC	NC	NC	NC
	Sodium	mg/L	150	129	NC	NC	NC	NC
	Potassium	mg/L	No trigger applied	10.1	NC	NC	NC	NC
Major Anions	Chloride	mg/L	17.5	222	250	NC	NC	NC
	Fluoride	mg/L	0.5	0.41	15	2.0	1.7	NC
	Sulfate	mg/L	50.0	640	1,000	NC	NC	NC
	Nitrate	mg/L	No trigger applied	47.4	500	NC	29	121.6
Metals	Aluminium	mg/L	0.2	0.04	0.2	20	0.055	0.086
	Arsenic	mg/L	0.01	0.03	0.1	2.0	0.013	0.017
	Boron	mg/L	0.9	0.13	40	NC	0.940	5.1
	Gallium	mg/L	0.005	0.002	NC	NC	NC	1.1
	Molybdenum	mg/L	0.1	0.007	0.5	0.05	0.034	6.2
	Nickel	mg/L	0.002	0.002	0.2	2.0	0.011	0.20
	Selenium	mg/L	0.01	0.004	0.1	0.05	0.011	0.01
	Tin	mg/L	0.002	0.001	NC	NC	NC	NC
	Vanadium	mg/L	0.01	0.009	NC	0.5	0.006	0.160

Source: Table 4-3 of MMP (Appendix 2).

NC = No criteria

* Hardness and calcium criteria in infiltrated water to calculated from Commissioning Phase testing results using cation/anion data and geochemical models to define limits below calcite precipitation levels.

** Baseline UPL to be updated with data collected prior to commencement of infiltration

10. Other Approvals and Consultation

10.1 Stakeholder and Community Consultation

10.1.1 DWER

Alcoa has a regular monthly meeting with representatives of the Industry Licencing, Water, and Contaminated Sites branches of DWER. These meetings have included discussions on trials for supporting studies, siting of infrastructure, approvals pathways and likely timing of submissions.

A pre-application meeting was held with representatives from the Industry Licensing and Contaminated Sites branches of DWER on 20 January 2026. Alcoa presented an overview of the Project, the CORA, and potential impacts to contaminated sites and key receptors. Subsequent discussions included the potential for cumulative noise impacts and the identification of contaminated sites that are not on the public contaminated sites register. In subsequent emails, DWER provided details of potentially contaminated land, which was subsequently included in the CORA and MAR.

Representatives of the Contaminated Sites Branch of DWER visited the Kwinana Refinery on 20 February 2024. The visit included Area O and RSA Main as well as other matters relevant to closure of the refinery and RSAs.

10.1.2 WA Planning Commission

The WA Planning Commission currently holds title over part of Long Swamp. Alcoa obtained the necessary access permits for all sampling and survey work to support the Project.

Alcoa contacted the WAPC regarding the installation of additional monitoring bores around Long Swamp and offered to provide further information on the Project. A site visit with the property officer was undertaken on 19 December 2025.

10.1.3 Development WA

Alcoa had a Teams meeting on 21 January 2026 with Development WA to discuss the Project and additional monitoring bores at Long Swamp. Alcoa provided background on the Project and discussed the need for additional monitoring bores. Development WA noted that a walkway and high pressure sewage pipeline were planned and undertook to provide input on locations and whether existing bores on their land might be suitable. An Access Licence was obtained for sampling and other survey work.

10.1.4 Groundwater Licence Holders

Alcoa contacted the holders of each groundwater licence inside the WQIZ via a letter sent to the address on the water register. The letter included a description of the Project and contact details for any further enquiries. The letter also noted that licence holders could contact DWER directly, and/or provide feedback during the works approval advertising period.

A copy of the letter is provided in Appendix 5. No responses were received.

10.1.5 Synergy

Synergy implements a site management plan on Lot 1 on Plan 24276, Peron Quary. Alcoa consulted with Synergy regarding the Project as well as access to existing bores and the proposed monitoring program. Discussions are ongoing.

10.1.6 Holder of Lot 170 on Plan 300773

Lot 170 on Plan 300773 includes part of Long Swamp and the land between Long Swamp and Area O. Alcoa consulted with the holder over access to Long Swamp for environmental studies, the locations of environmental monitoring bores, and other aspects of the Project.

10.1.7 Community

Alcoa provides regular updates to stakeholders on RSA water management programs through the Kwinana Refinery Community Consultation Network (CCN). Alcoa presented information on the Project to the CCN on 26 November 2025.

10.2 Other Legislation and Approvals

10.2.1 Contaminated Sites Act 2003

A Mandatory Auditors Report (MAR) has been prepared for the Project and will be submitted to DWER at a similar time to this works approval application. The MAR specifically considers potential impacts to existing known and unknown contaminated sites.

