WA FOREST ALLIANCE

WA Forest Alliance (WAFA) submission to the Environmental Protection Authority (EPA)

21 August 2025

Alcoa's Pinjarra Alumina Refinery Revised Proposal (Assessment 2253) and Bauxite Mining on the Darling Range for 2023-2027 (Assessment 2385)

This submission comments on both assessments. Throughout this document we referred to assessment 2253 as the Expansion. References to the Expansion ERDs are marked as '(EX chapter number - page number)'. Assessment 2385 is referred to as MMP and references to the MMP's ERDs are marked as '(MMP - 'page number')'. When referring to both, we will use the term 'the Proposals'.

WA Forest Alliance (WAFA)

WAFA is a grassroots, not-for-profit organisation that since formation in 1990, has worked for the full protection of WA's native forests and woodlands from logging, clearing and other threats. WAFA is an umbrella organisation for 27 member groups across the Southwest. WAFA referred the MMP to the EPA in 2023 as a third-party

This submission is supported by the 37,943 people who have "signed" their names to it.

In doing so they endorse this submission and ask that a copy of WAFA's submission be recorded in their name.

All names and additional comments are supplied in Appendix E.
Note: all names and contact details are confidential and not to be published or supplied to the proponent.

View from Mt Solus on the Bibbulmun Track. Photo: Donna Chapman

Overview

Throughout both ERDs, Alcoa uses non-committal language for negative impacts and optimistic scenarios for the environmental impacts of bauxite mining and the future of the NJF.

In outlining cumulative impacts, the company steers away from drawing conclusions as to the severity of the consequences. Non-committal language in relation to its future obligations - 'as far as practicable', and 'not expected to' - downplays the potential serious nature impacts and 'not expected to result' downplays the contribution of mining to cumulative impacts. This is despite bauxite mining being considered the major threat to the NJF.

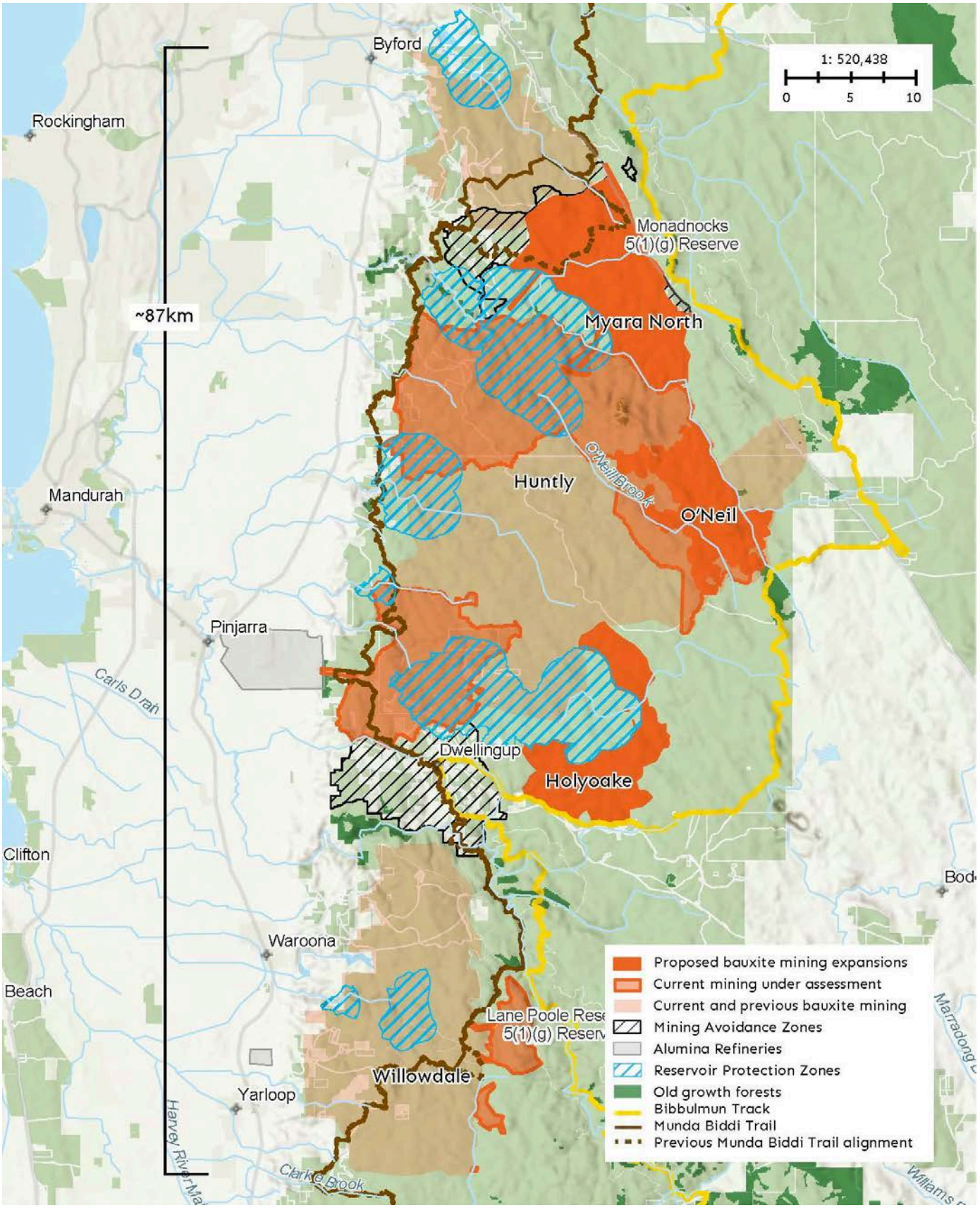
Alcoa makes its own case for its mining being environmentally acceptable. Public trust requires independent verification of the company's data, claims and promises.

<u>WAFA's demands</u>

The EPA should draw a line in the sand and recommend the Expansion not be approved, under any circumstances. Mining under the MMP should be phased out by 2028 under strict conditions that, in part, prevent Alcoa from extending its mining beyond that which is already planned and approved under the 2024-2028 Mining Management Program.

Alcoa must also be required to undertake remediation of rehabilitation and ensure that all current and future rehabilitation is properly executed to ensure it at least meets completion criteria.

This submission outlines WAFA's issues with Alcoa's Proposals and recommends conditions that must be placed on any future mining.



Map 1. The Expansion is shown as 'Proposed bauxite mining expansions', and the MMP areas under assessment as 'Current mining under assessment'. In addition, Alcoa's current mining, not under assessment, is shown as 'Current and previous bauxite mining'. As can be seen in Map 1, old growth forests are adjacent or within the Expansion and MMP. MMP mining and Expansion infrastructure overlap with Reservoir Protection Zones. The Expansion is also adjacent to the Bibbulmun Track, and the Munda Biddi Trail has been rerouted preemptively to avoid the Expansion.

The Northern Jarrah Forest

The Northern Jarrah Forest (NJF) is one of the last great ecosystems of its kind; a rich, ancient, and incredibly diverse landscape found only in the Southwest Biodiversity Hotspot. It provides critical habitat for many plants and animals including Black Cockatoos and mainland Quokkas.

The NJF stores and draws down huge volumes of carbon from the atmosphere, regulates rainfall and temperature along the Darling Scarp and is a catchment for major rivers from north of Perth down to Collie.

What makes this forest especially precious is the way it survives in some of the most nutrient-impoverished soils on Earth. Despite decades of research, we are still discovering new things about this forest. In an age of extinction and ecological instability, the NJF is a living library of untapped knowledge about resilience, cooperation between species, and adaptation to harsh climates.

Photo: Donna Chapman

The NJF also holds deep cultural and spiritual importance for the Noongar people, the Traditional Custodians of this land. After tens of thousands of years, their knowledge, stories, and connection to Country are woven into the landscape. Protecting the NJF means respecting and upholding this enduring relationship.

It's not just a forest, it's a living system that took millions of years to evolve and can't be recreated once it's destroyed. Nevertheless, over the past 150 years it has been subjected to extensive logging and clearing for timber, agriculture, housing, infrastructure and mining.