10.2.2 Other Relevant Legislation

A summary of other relevant legislation and approvals is provided in Table 10-1.

Table 10-1: Other Relevant Legislation

Approval	Description
Rights in Water and Irrigation Act 1914	
5C Licence to Abstract	**Not required.** The Project does not include abstraction of groundwater or surface water. Alcoa holds GWL159085(3) which approves abstraction for industrial purposes.
26D Licence to Construct	**Not required.** Project does not include the construction of abstraction or reinjection bores
Bed and Banks Permit	**Not required.** No disturbance to the bed and banks of a watercourse is proposed.
Environmental Protection Act 1986, Part IV	
Ministerial Statement	**Not required.** Significant impacts to key environmental factors are not anticipated due to the quality of treated water and limited mounding. Management under Part V of the EP Act is sufficient to ensure that the Environmental Protection Authority's (EPA's) objectives for key environmental factors will be achieved.
Environmental Protection Act 1986, Part V, Division 2	
Clearing Permit	**Not required.** Project infrastructure will be located on previously disturbed areas. A clearing permit is not required.
Biodiversity Conservation Act 2016	
Section 40 Authorizations.	**Not required.** No taking or disturbing of threatened fauna is proposed.

Approval	Description
Alumina Refinery Agreement Act 1961	
None	**Not required** Amendments to the state agreement act are not required for the Project.
Environment Protection and Biodiversity Conservation Act 1999	
Ministerial Statement	**Not required.** Significant impacts to protected matters are not anticipated.

11. Emissions and Discharges

Emissions and discharges associated with the Project are described in Table 11-1.

Alcoa

Table 11-1: Emissions and Discharges

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Controls	Location
Construction:				
Machines and construction activities	Noise	Minor during daytime	• Vehicles and construction tools to be in good working order. • Construction in daylight hours only.	Area O and pipeline route – See Figure 6-1
	Dust	Minor	• Existing dust management strategies, including watercarts, to be applied.	Area O and pipeline route – See Figure 6-1
Construction and packaging wastes	Solid Waste	Minor	• Existing waste management system implemented. * Waste generated, stored and disposed at the premises remains in line with waste provisions of the existing licence and the Project will not change the existing waste profile	Area O and pipeline route – See Figure 6-1
Commissioning and time-limited operation of pipeline:				
Leaks in pipeline	Water	Minor and Infrequent	• Pipeline designed to withstand operating conditions and pressures • Pipeline welded by competent personnel • Commissioning prior to ongoing use. • Pipeline visually inspected weekly while operational • Treatment of water the pipeline means any leaks pose low environmental risk.	Pipeline route – See Figure 6-1
Pumps	Noise	Intermittent during daytime hours	• Pumps to be in good working order.	Water Treatment Plant and Mineralisation System – See Figure 6-1
Commissioning and time limited operation of Infiltration Galleries				
Residual solids from milk of lime dosing	Sediments	Ongoing ~20 tonnes per year expected	• Residual solids will be mostly sand as well as calcium solids and are expected to be geochemically benign. • Remineralised water passed through a settlement tank to allow settling of solids prior to discharge. • Solids periodically removed and disposed of in lined RSA.	Mineralisation system – See Figure 6-1

Source of Emission or Discharge	Emission or Discharge Type	Volume and Frequency	Proposed Controls	Location
Treated water discharged into galleries	Treated Water	Up to 3.5 GL/year	• Treatment of water to meet quality specification. • Monitoring of groundwater quality and standing water levels. • Implementation of MMP. • Galleries to be fenced to prevent public and fauna access.	Infiltration Galleries – See Figure 6-1
Sediments in infiltration galleries	Suspended solids from Milk of Lime Dosing	Minor	• Any sediments in treated water will be residual solids from mineralisation. • Remineralised water passed through settlement tank to allow solids to settle prior to discharge. • Any sediments that build up in the galleries will be periodically removed and placed in lined RSAs. * Waste generated, stored and disposed at the premises remains in line with waste provisions of the existing licence and the Project will not change the existing waste profile.	Infiltration Galleries – See Figure 6-1
Overtopping of infiltration galleries	Treated Water	Infrequent. Up to 395 kL/hour	• Galleries sited in disturbed area – any run-off will infiltrate elsewhere in the quarry or evaporate. • Galleries sized so there is no overtopping. • Treatment of water to meet quality specification.	Infiltration Galleries – See Figure 6-1

12. Siting and Location

An assessment of the Project against the Environmental Siting Guideline (DWER 2020b) is provided in Table 12-1.

Alcoa

Table 12-1: Nearby Environmentally Sensitive Receptors and Aspects

Type / Classification	Description	Distance to Infiltration Galleries	Proposed controls to prevent or mitigate adverse impacts (if applicable)
Sensitive Land Uses / Users	Land use around Area O is industrial and rural. Surrounding land users and residential receptors are shown in Figure 8-1. Downgradient third-party groundwater licence holders are shown in Figure 8-11. A net reduction in industrial noise is anticipated. Dust or odour impacts are not anticipated. Water is treated and mineralised prior to infiltration and impacts to beneficial use are not anticipated (See Section 8.6).	• Nearest industrial neighbour ~400m west. • Other industrial and rural neighbours within ~1 km. • Downgradient third party groundwater licence holders between ~400m and ~1,000m).	• Treatment and mineralisation of water prior to discharge to protect environmental and beneficial uses of aquifer. • Infiltration galleries to be signposted and fenced to limit public exposure. • Monitoring of groundwater levels and quality. • Implementation of MMP.
Environmentally Sensitive Areas (ESA)	ESAs mapped by DWER are shown on Figure 8-24. Down-gradient ESAs are Long Swamp and Bush Forever Site 346. No direct disturbance to ESAs is proposed. Significant indirect impacts are not anticipated.	• Long Swamp (~750 m W). • Bush Forever Site 346 (~2 km NW).	• Treatment and mineralisation of water prior to discharge to protect environmental and beneficial uses of aquifer. • Monitoring of groundwater levels and quality. • Implementation of MMP.
Threatened / Priority Ecological Communities (TEC / PEC)	TECs and PECs are shown in Figure 8-21. The following have been recorded in or near the Alcoa landholdings: • *Melaleuca huegelii – M. systena* shrublands of limestone ridges – Critically Endangered (also listed as threatened under EPBC Act). • Banksia Woodlands of the Swan Coastal Plain – Priority 3 (listed as threatened under the EPBC Act) • Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain – Priority 3 (listed as threatened under the EPBC Act). No clearing or additional disturbance is proposed and impacts to TECs and PECs are not anticipated as mounding is minimal and water will be treated.	• Melaleuca Shrublands CR TEC (~1.5 km South). • Tuart Woodlands P3 PEC (adjacent to Area O to the east). • Banksia Woodlands P3 PEC (adjacent to Area O to the east and north).	• Project sited to avoid additional disturbance. • Gallery ~5m below natural ground level - significant mounding into PECs around Area O cannot occur. • Treatment and mineralisation of water prior to discharge to protect environmental and beneficial uses of aquifer. • Monitoring of groundwater levels and quality. • Implementation of MMP.

Type / Classification	Description	Distance to Infiltration Galleries	Proposed controls to prevent or mitigate adverse impacts (if applicable)
Threatened and/or priority fauna	Fauna habitat value of a quarry in Area O is limited. No additional disturbance is proposed and direct impacts to fauna habitat are unlikely. Fauna, including conservation significant fauna may drink water or drown in infiltration galleries Additional information is in Section 8.11	Fauna habitat occurs in and around Area O and Alcoa landholdings.	• No new disturbance proposed • Water treated prior to discharge. • Infiltration galleries to be fenced. • Galleries sides sloped to allow fauna egress.
Threatened and/or priority flora	Quarry at Area O has been historically excavated and cleared. No conservation significant species have been recorded in flora and vegetation surveys around Area O. No new disturbance is proposed and significant impacts to flora and vegetation are not anticipated. Additional information is in Section 8.10.	N/A	• Project sited to avoid additional disturbance.
Aboriginal and other heritage sites	Heritage Sites are shown in Figure 8-22. No disturbance to heritage sites is proposed and direct or indirect impacts are not anticipated. Additional information is in Section 8.13.	Local heritage sites within 1 km: • 8582 – Heritage Farm (removed) • 12096 – de San Miguel Home • 12102 – Long Swamp Closest Aboriginal heritage site: • 20865 – Mount Brown – Booyeeanup (lodged): ~2.6 km ENE.	• Project sited to avoid additional disturbance.
Public drinking water source areas	PDWSAs are shown in in Figure 8-10. Area O is not upgradient of any PDWSA and direct or indirect impacts are not anticipated.	Jandakot Underground Water Pollution Control Area – 5 km east.	• Infiltration galleries down-gradient of PDWSA. • Water treated prior to discharge.