Now, climate change is adding to the pressures. Since the 1970s, rainfall in the region has declined by 20 percent. In 2022 the Intergovernmental Panel on Climate Change (IPCC) report found that the NJF is at particular risk of climate collapse, saying that 'The resilience and adaptive capacity of the forests is being reduced by ongoing land clearing and degrading land management practices.' It points out that this can be mitigated by 'avoiding and reducing forest degradation' (Lawrence et al. 2022, 1636).

There are few Comprehensive, Adequate and Representative (CAR) protected areas in the NJF and the areas that are protected lack representativeness, indicating inadequacies in the State's conservation reserve system (Luxton et al. 2021). This is 'due to opposition and successful political lobbying by bauxite companies' (Forestry Australia 2022). However: 'There are still areas of high-rainfall, high-quality jarrah forest ... which would be very suitable as CAR reserves' (Forestry Australia 2022).

Scale of impact

Alcoa is proposing to clear 11,458 ha of the NJF: 7,500 ha for the Expansion and a further 3,958 ha under the MMP.

Including other areas already approved for its mining, Alcoa seeks to clear 17,274 ha of the NJF by 2045. With the addition of historic clearing, the miner could be clearing 45,525 ha of the NJF by 2045.

Alcoa claims to have cleared only 2 percent of the NJF - that figure nearly doubling to 3.84 percent by 2045 (EX 5-137, MMP 749). However this clearing involves the highest quality, most biodiverse parts of the NJF: the areas that must be protected to have the best chance of forest health in the future.

When forest mining by South32 and Newmont is included, 72,359 ha or 6.6 percent of the NJF will have been cleared by 2045 (EX 5-101).[1] This is 3,528 ha more than the EPA (2024, 48) calculated for all mining in the NJF in 2024. This does not include Newmont's referral to the EPA in July 2025 to clear 528 ha of native vegetation - NJF forest that is of 'excellent' to 'very good' condition. Nor does it include Chalice's proposed Gonneville mine or the impact of current and pending applications for mining exploration.

Photo: #MilesTweediePhotography

While Alcoa provides the cumulative figures for direct clearing from historical, concurrent and future approved and proposed mining, it offers no estimate of future mining arising from its planned 178,340 ha of exploration under the MMP within and outside the Mine DEs. Alcoa claims exploration will have 'a negligible actual total disturbance footprint … due to the design of exploration equipment and processes …minimal disturbance and natural recovery' (MMP 675-76). Supplementary exploration drilling uses different equipment, but environmental impacts are considered 'low' and to be minimised' (MMP 676-77).

The EPA has previously calculated that, if 25 percent of the additional exploration Alcoa and South32 have planned is mined, some 120,000 ha of the NJF will be cleared.

[1] The percentage of the NJF uses Alcoa's figure of 1.1 million ha for the area of the NJF. WAFA considers this is the correct figure (as a rounding up of 1,083,652 ha): the EPA has previously understated the percentage impact by erroneously using the figure of 1,898,799 ha (2024, 48-51).

Forest Mining	Ha
Proposed NJF clearing by Alcoa – Expansion and MMP	11,458
Completed, approved and proposed NJF clearing - Alcoa to 2045	45,525
Completed, approved and proposed NJF clearing - Alcoa/South32/Newmont to 2045	72,359 (6.6% of NJF)
Completed, proposed and possible NJF clearing, including Alcoa/South32 explorations	120,000 (11.0% of NJF)

The scale of the impacted area of Alcoa's past and future strip mining is, however, much larger than that for direct clearing. Alcoa states its present mining has fragmented 8,481 ha of forest, about 32 percent of the area it has cleared. Roughly a half the forest fragments are 0.1-100 ha in size, the remainder between 100-1,000 ha (EX 6-184). For the Expansion, Alcoa expects future fragmentation of 4,600 ha, in two areas, 10 km apart (EX 6-184).

No figures are given for forest fragmentation for the MMP. Neither Proposal provides figures for the associated 'edge-effects' on unmined forest.

Forestry Australia (2022) put NJF fragmentation from bauxite mining at around four times the area cleared. In its assessment of the impacts of Alcoa's bauxite mining on drinking water catchments, Water Corporation (2022) nominated a 50m edge effect on forest surrounding the mine sites, which almost doubles the impacted area.

Risks and recommendations

1. Alcoa is seeking to significantly expand its clearing of the NJF for bauxite mining but there is no room for further clearing if the integrity of the bioregion and critical habitat is to be sustained.

2. The full scale of impacts from the proposed direct clearing needs to be assessed alongside the associated forest fragmentation and edge-effects.

3. The cumulative impact assessment should include consideration of future mining arising from Alcoa's planned 178,340 ha of exploration under the MMP as well as all other mining and exploration (current, proposed and applied for) in the NJF including by South32, Newmont and Chalice.

4. WAFA urges the EPA to exercise its precautionary principle in relation to the scale of potential ecological impacts on the NJF and recommend non-approval of the Expansion and a phase-out of mining under the MMP by the end of the current 2024-2028 MMP, under strict conditions.

Holistic Impact Assessment

The EPA asked Alcoa to: 'Undertake a holistic impact assessment of the proposal on the environment, applying the EPA's principles and the EPA's objectives for environmental factors'.

The EPA's requirements for a holistic impact assessment are a useful baseline, but, as shown by Alcoa's submission, not strong enough to ensure a proper assessment of environmental impacts.

The EPA requirements are descriptive and do not demand critical analysis and quantification. They omit climate change modelling, functional ecosystem analysis, long-term risk scenarios and landscape-scale connectivity.

Alcoa's holistic impact assessments for both Proposals reflect this. While they technically fulfil the EPA's checklist - by identifying key environmental values, presenting simple diagrams, summarising combined effects, and noting residual impacts and offsets, they fall well short of a proper holistic assessment (EX 16-1–6; MMP 738–743).

The holistic impact assessments focus on individual impacts and do not see the forest for the trees.

The diagrams provided (EX 16-3; MMP 739):

- miss key ecological values such as soil quality and nutrient cycling, and critical components like microbial activity, mycorrhizal fungi, and invertebrate soil communities;

- overlook the non-linear, interconnected nature of ecosystem processes;

- have no temporal layering of environmental change;

- and have no proper treatment of cumulative impacts, whether from past degradation, future mining, or climate vulnerability.

In the MMP, a brief summary of potential effects on the environment as a whole makes a limited attempt to describe interactions (MMP 744–46), but for the Expansion, this integrative view is mostly missing. Commentary on how different impacts or aspects are connected is superficial. The combined effects are described vaguely, with broad generalisations about interactions, followed by unsupported conclusions such as: 'The loss of flora and vegetation within mined areas is not expected to significantly impact fauna habitats or populations in surrounding forest and vice versa, as the flora to fauna interactions will continue in the surrounding forest' (EX 16-4). No evidence or references are provided to support this assertion.

Alcoa's shallow approach overlooks how environmental and social effects interact, compound, or cascade over time and space. Take, for instance, dust suppression using water can affect nearby forest ecosystems via runoff, spray drift or contaminants (MMP 252), with consequences for flora and fauna. These interactions are not properly considered, let alone assessed in the holistic assessment.

The same omissions apply to climate change impacts, habitat fragmentation, and cumulative effects from surrounding projects. As noted elsewhere, the NJF is already under intense pressure and climate change is pushing it towards transition or collapse. The compounding influence of climate change intensifies the impacts of clearing, mining, and other disturbances on forests, waterways, and species. A proper holistic assessment would consider these dynamics, but Alcoa's does not.

Alcoa offers only optimistic assessments of its mitigation measures. Different possible scenarios for the NJF are not presented: only best-case outcomes from ecological systems rebounding in relatively short time periods. There is no consideration of possible tipping points for the NJF.

Risks and recommendations

1. Alcoa has not properly analysed the Proposals' impacts on 'the environment as a whole', missing critical connections across systems, scales, and time. It assumes best-case scenarios, lacks ecological depth, and depends on ecological systems rebounding in relatively short time periods.

2. WAFA urges the EPA to exercise the precautionary principle and reject the current holistic assessments as inadequate for a proposal of this scale and sensitivity.