Type / Classification	Description	Distance to Infiltration Galleries	Proposed controls to prevent or mitigate adverse impacts (if applicable)
Rivers, lakes, oceans, and other bodies of surface water, etc.	Cockburn Sound is ~3.5 km west of the Infiltration Area. There are no defined watercourses down-gradient of the Infiltration Area. There are no down-gradient RAMSAR or Important wetlands. Downgradient wetlands are: • Long Swamp (Conservation) • Hendy Road Swamp East (Resource Enhancement) • Hendy Road Swap West (Multiple Use) • Unnamed 1 (Resource Enhancement) • Conway Road Swamp (Resource Enhancement) Down-gradient wetlands are shown in Figure 8-15. Significant impacts are not anticipated. Further information is in Section 8.8.	• Cockburn Sound (~3.5 km W) • Long Swamp (~750 m E). • Hendy Road Swamp East (~1.1 km SW) • Hendy Road Swamp West (~1.2 km SW) • Unnamed 1 (~2.5 km E) • Conway Road Swamp (~2.3 km WSW)	• Water treated prior to discharge. • Discharge criteria set to protect environmental values. • Monitoring of water levels and quality. • Implementation of MMP.
Acid sulfate soils	Area O has already been excavated and pipelines will follow existing disturbed routes. No dewatering or disturbance to Acid Sulfate Soils is proposed.	N/A	N/A

13. Risk Assessment

13.1 Risk Assessment Overview

EHS completed a risk assessment of the proposed activities was completed in accordance with the DWER (2020c) Guideline for Risk Assessments. Consequence criteria are in Table 13-1, Likelihood criteria in Table 13-2 and the risk matrix in Table 13-3.

Table 13-1: Consequence Criteria

Consequence	Consequence Description	
	Environment	Public health* and amenity (such as air and water quality, noise and odour)
Severe	• Onsite impacts: catastrophic • Offsite impacts local scale: high level or above • Offsite impacts wider scale: mid-level or above • Mid to long-term or permanent impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are significantly exceeded	• Loss of life • Adverse health effects: high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • Local scale impacts: permanent loss of amenity
Major	• Onsite impacts: high level • Offsite impacts local scale: mid-level • Offsite impacts wider scale: low level • Short-term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded	• Adverse health effects: mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • Local scale impacts: high level impact to amenity
Moderate	• Onsite impacts: mid-level • Offsite impacts local scale: low level • Offsite impacts wider scale: minimal • Specific Consequence Criteria (for environment) are at risk of not being met	• Adverse health effects: low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • Local scale impacts: mid-level impact to amenity
Minor	• Onsite impacts: low level • Offsite impacts local scale: minimal • Offsite impacts wider scale: not detectable • Specific Consequence Criteria (for environment) likely to be met	• Specific Consequence Criteria (for public health) are likely to be met • Local scale impacts: low level impact to amenity
Slight	• Onsite impact: minimal • Specific Consequence Criteria (for environment) met	• Local scale: minimal impacts to amenity • Specific Consequence Criteria (for public health) criteria met

^ For areas of high conservation value or special significance, we will use the Guideline: Environmental siting to inform our decision

* In applying public health criteria, we may use the Department of Health's Health risk assessment (scoping) guidelines

'Onsite' means within the prescribed premises boundary (This is taken as the L5245/1967/14 Prescribed Premises and the Works Approval Area.

Table 13-2: Likelihood Criteria

Likelihood	Likelihood Description
Almost certain	The risk event is expected to occur in most circumstances
Likely	The risk event will probably occur in most circumstances
Possible	The risk event could occur at some time
Unlikely	The risk event will probably not occur in most circumstances
Rare	The risk event may only occur in exceptional circumstances

Table 13-3: Risk Matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

13.2 Risk and Impact Assessment

The risk assessment for the Project, as presented by EHS in the CORA is in Table 13-4.