3. Alcoa needs to properly assess the risk of tipping points and prioritise their avoidance. A revised holistic assessment should include:

    a. Climate change modelling and long-term impact forecasting for the NJF.

    b. A systems-based diagram showing feedbacks, the strength of interactions and cumulative effects

    c. Adaptive, measurable, and independently verifiable mitigation strategies based on the holistic assessment

    d. Clear criteria for ecological thresholds and ecosystem collapse risks

    e. Stronger engagement and co-design with Traditional Owners.

4. Given Alcoa's inadequate, holistic impact assessment, WAFA urges the EPA to undertake Strategic Advice under section 16e of the Environmental Protection Act for the entire NJF bioregion. This process could address knowledge gaps, provide a thorough cumulative impact assessment for the NJF bioregion and advise the WA Government on its long term management.

Flora and Vegetation

EPA Objective: To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

Both Proposals will mainly clear three 'open forest' vegetation types of the NJF. These are defined by species composition, landform and soil type: 'P' is mid and lower slope forest of Jarrah, Marri and Western Sheoak; 'S' is mid to upland slope forest of Jarrah, Marri and Banksia Grandis; and 'T' is ridge and upper slope forest with Jarrah and Marri (Stantec 2023, 4, EX 5-14, 17). Alcoa considers these forest complexes are of low conservation significance, due to their relative extent in the region, but acknowledges their value as habitat for conservation significant fauna (EX 5-101, 17-4).

The impacted forest is predominantly of juvenile to immature age (<70 years since logged), largely reflective of the structure and condition of the NJF more broadly. Still, about 10 percent of the Expansion Mine DE and 15 percent for the MMP is mature-age forest (25 percent is the Willowdale area) (EX 5-27, MMP 190). About 50 percent of the Exploration DE is Immature with 25 percent Mature and less than one percent old growth (MMP 691). Vegetation condition is rated according to age structure: 'excellent' for mature to 'good' for juvenile.

Whilst Alcoa plans to avoid mapped old growth forests, the official definition is flawed and limited and mature-age forests may still be old growth ecosystems. Alcoa notes that there is 0.26 ha of old growth forest mapped in O'Neil, but discounts it as being less than the resolution of 0.5 ha blocks (ERD 5-34) and does not give any further information. There are also multiple patches of old growth forest on the boundary of O'Neil and within the Huntly DEs (see Map 1) which may be impacted by edge effects, or accidental clearing outside endorsed areas. Breaches of endorsed areas have been reported recently and are a genuine risk (Ramboll 2025).

Groundwater dependent ecosystems (GDEs) make up 26 percent of the Expansion Mine DE and about 16 percent for the MMP (EX 5-46, MMP 180). Although not to be cleared, GDEs will be impacted by waterlogging and changes to groundwater levels (EX 5-47).

In addition to the GDEs, one Threatened Ecological Community (TEC) is listed for the MMP, Empodisma peatlands, while one Priority Ecological Community (PEC) occurs for both Proposals, Granite communities of the NJF (EX 5-42, MMP 244). The TEC and PEC are listed for the MMP despite not being recorded in the MMP Mine DEs as 'there have not been sufficient Targeted surveys to date' (MMP 273).

For the MMP, baseline and targeted flora surveys conducted within or near the Huntly Mine DE in 2020-2024 recorded ten flora species listed as Priority by DBCA. However, the targeted surveys covered only 2 percent of the Huntly Mine DE and none of the Willowdale Mine DE. While not having been found in this small survey area, Alcoa admits that 'given the lack of survey intensity and coverage', flora species listed as

threatened may be present (MMP 225) and therefore unable to be considered in this assessment.

Alcoa has mapped potential suitable habitats of conservation significant flora (warranting special protection), noting this is not an indicator of populations (EX 5-88). Twenty conservation significant flora species are known or considered likely to occur across the impacted area of the Expansion (EX 5-92-95), but potentially more (EX 5-88). For the MMP, the number is 25 (MMP 223).

Mining impacts

Alcoa states the Expansion involves the 'loss of floristic diversity, ecosystem diversity and structural complexity' of the cleared vegetation - predominantly Jarrah-Marri forest (EX 5-190, 17-4). It assesses these impacts as both 'partial' - because the vegetation complexes to be mainly impacted 'are well represented' in the NJF (EX 17-4) - and short term - up to 30 years when rehabilitation will be established (EX 16-1), however there are serious doubts on rehabilitation's effectiveness (see Rehabilitation).

Just under 90 percent of the forest to be cleared for the Expansion is in 'excellent' (mature) or 'very good' (immature) condition and only 2 percent degraded or completely degraded (EX 5-108). For the MMP, 'vegetation condition of the Huntly Mine DE is ranked lower than that of the NJF, and vegetation condition of the Willowdale Mine DE is ranked similar to that of the NJF' (MMP 211). The degree of dieback infestation was the main factor in lowering the assessment of vegetation condition for both Mine DEs. This suggests the potential for greater risk of dieback spread in the MMP.

Alcoa states it will clear no more than 49 ha of potential occurrences of the PEC, Granite communities of the NJF, and no more than 1,341 ha of potential GDEs (EX 5-194)

Alcoa expects conservation significant flora species will not become threatened as a result of mining as their habitats are found elsewhere (EX 5-119) and considers GDEs to be more affected by climate changes impacts on hydrology (EX 5-192).

Climate

Alcoa acknowledges the IPCC's *high confidence* projection that, in the next 30 to 40 years, climate change will increasingly threaten the NJF's biodiversity, 'potentially leading to irreversible changes in ecosystem composition and structure and the extinction of some threatened species' (EX 5-63, Lawrence et al. 2022, 1597). Whereas the IPCC also states **ongoing clearing is reducing the 'resilience and adaptive capacity' of the forests and should be avoided** (Lawrence et al. 2022, 1636), Alcoa concludes the Proposals are 'unlikely to cause cumulative impacts in combination with climate change' (EX 5-156) and are 'not expected to amplify the impacts on vegetation condition' from climate change (EX 5-182). Alcoa also states cumulative

impacts - that include mining and climate change - on the vegetation types they will predominately clear for mining are 'not anticipated to cause a significant impact' (EX 17-4). **This flies in the face of the IPCC's warnings for the NJF that have been reflected in recent forest die-off events. It is also completely inconsistent with Alcoa noting for its offsets that there are 'knowledge gaps' in relation to the NJF's 'vulnerability to climate change' (Alcoa 2025a, 18).**

Alcoa offers no mitigation measures, such as avoidance, in response to major climate change impacts in the NJF that have already occurred, notably the forest die-off events in recent years.

NJF impacted by drought 2024. Photo: Joe Fontaine

Fragmentation

Forest fragmentation reduces biodiversity and ecosystem functionality and resilience. In terms of vegetation, habitat fragmentation is 'one of the most important causes for the decline of plant species' (Heinken and Webber 2013).

'Maintaining the total area of forest and minimising fragmentation arising from permanent clearing are key elements of biodiversity conservation strategies' (Conservation and Parks Commission 2023, 50).

For the Expansion, Alcoa mentions fragmentation having impacts on Jarrah forest ecosystems in its holistic impact assessment, but without elaboration (EX 16-4). Fragmentation is only mentioned as not impacting conservation significant flora (EX 5-188).

For the MMP, Alcoa notes 'increased edge effects on vegetation, which include changes in understorey structure and composition' - but only in relation to ecological

linkages protecting diversity (MMP 196). For the Expansion, Alcoa recognises vegetation may be impacted by dust disposition (an edge effect) but has no data on Jarrah forest susceptibility and the company states that, from experience, it knows the impacts will not be significant (EX 5-192).

Water Corporation (2022, 20, 38) has a different view: 'No definitive study has been undertaken of edge effects of mining in the Northern Jarrah Forest, although significant tree death on the margins of rehabilitated areas has been observed, resulting from localised changes to hydrology associated with post mining revegetation'.

Importantly, as Seigel et al. (2023) explain, international research into forest fragmentation has tended to focus on the effects on individual species, such that 'much less is understood about its effects on *species interactions*'. They found mutualisms (beneficial species interactions) - seed dispersal, pollination and mycorrhizae (plant root-fungi interactions) - were more negatively impacted by forest fragmentation than antagonistic ones such as predation. There is no mention by Alcoa of such facets of ecology, yet declines in pollination networks are just one of potentially many that can impact ecosystem health over time (Campbell et al 2024, 16).