Table 13-4: Risk Assessment

#	Unwanted Event	Pathway	Receptors	Potential Adverse Impacts	Context / Inherent Risks	Mitigation Measures	Conseque	Likelihood	Residual
1	Water quality declines at receptors	• Failure of water treatment plant(s) results in infiltration of poor quality water • Geochemical reactions in aquifer cause a decline in water quality. • Mobilisation of existing known or unknown land contamination • Infiltration in excess of approved amount slows attenuation of COPCs	Long Swamp (Conservation Category Wetland)	• Decline in water quality impacts freshwater ecosystem • Death or decline in vegetation health	• Water quality data indicates that any contribution from the Tamala Limestone to surface water in Long Swamp is likely to have a dilutionary effect and may partly ameliorate salinity in the wetland. • A DAF of 2.78 is expected between the infiltration gallery and Long Swamp. All of the COPCs above background levels or ANZG 95% values in the discharge are expected to be within background or ANZG 95% values at Long Swamp. • Conservative mass flux estimates predict a minimal additional contribution to Long Swamp under 3.5GL/a infiltration (~0.27% of modelled evapotranspiration). • A large portion of infiltrated water is expected to flow along the base of the Tamala Limestone and flow under, rather than through Long Swamp	• Infiltration limited to no more than 3.5GL/annum • Treatment of water to acceptable standard prior to discharge. • 14 days of water testing to demonstrate that treated water meets the specification prior to any discharge. • Automatic bypass to ROWS Pond should continuous EC monitoring indicate treatment plants are not functioning. • Hardening (and associated pH adjustment) of water prior to discharge to limit dissolution • Water level and quality monitoring to demonstrate that land contamination is not being mobilised and that other receptors are protected.	Major	Unlikely	Medium
			Downgradient Damplands (Hendy Road Swamps; Conway Road swamp)	• Death or decline in wetland vegetation	• Hendy Road Swamp East and Conway Road Swamp are resource enhancement damplands. • Hendy Road Swamp east is a multiple use dampland that is highly degraded • Particle tracking suggests that infiltrated water will not flow towards these wetlands and water quality impacts are not anticipated. • The MMP (Appendix 2), includes monitoring bores between the infiltration gallery and these wetlands.		Minor	Rare	Low
			Other Downgradient Sumpland; (Unnamed 1)	• Decline in water quality impacts freshwater ecosystem • Death or decline in vegetation health	• Unnamed 1 is a resource enhancement wetland and is ~1 km further downgradient of infiltration gallery than Long Swamp. • Analysis of Landgate aerial imagery shows no fill events, which suggests this is a dampland, rather than a Sumpland. • Due to longer distance from gallery, water quality is expected to be closer to background at this location due to attenuation and dilution. • Measures to protect water quality in Long Swamp protect this wetland. • The MMP (Appendix 2), includes monitoring bores near this wetland.		Minor	Rare	Low
			Groundwater Dependent Vegetation	• Death or decline in vegetation health	• Due to the high permeability of the Tamala Limestone, minimal mounding and a minimal change in areas where vegetation may access the groundwater is anticipated. • The nearest vegetation where the groundwater is within 5 m is the upland vegetation around Long Swamp (~700 m) East. Water quality is expected to be within background at this location. • Existing and new monitoring bores are proposed adjacent to Long Swamp • Most infiltrated water is expected to flow along the base of the Tamala Limestone and will not be accessed by vegetation.		Minor	Rare	Low
			Threatened and Priority Ecological Communities	• Death or decline in vegetation health due to poor water quality	• Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain (Priority 3) is present around Area O and may be present around Long Swamp. Note many of the Tuarts around Area O were intentionally planted and are not native vegetation under the EP Act. • Banksia woodlands of the Swan Coastal Plain (Priority 3) is present around Area O. • Both of these priority 3 ecological communities are listed under the EPBC Act. • Other vegetation down-gradient may be representative of a TEC or PEC • Modelled groundwater levels at Area O is >5 m below the surface and this is unlikely to change under infiltration. • Most infiltrated water is expected to flow along the base of the Tamala Limestone and will not be accessed by vegetation. • Due to High Quality of infiltrated water, impacts to PECs or TECs are not anticipated.		Moderate	Rare	Medium