Mitigation

For the Expansion, Alcoa proposes to mitigate environmental impacts on flora and vegetation through *avoidance* of clearing old growth forest and known populations of threatened flora, and waterlogging and salinity impacts to significant flora. It will also *minimise* clearing of mature-age forest and potential occurrences of granite communities, GDEs and threatened flora species habitats (EX 5-167).

For the MMP, Mining Avoidance Zones (MAZs) will be created for old growth forests, threatened flora populations and habitats, and any Threatened Ecological Communities (TECs) (MMP 260). Alcoa states that clearing will be minimised for mature-age forest, potential Priority Ecological Communities (PECs) and GDEs, and Priority flora (MMP 261).

For both Proposals, clearing of Priority flora populations is to be limited to no more than ten percent of the known species population, if the known population is more than 100 plants, or otherwise limited to no more than two percent of the known species population. A species-specific buffer is to be placed around retained populations (EX 5-194, MMP 277-78).

Limited Disturbance Areas (LDAs) (mining is prohibited but infrastructure and haul roads are allowed) are to be applied to granite outcrops >1ha (with a 50 m buffer), PECs, streamzone vegetation (with a 100m buffer) and Priority and other significant flora (as far as practicable) (MMP 255).

MAZs for TECs do not include buffers. However, Empodisma peatlands are vulnerable to minor hydrological changes and so require buffers to protect from mining. Granite communities are also sensitive to hydrological changes, weed incursion and other disturbances.

Risks and recommendations

1. Alcoa admits 'cumulative impacts are expected to result in the maintenance of an immature forest structure, an increased potential for canopy die-off, a change in stream zone and swamp vegetation, and a potential reduction in understorey density that opens up the forest structure' (EX 5-162).

2. Alcoa downplays the biodiversity and ecological integrity value of vegetation to be cleared by relying on broad-scale representation of Jarrah-Marri complexes. Localised clearing of this forest cannot be justified in the context of ongoing cumulative threats and losses across the NJF.

3. Alcoa misrepresents significant residual impacts on flora and vegetation in claiming they are partial and short term. This:

    - understates how long it takes for mature forest structure and complexity to develop (at least 100 years).

    - ignores evidence that large, tall Jarrah trees are unlikely to return after replanting (Campbell et al. 2024, see Rehabilitation).

    - ignores the prediction that climate change will 'drive replacement of large trees with short, multi-stemmed individuals, transforming ecosystem structure' (Matusick et al. 2016, Water Corporation 2022, 7).

    - misrepresents the mitigation capabilities of rehabilitation for biodiversity and ecological integrity (see Rehabilitation)

    - ignores Alcoa's mining plans beyond the Proposals that will result from 178,340ha of exploration.

4. In association with historical logging, the company admits 'cumulative impacts are expected to result in the maintenance of an immature forest structure' (EX 5-162). Forest maturation is important for forest biodiversity and health, resilience to bushfires and fauna habitat (Conservation and Parks Commission 2023). Clearing sets maturation processes back in impacted areas by at least a century. With simultaneous climate effects, this may be forever: the NJF is at risk of transitioning to a different forest structure and the principle of intergenerational equity must be applied.

5. To ensure old growth forests on the boundaries of proposed mining and exploration activities are not affected by edge effects, clearing outside boundaries, and other indirect impacts, there should be no new clearing or

exploration within 2 km of old growth forests to safeguard them as critical habitats for now and the future.

6. The official definition of old growth forest is very limited and flawed. Because of that, many mature forests that are old growth ecosystems are currently not, but should be included in avoidance zones. They are often of similar quality to old growth forest and provide equally important habitat.

7. Alcoa expects the Proposals will *not* contribute to climate change impacts on vegetation conditions. The points above make this untrue: the Proposals are synergetic with threatening processes and trends in the NJF.

8. Due to extremely limited baseline flora surveys being undertaken, more conservation significant flora may also be unaccounted for, which makes it impossible to thoroughly assess the scope of impacts. The EPA should not accept Alcoa's evaluation of impact on conservation significant flora based on inadequate data.

9. The absence of buffers around TECs like Empodisma peatlands contradicts conservation best practice. Without buffers, MAZs do not provide meaningful protection. Alcoa must adopt precautionary buffers (50–100m minimum), as recommended for TECs elsewhere. Recommendations of the recent Auditor General's report *Conservation of Threatened Ecological Communities* should also be adopted to ensure stronger alignment with the State and Federal biodiversity and conservation acts, clear accountability mechanisms, and a pathway to ongoing ecological resilience for TECs.

10. Alcoa must also be required to apply more precautionary buffers around GDEs. It must demonstrate that ecosystem function will be maintained, not just vegetation retained, taking into account predicted changes to groundwater regimes under climate change.

11. Mitigation should be a tool for protecting nature, not a justification for destroying it.

12. In line with the principle of the conservation of biological diversity and ecological integrity, the EPA should reject the Expansion based on the lack of avoidance of high conservation value vegetation as well as misrepresentation of impacts. Further avoidance must be implemented for the MMP based on independent assessment of the cumulative and residual impacts as well as further flora studies.

Rehabilitation

'While rehabilitation will eventually mature 'a' jarrah forest it will not be 'the' jarrah forest...' (Stantec 2023, 22)

Alcoa's assertions of rehabilitation success are central to its claims to be able to mitigate the significant residential impacts on flora and vegetation, terrestrial fauna, inland waters, social amenity and, in some part, GHG emissions (through sequestration), protecting the biodiversity and ecological integrity of the NJF accordingly (EX 2-36, MMP, 377). So confident is Alcoa in its rehabilitation that it is only for terrestrial fauna (and refinery GHG emissions) that offsets are considered necessary.

Alcoa's claims to successful rehabilitation in this regard rest on its performance against DBCA-approved completion criteria and its adaptive management approach to achieving improvement.

However, such completion criteria have not been fit for the task of assessing rehabilitation performance against the goal of restoring the Jarrah forest ecosystem. Indeed, some past rehabilitation prescriptions have contributed to contemporary problems that require remedial management.

Current completion criteria are to be revised, but no details are provided. While this is not entirely within Alcoa's court, a proper assessment of its future mining and rehabilitation on the basis of new completion criteria cannot be made while this information gap remains.

If the EPA is to advise on the new completion criteria, this advice should require more robust biodiversity indices that align with the International Principles and Standards for the Ecological Restoration and Recovery of Mine Sites (Young et al. 2022, Campbell et al. 2024). There should be a clear alignment of rehabilitation prescriptions with the goal of ecological restoration and forest health, with goals set from 'robust baseline data for reference/target vegetation types' (Daws et al. 2023).

That said, the precautionary principle should be applied and the Expansion not be recommended for approval because of the degree of uncertainty that is associated with large scale mining rehabilitation prescriptions that have not been trialed under current and expected climate change scenarios.

A recent independent review of Alcoa's rehabilitation warns that the 'severity, duration and scale' of potential environmental impacts of Alcoa's future mining mean **there are real doubts as to 'whether these impacts can be realistically and credibly managed through rehabilitation'** (Stantec 2023, 28).

The independent review established, among other things:

- Alcoa is unable to properly assess rehabilitation by mainly relying on species richness.

- ***At 25 years, understory cover in rehabilitation areas is about half that in non-mined forest areas*** (Stantec 2023, 10, EX 2-44).

- ***Marri rehabilitation rates have not met completion criteria levels in recent years***. Hence, a 'large area' has needed remedial infill planting, but it is unclear how Alcoa will fix this deficit in the future (Stantec 2023, 29).

- More and different vegetation data is needed to address the ***'broad questions and knowledge gaps regarding the maintenance of ecological integrity, including fauna habitat values, of the NJF'*** (Stantec 2023, 13).

Alcoa rehabilitation near Jarrahdale

<u>Inadequate indices</u>

Alcoa's main measure of success is **species richness** (the total number of flora species compared to a nearby unmined forest plot). For three decades, Alcoa's rehabilitation has averaged around 80 percent species richness at 15 months of age, meeting or exceeding this completion criteria (EX 2-39).

While species numbers may be similar to those in unmined forest, for some time their **composition** (relative abundance) has been found to differ as some species are present in greater proportions than in the forest (Norman et al. 2006, 284). Accordingly, '**it cannot be claimed that plant community composition has been completely restored'** (Koch 2007, S36). More recently, the independent review found that, despite improvements in rehabilitation methods, **differences in species composition between rehabilitated and unmined forest remain** (Stantec 2023, 13). What is more, certain species that were abundant before clearing are not taken into account in compositional targets in the completion criteria (Stantec 2023, 13). Examples include *Banksia grandis*, *Allocasuarina fraseriana* and *Xanthorrhoea preissii* (EX 2-42). This is because 'compositional targets are only considered within the completion criteria for plant density', these being only for certain species (Stantec 2023, 13).

Measures of **functional diversity** (FD) (the range of roles organisms have in ecosystems) have been added to ecological restoration goals because of their

associations with biodiversity (Standish et al. 2021). Functional traits 'are the link between species and ecosystem functions: traits are informative of how species respond to environmental changes and in turn shape ecosystem functioning' (Merchant 2023, 1). In Alcoa's rehabilitation, it was found 'three of four FD indices had not reached those of reference jarrah forest 25 years after restoration had been initiated' (2021, 9). Importantly, these FD indices 'did not correlate with species richness, indicating a risk of over-reliance on richness as a metric of rehabilitation performance' (Stantec 2023, 14).

To assess Alcoa's rehabilitation, Campbell et al (2024, 2, 6) used ecological 'attributes that measure progress against five-star outcomes', and only gave it **two-stars out of five.** Their report found that **rehabilitation does not:**

> **'(a) Return to a state similar to the native reference ecosystem,**
> **(b) Improve over longer timeframes, nor**
> **(c) Show sustained improved outcomes from adaptive management processes**.'

Moreover, the scientists found 'early forking [of Jarrah trees] is significantly more common' in rehabilitation, indicating **a 'restricted capacity to develop the distinctive structure of mature, high-quality jarrah trees, even over long timeframes**'.

The authors attributed these failures to mining having removed the lateritic substrate (bauxite) on which the forest ecosystem has evolved. Alcoa denies this (EX 7-27, MMP 422) **but does not *attempt* to restore the three Jarrah-Marri vegetation complexes that it clears *because* 'the major changes in social profile and landscape during mining and restoration override the more subtle social and landscape differences' that shape the pre-mining vegetation types** (Koch 2007, S27-28). This failure 'may effectively remove critical ecosystem elements from the wider spatial mosaic of the NJF' (Campbell et al. 2024, 16).

The independent review also noted 'there are no specific fauna standards or targets to return particular taxa or groups of fauna to rehabilitation in current completion criteria', with CWD habitat structures acting as 'a surrogate for faunal return'. The review argues more consideration should be given 'to the fundamental role animals play in many key ecological processes required for restoration including pollination, social development and establishment of vegetation (e.g. through seed dispersal) (Stantec 2023, 18).

'[S]tudies have demonstrated that soil organic matter and microbial biomass re-establishes over time in rehabilitation sites, although recovery of organic matter (as measured by total organic C) is slower than the recovery of microbial biomass and in 18–26 years old rehabilitation remains below that of the non-mined forest mean' (Stantec 2023, 19). However, the independent review questioned if these chronosequence studies of older sites will predict what happens under more recent rehabilitation prescriptions and practices (Stantec 2023, 19).

Backlog and remediation

If completion criteria are not met, remediation in terms of additional species planting is necessary, particularly as there is only limited species establishment in rehabilitation from surrounding forest (Norman et al. 2006, 286).

Remediation is also required to remedy work that has not been done properly. The independent review noted: '**Given the acknowledged importance of pit floor ripping for long-term rehabilitation performance, it is a concern that there have been occasions where this has not occurred' and there has been 'apparently no remedial action**'. This highlights problems in Alcoa's self-certification and 'the importance of effective monitoring and evaluation by regulating agencies' (Stantec 2023, 19).

Alcoa aims to address its rehabilitation backlog (EX 2-27, MMP 219), however, there are serious doubts as to its capability to do so. Alcoa needs to source large quantities of seed, which can only be collected in limited quantities from State Forest. It is known in the industry that seed supply is not currently keeping up with the demand (also WABSI 2025, 32). Seed shortages for certain species can impact species and plant functional diversity in rehabilitation (Andres et al. 2023).

Alcoa also relies on regrowth from topsoil, but when this is in short supply and or not handled properly, the diversity shortfalls are compounded.

Adaptive management

The independent review found a series of inadequacies and 'identified opportunities for improvement to the monitoring and evaluation process, particularly for remedial or corrective actions that would be critical to reducing vulnerabilities, provide a strong evidence-base to support adaptive management and allow a more robust and credible evaluation of rehabilitation success' (Stantec 2023 28). Alcoa does not address these inadequacies in the ERD for either Proposal.

Climate change

Alcoa assumes a best-case scenario that future rehabilitation will be successful with climate change. The independent review, however, found there is 'no published data on the resilience of current era rehabilitation to drought or water stress', noting it will be some years before this can be assessed (Stantec 2023, 26). In short, 'more accurate assessments of the response of rehabilitation to disturbances resulting from climate change are required' (Stantec 2023, 31). Also, expectation of rehabilitation adaptability assumes appropriate deep ripping and initial site preparation. As mentioned before, this has not always been the case (Stantec 2023 19, 34).

Alcoa makes no mention of the 'thirsty' nature of young rehabilitation and the detrimental impacts high Leaf Area Indexes can have on surrounding forest health in a drying climate (Wardell-Johnson et al. 2015).

Biodiversity Indicators (BIs)

The EPA 'required Alcoa to develop adequate and scientifically robust Biodiversity Indicators (BIs) and a supporting detailed monitoring framework that could be used to assess whether impacts of and environmental outcomes ... are likely to be consistent with the ongoing ecological integrity... of the NJF' (Stantec 2023, 27). The independent review found no evidence that Alcoa's proposed new BIs will drive improvement in ensuring rehabilitation is consistent with the ongoing ecological integrity of the NJF. Nor do the BIs adequately address current rehabilitation deficiencies. The draft BIs have not changed since being reviewed (EX 2-47-48).

Mine closure

The Huntly Mine Closure plan has not been updated to reflect the current Forest Management Plan (Alcoa 2025b, 116).

For future land use type, Alcoa has selected the 'production from relatively natural ecosystems' - conservation, recreation, tourism, water catchment (Alcoa 2025b, 94) - rather than 'conservation and natural environments', which includes 'land under rehabilitation that has been restored to a near natural state' (ABARES 2016, 6-7). In multiple places, Alcoa continues to cite timber production as a closure outcome, even though commercial logging has ended.

For flora and vegetation closure works program, problematic Jarrah-Marri overstorey density, resulting from past rehabilitation prescriptions, is almost entirely the focus for ecological integrity (EX 5-190, Alcoa 2025b 127-28). This highlights the inadequacies of current completion criteria for biodiversity and ecological integrity.

There is no mention of ecological functioning monitoring and goals, nor clear explanation of who collects, analyses, and is accountable for monitoring data (Stantec 2024, 28).

Rehabilitation is not, and never will be, the mitigation measure Alcoa proposes it to be for the significant environmental impacts of both Proposals.

Risks and recommendations

1. Alcoa's assurances of successful rehabilitation require close scrutiny by the EPA. Notably, key indices are lacking in Alcoa's success assessments, such as species composition, functional diversity, understory cover, Marri rehabilitation rates, and the form of Jarrah trees.

2. Alcoa places great store on 'box-ticking' of completion criteria rather than actual ecological outcomes. Responsibility for this lies in part with State regulators: nevertheless it is intolerable.

3. **The EPA needs to interrogate Alcoa's claim that bauxite removal has not impacted rehabilitation.** Rehabilitation failures can be linked to mining having removed the bauxite on which the Jarrah forest ecosystem has evolved. No

matter what Alcoa claims, even best efforts at rehabilitation do not - and cannot not - restore the Jarrah forest.