#	Unwanted Event	Pathway	Receptors	Potential Adverse Impacts	Context / Inherent Risks	Mitigation Measures	Conseque	Likelihood	Residual
			Stygofauna	• Local impacts to stygofauna due to decline in groundwater quality	• Due to treatment of water, habitat loss or degradation due to water quality is not anticipated. • Due to extensive nature and high connectivity of Tamala Limestone, impacts are localised and a change in the conservation status of any species that may be present is not anticipated, even if poor quality water were to be infiltrated.		Slight	Unlikely	Low
			Other groundwater users	• Groundwater not fit for intended purpose • Health impacts from human contact with water	• Groundwater is used for industrial purposes down-gradient of infiltration gallery • After treatment, infiltrated water meets DoH NPUG Guidelines. • Impacts to down-gradient beneficial use are not anticipated.		Minor	Rare	Low
2	Excessive Groundwater Mounding at Receptors	• Infiltration in excess of approved amount • Mounding exceeds modelled predictions at receptors • Water is over-hardened prior to discharge, resulting in calcification and clogging of aquifer and increased mounding	Long Swamp	• Waterlogging causing death or stress of wetland or upland vegetation • increased groundwater contribution impacts wetting and drying cycle causing sumpland to become a lake	• Groundwater modelling suggests that groundwater levels in the Long Swamp Sediments may increase by up to 0.17 m. As evaporation rates are much greater than this inflow, a change in surface water is not expected. • Surface water in the cooler and wetter months is often 0.2 – 0.4 m higher than groundwater, precluding entry of groundwater into Long Swamp. • If a transient 0.2 m rise during the wettest parts of the year is conservatively assumed, this will almost exclusively occur in wetland vegetation types which are naturally tolerant of water logging. • Outside the zone of seasonal waterlogging (~0.9 mAHD) capillary rise is unlikely to impact vegetation due to the steep sides of the swamp	• 44 new monitoring bores to be installed with these bores having operational and compliance triggers. These bores are placed upgradient of environmental receptors to act as an early warning, • The overall monitoring network consists of 78 groundwater bores that will be monitored and reported. • Ability to decrease rate and/or spread water out over larger trench area and/or bypass to ROWS Pond should the trench water level indicate it is too full. • The ten (10) R3 sentinel bores will have water level triggers which will be based from the predicted numerical modelling at this location (water level +0.5 m). Resulting actions may be to decrease infiltration or undertake additional site specific risk assessments if a trigger is activated.	Major	Unlikely	Medium
			Other down-gradient Wetlands (Hendy Road Swamps; Conway Road Swamp; Unnamed 1	• Waterlogging causing death or stress of wetland or upland vegetation • increased groundwater contribution causes damplands to become sumplands or sumplands to become lakes	Groundwater modelling suggests that: • Mounding of 0.2 m is anticipated in Tamala Limestone at Hendy Road Swamps. • Mounding of <0.2 m is anticipated in Tamala Limestone around Conway Road Swamp and Unnamed 1. • Mounding in swamp sediments is expected to be lower than in Tamala Limestone and increased flux a small fraction of evapotranspiration.		Minor	Rare	Low
			Troglofauna	• Local impacts to troglofauna due to habitat loss from groundwater mounding	• Minimal mounding is anticipated (<0.5 m within 500 m of infiltration trench). • Due to extensive nature and high connectivity of Tamala Limestone, impacts are localised and a change in the conservation status of any species that may be present is not anticipated, even if mounding is significantly higher than predicted.		Slight	Rare	Low
			Cockburn Sound	• Poor Quality Infiltrated water flowing into Cockburn Sound	• Cockburn Sound is ~3.5 km west of infiltration site. • Source water specification meets Moderate Ecological Protection criteria for Cockburn Sound, except for aluminium, which is expected to attenuate.		Major	Rare	Medium

#	Unwanted Event	Pathway	Receptors	Potential Adverse Impacts	Context / Inherent Risks	Mitigation Measures	Conseque	Likelihood	Residual
3	Increase in flux through Safety Bay Sands transports contaminated water under the refinery into Cockburn Sound	• Infiltration causes increased flux from Tamala Limestone into the Safety Bay Sands and then into Cockburn Sound	Cockburn Sound	• water quality impacts	• Modelling predicts infiltration will result in a flux increase of ~0.23 kL/h through the impacted area of the Safety Bay Sands at the Refinery. • The minimum groundwater recovery rate, set in the GMMP is 8 kL/hour. This is sufficient to prevent entry of contaminated water to Cockburn Sound. • Recovery Rates at the refinery can be increased if required.	• Implementation of the MMP, including monitoring of refinery delineation bores. • Groundwater recovery at the refinery in accordance with the GMMP.	Major	Rare	Medium
4	Increase in flux through the Safety Bay Sands transports contaminated water under the Tank Farm into Cockburn Sound	• Infiltration causes increased flux from Tamala Limestone into the Safety Bay Sands and then into Cockburn Sound	Cockburn Sound	• water quality impacts	• Modelling predicts infiltration will result in a flux increase of ~1.3 kL/h through the impacted area of the Tamala Limestone. • Golder 2019 reports soil at the tank farm is not considered contaminated with hexavalent chromium. Only one groundwater sample (KW024) reported pH greater than 8.5 in March 2018. This sample also contained the highest concentration of hexavalent chromium (less than Tier 1 screening criteria). The aluminium and arsenic concentration of the same sample exceeded the adopted Tier 1 screening criteria for non-potable groundwater use. The alkaline groundwater conditions are likely associated with historical spills of caustic liquid alkaline conditions suggests that the impacts are of localised in nature. This implies the mapped extent used in this risk assessment is extremely conservative • The increase in flux through this area is based on an increase of water level 0.1 m and resulting gradient increase. Naturally, water levels have fluctuated at levels much higher than this. • To impact Cockburn Sound, this water would also need to travel though the lower permeability Safety Bay Sands.	• Implementation of the MMP, including monitoring of refinery delineation bores. • Implementation of the GMMP	Major	Unlikely	Medium
5	Increase in flux through the Tamala Limestone transports contaminated water beyond the RSA ABC Area	• Infiltration causes increased flux from Tamala Limestone into the Safety Bay Sands and then into Cockburn Sound	Cockburn Sound	• water quality impacts	• Modelling predicts infiltration will result in a flux increase of ~13.5 kL/h through the impacted area of the Tamala Limestone. • In 2024 the RSA annual bore extraction rate was 952 ML (108.7 kL/hr) and has in the past operated in excess of 1,200 ML/yr (137 kL/yr). The recovery bore network therefore has sufficient capacity to manage this small additional flux and prevent migration of contaminated water beyond the existing capture zone. • Recovery Rates at the refinery can be increased further if required.	• Implementation of the MMP, including monitoring of refinery delineation bores. • Groundwater recovery at the refinery in accordance with the GMMP.	Major	Unlikely	Medium
6	Mobilisation of contamination from other known or unknown contaminated sites	• Water levels rise, contact and mobilise additional contamination • Increase in flux through existing contamination • Unknown contamination down-gradient not identified	Contaminated sites and any downgradient receptors Water quality impacts to environmental receptors from land contamination are considered in Risk 1 above	• contamination crosses allotment boundaries • water quality impacts at receptors • Change in contaminated land status of unimpacted properties	• Minimal mounding is anticipated from infiltration (~40cm is expected at Perron Quarry, the closest known contaminated site, which has been remediated for restricted use. This equates to an increase in flux of ~3 kL/h. • A smaller increase in flux is anticipated at other sites, which are further downgradient (0.004-0.04 kL/h). • Review of Land use records indicates a low risk of unknown contamination between the infiltration gallery and Cockburn Sound. Any unknown contamination, if present, would pose a similar risk to known contaminated sites	• Implementation of the MMP including monitoring of water levels and quality at the Refinery, Tank Farm and Perron Quarry.	Major	Unlikely	Medium