4. Rehabilitation is already failing to meet ecological restoration criteria and a drying and warming climate will make success more difficult. There is no 'published data' on the resilience of current rehabilitation methods to climate change and future adaptability is reliant on adequate site preparation, which has found to be not always the case.

5. Given the inadequacies in Alcoa's indices of performance, compounded by Alcoa not meeting its completion criteria in 60 years of mining, there needs to be greater clarity regarding the company's long term responsibilities for remediation and management of its rehabilitation and stricter monitoring of compliance.

6. New completion criteria are under development. There cannot be a proper, informed assessment of Alcoa's future mining and rehabilitation until the new criteria are known. At the very least, new completion criteria must address the shortfalls in current prescriptions (for example, through the inclusion of functional indices), rehabilitation failures (Marri establishment rates), the impacts of climate change and FMP focus on forest health through maturation of forest structure. WAFA recommends new criteria based on the International Principles and Standards for the Ecological Restoration and Recovery of Mine Sites (Young et al. 2022, also Campbell et al. 2024). Rehabilitation prescriptions should align with the goal of ecological restoration and forest health, with goals set from 'robust baseline data for reference/target vegetation types' (Daws et al. 2023).

7. Deficiencies in Alcoa's self-certification and regulatory agency oversight of rehabilitation must be rectified before any consideration of an approval. Alcoa should be held immediately accountable for its rehabilitation management breaches.

8. The EPA must investigate credible reports of current mine site preparation and planting inadequacies and failures. WAFA has received photos that show steep slopes and consequent mine wall erosion (see Terrestrial Environmental Quality) and it is well known in the industry that there is a major seed shortage that will impact initial species diversity.

9. **It is not acceptable for the Proposals to go ahead – under any conditions – until the EPA can assess future completion criteria and the shortfalls in remediation of past rehabilitation and current rehabilitation practices are addressed.**

Terrestrial fauna

EPA Objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

Both Proposals impact largely **'contiguous intact forest'** with **'multiple habitat types' for a wide range of fauna species** (EX 6-25, 6-132, MMP 297). The Proposals' DEs also have high connectivity with protected fauna habitats in Lane Poole Recreation Reserve, Monadnocks Conservation Reserve, and Serpentine National Park between them.

The impacted fauna habitats have high conservation values. Around 75 percent of the Expansion DEs vegetation is rated 'good' to 'excellent' quality habitat (EX 6-25); for the MMP, around 90 percent is rated 'high' or 'medium' quality with 'high' applying to 11 of 14 conservation significant fauna species (MMP 335-37) and 'critical for the survival of 7 threatened species: the three Black Cockatoo; Chuditch; Quokka; Western Ringtail Possum; and Woylie' (MMP 367).

L-R: Woylie (Photo: Josie Nolan), Quokka (Photo: Philippa Beckerling), Chuditch (Photo: Clarissa Human), Western Ringtail Possum (Photo: Alison Cassanet)

Both Proposals are considered to **directly impact fauna diversity and ecological integrity** through **habitat loss and injury or death** from clearing and mining processes, and have indirect impacts such as **habitat fragmentation**, disturbances from light, noise and or vibration and attraction of feral animals. (EX 6-146, EX 6-169, MMP 362).

The significant residual impacts for both Proposals are virtually identical. Habitat loss is considered 'limited', 'temporary' and 'partial', but occurring 'in the context of widespread cumulative impacts (from logging, fire, dieback, climate change and mine rehabilitation under past completion criteria) and habitat fragmentation. Direct mortality of fauna is expected to be 'low', 'short-term' and manageable (EX 6-207-08, 17-8, MMP 384).

Habitat loss

The direct fauna habitat loss through clearing for both Proposals will be 11,458 ha. For the Expansion, up to 7,500 ha of habitat for Chuditch, Quokka, Woylie and Numbat and Western Ringtail Possum (EX 6-156-57). In addition, fragmentation is said to impact about 4,600 ha (EX 6-184). For the MMP, 4,119 ha of habitat (4,042 ha for Huntly and 77 ha for Willowdale) for 17 conservation significant fauna species will be cleared, with eight of these Threatened and seven Priority species (MMP 365, 384). After mitigation, Alcoa states the direct loss of fauna habitat will be 4,101 ha (MM 393). These numbers should be clarified. There are no area figures for habitat fragmentation for the MMP.

Alcoa acknowledges potential significant impacts for local populations from both Proposals, but considers residual impacts to be largely mitigated by: **habitat clearing being 'limited' relative to their regional extents, clearing avoidances, fauna dispersals, and rehabilitation**.

The only recognised **long-term impacts from clearing are losses of coarse woody debris (CWD) and mature trees** (EX 6-207, EX 17-4, MMP 367). 'Rehabilitation restores **minor densities of CWD and does not restore tree hollows**, both which will take over a century to accumulate to levels comparable to un-mined forest. CWD and tree hollows provide shelter, breeding habitat, invertebrate microhabitats and are **key elements of fauna habitat quality and ecological integrity'** (EX 6-177). CWD returned with rehabilitation is reduced in 'availability and habitat amenity' by wildfire, with the risk that this occurs before the rehabilitation itself starts creating it (Grigg and Steele 2011).

Calling the losses of 'key elements of fauna habitat quality and ecological integrity' 'partial' diminishes their critical importance, especially when Alcoa acknowledges there are other cumulative impacts on habitat (EX 6-207, MMP 367).

Habitat fragmentation is stated to be only 'temporary and effectively mitigated by rehabilitation' and/or 'medium term' up until 'the establishment of rehabilitation and removal of road crossings' (EX 17-4). 'The total duration of fragmentation impacts is expected to be about 15 to 20 years in each mine region, being the cumulative timeframe for mining, rehabilitation, and fauna recolonisation' (EX 6-184).

That said, Alcoa acknowledges potential significant impacts of habitat fragmentation on threatened Woylie and Chuditch (EX 6-207, 17-4). Chuditch are known to require large home ranges and habitat that is not excessively fragmented (DCE 2012). For this species, Alcoa admits fragmentation 'may cause localised disruption of breeding' and 'insufficient foraging resources for individuals' but again on a 'temporary' (now less than ten years) basis 'following completion of rehabilitation' (EX 6-185). However, the reduced survival rates of individuals can cause population declines.

Black cockatoo breeding habitat loss is the stated exception to impacts being temporary/medium term: this is considered 'long term', *despite* the retention (avoidance) of known and suitable nesting trees (EX 17-4).

As a whole, Alcoa fails to take seriously the knowledge that a range of fauna species' threatened status is due in part or substantially from the loss and or fragmentation of their habitats. The company also downplays the impacts of clearing and fragmentation on fauna individuals and populations in the short term.

Alcoa proposes to '**avoid or minimise clearing high value habitats**' (EX 6-190), specifically for Black Cockatoos, Critical Weight Range (CWR) mammals (considered particularly vulnerable to extinction), Woylies, Quokka, Chuditch, Western Ringtail Possums, Numbats and Carters Freshwater Mussel, and Short-Range Endemic (SRE) fauna (EX 6-190-92, MMP 5, 380). The MMP proposes to protect 'key values' of old growth forest, known, suitable, significant and known roosting Black Cockatoo nesting trees, active Chuditch breeding dens and identified Woylie populations (MMP 375-76).

However, targeted species habitat avoidance 'will be undertaken as far as practicable' with only 'a moderate certainty of effectiveness' (EX 6-188-89, MMP 377-78). In other words, avoidance is not assured and, for species with relatively small populations, loss of high value habitat could well impact their survival.

In the case of Quokka, for the MMP, clearing will be minimised within 50m of a mapped population and underpasses established for all infrastructure adjacent to populations (MMP 378). Elsewhere, Alcoa states 'there is **uncertainty as to the species use of constructed fauna underpasses**, which may also be subject to higher feral predator activity' (MMP 384).

Conservation significant species that are not listed as threatened, such as the Quenda and others, are not subject to avoidance zones meaning much of their habitat will be cleared.