#	Unwanted Event	Pathway	Receptors	Potential Adverse Impacts	Context / Inherent Risks	Mitigation Measures	Conseque	Likelihood	Residual
7	Geotechnical risks	• Discharge of low TDS, acidic and unhardened water dissolves aquifer matrix	Down-gradient land users Water quality impacts from dissolution are considered in Risk 1 above	• Dissolution of aquifer causing geotechnical instability or sinkholes	• Without hardening dissolution of Calcium Carbonate would occur at ~0.1g/L. • As infiltration is into a gallery and not via reinjection bores, unhardened water will equilibrate with natural limestone in the upper formation (former unsaturated zone) within Area O limiting subsequent dissolution in the saturated zone downgradient of Area O. • Mineralisation significantly reduces dissolution risk. • Note that natural rainfall is also soft and will dissolve calcium carbonate.	• Mineralisation of infiltrated water. • Implementation of MMP	Minor	Rare	Low
8	Clogging of Aquifer	• Overhardening of infiltrated water causes calcite deposition and reduces aquifer permeability	Down-gradient groundwater licence holders	• Production bore yields impacted	• Due to the high permeability of the Tamala Limestone, clogging causing a decline in yields is not anticipated. • Dosing rate in mineralisation plant will be reviewed based on treated water quality prior to infiltration to ensure infiltrated water is not saturated with calcium. • Any clogging effect would be evident as increased mounding in R1, R2 Sentinel bores and R3 Delineation bores, which are upgradient.	• Implementation of MMP including monitoring of water levels in Area O to detect mounding that may indicate clogging. • Adjustment of hardening dose rate if required.	Minor	Rare	Low

Source: Table 6-11 of CORA (Appendix 1)

14. Capital Costs and Works Approval Fee

A capital cost estimate to inform the works approval fee is provided in Table 14-1. The capital cost of [redacted] attracts 305 fee units which equates to a works approval fee of [redacted]

Table 14-1: Capital Cost Estimate

Item	AUD ($)
Pipeline materials and installation	[redacted]
Infiltration Galleries	
Fencing	
Support Infrastructure	
Total	

15. References

Alcoa. 2025. *Kwinana Groundwater Monitoring and Management Plan.* Perth: Alcoa of Australia Limited.

ANZEEC & ARMCANZ. 2000b. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Volume 3 - Primary Industries — Rationale and Background Information (Irrigation and general water uses, stock drinking water, aquaculture and human consumers of aquatic foods).* Canberra: Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

ANZG. 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Canberra: Australian and New Zealand Governments and Australian state and territory governments.

Biota. 2024. *Anketell Road Upgrade Consolidated Biological Report.* Perth: Biota Environmental Sciences.

BOM. 2025. *Climate Data Online.* Accessed 05 19, 2025. http://www.bom.gov.au/climate/data/?ref=ftr.

DoH. 2014. *Contaminated sites ground and surface water screening guidelines.* Perth: Department of Health.

DWER. 2021. *Cockburn Groundwater Allocation Plan.* Perth: Department of Water and Environmental Regulation.

DWER. 2020a. *Decision Report: Review of Existing Licence L6543/1991/11. Licence Holder: Water Corporation of Western Australia. Premises: Kwinana Wastewater Treatment Plant.* Perth: Department of Water and Environmental Regulation.