Any mining avoidance is welcome, but those from pre-clearing surveys require regulatory oversight and verification and **the relatively small scale of many species-specific avoidance measures does not compensate for the forever loss of 'contiguous intact' forest habitat** in the Proposal areas. In the case of Black Cockatoos: they 'require large areas of habitat for breeding, night roosting and foraging, as well as connectivity between these habitats to assist their movement through the landscape' (DAWE 2022).

Alcoa expects **direct mortality of fauna** during clearing 'to be low and not cause a significant impact' as clearing will be 'progressive and staged' and adjacent to unmined forest where fauna can find refuge (EX 6-207) - given the opportunity to escape (EX 6-169) and 'as far as practicable' (EX 6-204). There is no evidence provided that direct mortality from clearing is 'low', only some evidence for 'vehicle interactions' during mining at Huntly (EX 6-169). It cannot be believed that all creatures great and small can, and do, escape clearing processes, and soil fauna does

not seem to be considered at all. Indeed, the mitigation strategies of pre-clearing monitoring and relocations and progressive clearing are in fact considered to also be of moderate effectiveness (EX 6-204, MMP 379).

Alcoa only once mentions potential problems with **fauna dispersal** (animals spreading into unmined forest as a mitigation measure) causing 'a level of intraspecific and interspecific competition for habitat resources'. Without supporting evidence, Alcoa asserts this is only 'for a period, until home ranges are re-established, and a biodiversity equilibrium is once again attained' (MMP 362).

Great weight is placed on mitigation of impacts on fauna through **rehabilitation**. Rehabilitation is said to restore most habitat values in the range of 7 to 14 years (EX 6-162). Alcoa claims rehabilitation 'restores most terrestrial vertebrate biodiversity … within about 10 years', but not Woylie or reptiles (EX 6-177-78) while invertebrate biodiversity is partially restored in 'about 10-20 years' (EX 6-177).

However, it cannot be concluded from species sightings in rehabilitation that appropriate fauna communities have re-established (Craig et al. 2015; Anderson et al. 2022): 'presence may not indicate persistence' (Cross 2020). Chuditch individuals were found to 'quickly re-colonize restored areas and use available habitat', but no conclusions were drawn as to the consequences for Chuditch 'survival and demography' (McGregor et al. 2014). The independent review of rehabilitation considers there is much room for improvement in monitoring and evaluation of rehabilitation as fauna habitat, such as including specific targets to return particular groups of fauna. This is important due to the ecosystem functions fauna provide in pollination, soil development and establishment of vegetation through seed dispersal (Stantec 2023, 18, Anderson et al. 2022).

Moveover, Alcoa provides mixed messages on the effectiveness of different rehabilitation completion criteria. 'The effectiveness of rehabilitation under past prescriptions has been demonstrated through long-term research and is at a high level of confidence'. There is moderate confidence in contemporary rehabilitation prescriptions improving fauna habitat values (e.g. for Black Cockatoos and reptiles) compared to past prescriptions (e.g. 1980s-1990s)' (EX 6-208) perhaps 'given the lack of studies on recolonisation of fauna in current era rehabilitation' (Stantec 2024, 35). On the other hand, Alcoa cites pre-2016 rehabilitation prescriptions as a cumulative negative impact (EX 207, MMP 367) and expects more recent prescriptions to improve habitat quality for a number of species (EX 6-178-81, Stantec 2003, 35).

Given the failure to meet completion criteria for rehabilitation to date – let alone those measures needed to protect the flora and vegetation biodiversity and ecological integrity in the future (Stantec 2023), the claim to mitigate habitat loss through rehabilitation is in doubt.

Despite expressing confidence in their rehabilitation, Alcoa concludes mitigation measures will not counterbalance the likely significant residual impacts on habitat for some threatened species, therefore, offsets are required (see Offsets) (EX 14-3) .

Black Cockatoos

Classification

Alcoa lists Baudin's and Carnaby's Cockatoos as Endangered and Forest Red-Tailed Cockatoos as Vulnerable.

The Baudin's Black Cockatoo's conservation classification is incorrect. Appeals Convenor Reports to the WA Minister for Environment have stated repeatedly it is Critically Endangered, as per the IUCN Red List of November 2021. The Environment Minister has upheld the Appeals Convenor's recommendations on this a number of times and strengthened offsets as a result[2]. **An incorrect classification downplays the extinction risk for Baudin's Cockatoos and has consequences for offset calculations.**

Foraging

For the Expansion, over **7,000 ha of Black Cockatoos high value habitat** for foraging and breeding will be cleared.

Again, Alcoa expects short term impacts with Black Cockatoos **foraging on rehabilitation** in 7-11 years from clearing (EX 6-151). In the meantime, the birds are expected to adjust to mining and feed elsewhere. Alcoa admits there is 'insufficient data' to determine the carrying capacity of wider forests and whether habitat clearing would in fact 'result in a decline in local populations of Black Cockatoos' (EX 6-151). The company only takes carrying capacity issues seriously in relation to poor fruiting years for Jarrah and Marri (EX 6-152).

Alcoa does not consider the specific impact of loss of foraging habitat on breeding birds, which is considered 'critical' for all three species in the Jarrah forest (DAWE 2022, 10). As Black Cockatoos rely on proximate food sources to successfully raise chicks, any '[l]ack of foraging resources increases the likelihood that birds won't regain condition after breeding, won't breed again the following season, and that juveniles won't survive to become part of the adult population (DAWE 2022, 7).

Black Cockatoos do forage in rehabilitation areas. Yet there is no data on whether rehabilitation provides *equivalents* in terms of food availability and quality. Alcoa admits foraging 'within mine rehabilitation has been recorded at low densities compared to un-mined forest' (EX 6-151), but puts this down to overstory stem density. It speculates that contemporary rehabilitation prescriptions to reduce overstory density '*may* improve' foraging habitat quality (EX 6-179, emphasis added). Still, there are no guarantees that rehabilitation will provide the same quantity and quality of food as unmined vegetation.

[2] Appeals 058/21-CPS 9237/1 Cowaramup Bay Road Upgrade; 040/21-CPS 9094/1 Lot 2168 Denbarker; 010/22-CPS 9333/1 Old Vasse Road, Hawke Road, Wheatley Coast Road and Perup Road Reserves, Shire of Manjimup; 018/23-CPS 9769/1 Lot 3060 On Plan 36442 Talbot West Road, Shire of York; and 034/22-CPS 8958/1 Lot 230 on Deposited Plan 232802, Elgin, Shire of Capel.

Alcoa claims to be world class in its rehabilitation, yet finds excuses for disappointing outcomes in past prescriptions while promising rectification in the future. There are known failures from 'contemporary' prescriptions and practices that Alcoa does not acknowledge in relation to mitigation of fauna habitat losses. Marri trees, for example, provide critical foraging and breeding habitat for Black Cockatoos (EX 6-60, Johnstone et al. 2013). 'Marri is a primary foraging species for Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo' (DAWE 2022, 10). An independent review of Alcoa's rehabilitation found that Marri rehabilitation was not successful and, moreover, remedial work had not been done (Stantec 2023).

Alcoa also does not fully take into consideration the compounding and cumulative effects of stresses like climate change, bushfires and prescribed burns in their rehabilitation efforts (EX 6-187). Instead, Alcoa makes general statements such as climate change will 'result in changes to the fauna habitat types caused by changes in the structure of vegetation communities' (EX 6-187). This misses, for example, how climate change is affecting flowering and seed setting or the availability of perennial water sources in summer and autumn that may impact breeding locations of Black Cockatoos. These are mentioned separately elsewhere (EX 6-151-52), but not in terms of holistic scenarios for the NJF.

Breeding

The impacts of **habitat loss for Black Cockatoos breeding** are considered 'long-term (> 100 years)' (EX 6-151). The key factor is the loss of trees with nesting hollows that can take 100 to 150 years to *start* forming in Jarrah and Marri (EX 6-59) – and then decades more to develop suitable nest hollows (DAWE 2022).

Carnaby's Black Cockatoo. Photo: Keith Lightbody.