DWER. 2021. *Guideline: Assessment and management of contaminated sites. Activites Regulated under the Contaminated Sites Act 2003, Contaminated Sites Regulations 2006 and National Environment Protection (Assessment of Site Contamination) Measure 1999.* Perth: Department of Water and Environmental Regulation.

DWER. 2020b. *Guideline: Environmental Siting: Part V, Division 3, Environmental Protection Act 1986.* Perth: Department of Water and Environmental Regulation.

DWER. 2020c. *Guideline: Risk Assessments: Part V, Division 3, Environmental Protection Act 1986.* Perth: Department of Water and Environmental Regulation.

DWER. 2019. *Industry Regulation Guide to Licensing: Activities Regulated Under the Environmental Protection Act 1986 and Envrionmental Protection Regulations 1987.* Perth: Department of Water and Environmental Regulation.

DWER. 2016. *Technical Expert Report: Potential Environmental Consequences of Expanding the Managed Aquifer Recharge of Wastewater at the Kwinana Wastewater Treatment Plant.* Perth: Department of Water and Environmental Regulation.

Ecologia. 2021. *Alcoa Kwinana Refinery Flora and Fauna Survey.* Perth: Unpublished Report prepared for Alcoa of Australia.

EHS. 2026a. *Kwinana Infiltration Project: Commissioning/Operational Risk Assessment.* Melbourne: EHS Support Pty Ltd.

EHS. 2026b. *Monitoring and Management Plan.* Melbourne: EHS Support Pty Ltd.

EHS. 2025b. *Proposed Background Environmental Monitoring Thresholds.* Melbourne: EHS Support Pty Ltd.

EHS. 2025a. *Refinery and and RSA Groundwater Modelling: Alcoa Kwinana.* Melbourne: EHS Support Pty Ltd.

EHS. 2025c. *Revised Relevant and Applicable Environmental Quality Guidelines (EQGs) for Cockburn Sound (Draft).* Melbourne: EHS Support Pty Ltd.

EPA. 2008. *Environmental Guidance for Planning and Development.* Perth: Environmental Protection Authority.

Hill, A L, C A Semeniuk, V Semeniuk, and A Del Marco. 1996. *Wetlands of the Swan Coastal Plain Volume 2a: Wetland Mapping, Classification and Evaluation, Main Report. ISBN: 0 7309 3748 8.* Perth: Water and Rivers Commission and Department of Environmental Protection.

MBS. 2026a. *Long Swamp: Reconnaissance Flora and Vegetation Survey.* West Perth: MBS Environmental.

MBS. 2026b. *Sensitivity of Vegetation to Water Level Increase.* West Perth: MBS Environmental.

NHMRC & NRMMC. 2011. *National Water Quality Management Strategy: Australian Drinking Water Guidelines 6 2011 Version 3.9 Updated December 2024.* Canberra: National Health and Medical Research Council & National Resource Management Ministerial Council.

NRMMC. 2009. *Australian Guidelines for Water Recycling: Managed Aquifer Recharge. National Water Quality Management Strategy Document No 24. ISBN 1 921173 47 5.* Canberra: Natural Resource Management Ministerial Council, Environment Protection and Heritage Council and National Health and Medical Research Council.

PGV. 2022a. *Alcoa Future Residue Storage Areas: Targeted Orchid Survey.* Perth: PGV Environmental.

PGV. 2022b. *Alcoa Future Residue Storage Areas: Tuart Woodland TEC Assessment.* Perth: PGV Environmental.

Rockwater. 2025. *Review of Borefield Performance and Groundwater Quality in 2024.* Perth: Rockwater Hydrogeological and Environmental Consultants.

US EPA. 2009. *Unified Guidance: Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities. EPA 530-R-09-007.* Washington DC: United States Environmental Protection Agency.

Weston. 2005. *Biodiversity Strategy Vegetation and Flora Assessment. Hope Valley – Wattleup Redevelopment Project Area.* Perth: Prepared for Bowman Bishaw Gorham Environmental Management.

Wood. 2025. *Alcoa Kwinana RSA Water Treatment Plant Noise Assessment (Rpt01-AU03129-Rev0).* Perth: Wood PLC.

Wood. 2025. *Minetek Evaporators Noise Assessment AU02767-FN2.* Brisbane: Wood.

Appendix 1: Kwinana Infiltration Risk Assessment (EHS 2026a)

Provided separately

Appendix 2: Infiltration Management Plan (EHS 2026b)

Provided separately

Appendix 3: Long Swamp: Reconnaissance Flora and Vegetation Survey (MBS 2026a)

Provided separately

Appendix 4: Sensitivity of Vegetation to Water Level Increase (MBS 2026b)

Provided separately

Appendix 5: Letter sent to Groundwater Licence Holders

Provided separately