The Expansion could impact about 300 known and 650 suitable nesting trees[3] (EX 6-151). Following pre-clearing surveys, all **such trees will be avoided with a 30 m minimum buffer**, 'unless clearing is for Critical Infrastructure whereby .... a 10 m radius buffer will be implemented instead, unless the tree cannot be avoided' (EX 6-191, 6-223, also MMP 376, 397, 401). 'Short-lived' exploration activities will have a 10m buffer.

There is inconsistency between proposed nesting trees buffers throughout the Proposals. In some MMP appendices the buffer is described as 50m as part of the Limited Disturbance Areas (LDAs) (Alcoa 2023a 34 and Alcoa 2023b 37), and 10m in other appendices for the Expansion (Alcoa 2023c 48).

A 30 m buffer is inadequate to prevent edge effects and mining related disturbances. The proponent has not demonstrated how a 30 m buffer will adequately prevent edge-related effects like dust, noise, and light intrusion, and consequent disturbances to black cockatoo nesting activity. There is also no evidence that a 30 m buffer will provide sufficient foraging for nesting females, given their requirements for food sources in the vicinity of their nests (DAWE 2022).

Alcoa is currently required to provide 10 m buffers and from January 2027 50 m buffers by the Ministerial Approval Conditions for Alcoa's 2023-2027 Mining Management Program. From 1 June 2024 - 31 May 2025 Alcoa breached the 10 m buffer 6 times (Ramboll 2025).

DBCA has previously advised: **'Minimum buffer distances should be at least 250 meters for black cockatoo habitat trees that are *known* breeding trees ... and 50 meters for *potential* black cockatoo nesting trees'** (Appeals Convenor, 34-36).

The further loss of between 114,100 - 144,500 potential nesting trees in the Expansion alone (EX 6-151, 15-25) will have much longer-term consequences for 'the future local extent of breeding habitat' for Black Cockatoos (EX 6-209). The MMP will remove about 167 'habitat' (potential nest) trees, however, **only 29.8% and 80.4% of the Huntly and Willowdale mine DE (respectively) has been assessed** and numbers of known and suitable trees are not given. Accordingly 'estimates are only indicative' (MMP 365). This an indictment of Alcoa's current practices and a major flaw in its assessment of its long term impacts on Black Cockatoos as potential trees are the breeding trees of the future.

The overall number of roosting trees or sites are not specified for either Proposal.

[3] Black Cockatoo trees are categorised in the Expansion and by DBCA as either 'known' trees, which have nest hollows in use or 'suitable' trees which have suitable hollows, these are combined in the MMP as 'nest' trees. 'Potential' trees lack hollows but are old enough to have them develop in a few decades. These are referred to as 'habitat' trees in the MMP (EX 6-59 and MMP 332). 'Significant' trees are mentioned, but not apparently defined for the MMP (eg MMP 375, 379, 381)

Alcoa states it initiated research into 'Black Cockatoos usage of retained nesting trees within mined landscapes' (MMP 376). Preliminary data suggests that 80% of 'revisited retained nesting trees *that remain viable* have been used' (MMP 376, emphasis added), however, there is no explanation for that category of tree and no reference is provided.

The Proposals will **remove the breeding trees of the future**, which, due to climate change, are not on a certain recovery trajectory.

Risks and recommendations

1. The impact on fauna habitat is much greater than the 11,458 ha of direct clearing due to fragmentation, competition for remaining habitat, and longer term impacts of failing rehabilitation which will be exacerbated by climate change. The Proposals' impact assessments must be updated accordingly and based on independent studies.

2. Targeted species habitat avoidance must receive regulatory oversight and verification. The impact of direct mortality of fauna during clearing as well as fauna dispersal must also be independently assessed and further assessment undertaken on the impact of soil fauna.

3. The EPA and DBCA must require the updated rehabilitation completion criteria to include fauna-specific criteria, including targets to return particular groups of fauna and improved evaluation of rehabilitation as habitat.

4. The failure to rehabilitate Marri, a key Black Cockatoo food and nesting tree, as well as admissions that foraging within mine rehabilitation is lower compared to unmined forest, must be addressed with further research and factored into the EPA's assessment of habitat recovery.

5. The Baudin's Black Cockatoo's conservation classification must be corrected to Critically Endangered, as per the IUCN Red List of November 2021 and previous decisions by the EPA Appeals Convenor and WA Environment Minister.

6. No known and suitable Black Cockatoo nesting trees at all should be cleared, and critical infrastructure should be rerouted. The buffer for Black Cockatoo nesting trees must be clarified and increased from 10-50 m to a minimum 250 m buffer for known and suitable nesting trees and 50 m for potential nesting trees in line with DBCA's recommendation, particularly in light of the reported breaches of existing buffers in the last year. **The Baudin's Black Cockatoo is Critically Endangered and the retention of both current and upcoming feeding and breeding habitat is essential to the species' survival**.

7. **It is not acceptable for the Proposals to go ahead – under any conditions – until updated to reflect the above recommendations.**

Offsets

Offsets are a last resort measure to 'counterbalance any significant residual environmental impacts' (EPA 2014). Whilst the EPA hasn't specifically requested comment on offsets, WAFA has identified the proposed offsets as a serious concern. Conservation offsets are unacceptable if they allow an ongoing net loss of fauna habitat, as both Proposals do.

For Alcoa, the *only* significant residual impact from both Proposals is the 'loss or degradation' of habitat of six threatened fauna species: the three Black Cockatoos, Woylie, Chuditch and Quokka (EX 14-3-4, MMP 720).

Alcoa proposes additional conservation actions in State Forest (EX 14-6-8, MMP 724-25) 'to protect and enhance' the above species' habitats, benefiting also Numbats, Western Ring Tailed Possums, Quenda, Brushtailed Phascogale, Western Brush Wallaby and Rakali (EX 14-9, MMP 724-75). Conservation actions are chosen as threatened species recovery plans consider it **better to protect and improve existing habitat** than to replant elsewhere (Alcoa 2025a, 20). Additionally, Alcoa plans to 'help resolve knowledge gaps' re maintaining the ongoing ecological integrity of the NJF (EX -9, Alcoa 2025a, 18).

Alcoa will fund the conservation actions for 20 years at $3,500 per cleared ha, determined annually (EX 14-19, Alcoa 2025a, 66).

Offset areas are calculated as per the tables below, with some overlap in habitat between species.

Expansion (EX 14-4, 14-14):

Threatened Species	Habitat impacted (ha)	Weighted Av. habitat quality score	Quantum of Impact (ha)	Offset extent (ha)
Forest red-tailed BC	7,415	9	6,572	20,350
Baudin's BC	7,437	9	6,591	22,065
Carnaby's BC	7,431	8	5,842	20,050
Woylie	7,354	5	3,783	13,890
Chuditch	7,395	7	5,283	17,020
Quokka	1,359	7	883	2,895

MMP (MMP 723, 727):

Threatened Species	Habitat impacted (ha)	Habitat value	Significant Residual Impact (ha)	Offset extent (ha)
Forest red-tailed BC	3,932	10	2,267	7,518
Baudin's BC	3,918	10	2,416	8,609
Carnaby's BC	3,918	10	2,416	8,609
Woylie	4,117	7	1,961	8,512
Chuditch	4,117	8	1,537	5,062
Quokka	96	8	36	119

The 'habitat impacted' pertains to clearing and not fragmentation which is another source of habitat degradation.

The offsets calculator treats species as amorphous across the NJF region. However, WA researchers have highlighted the significance for conservation management of the impact of the habitat matrix (including habitat loss and fragmentation) on Black Cockatoo flock size, daily distances travelled, distances between roosts etc (Rycken et al. 2021).

Also, the data shows, for example, that in the non-breeding season, Carnaby's Black Cockatoos forage only a mean maximum radius of about 4 km and up to 6 km from their resident roost. Baudin's are similar while distances for Red-Tails are less (K. Riley and Murdoch University unpubl. data 2024, EPA 2019, 31). These findings support previously-reported daily maximum foraging distances from roosts of around 6km (e.g. Rycken et al. 2021). When breeding, some Carnaby's can travel 100-200 km in a short period, but many others take weeks to migrate, moving shorter distances each day as they forage. While this research comes from the Swan Coastal Plain: the point is, Alcoa does not cite research of this kind, the implications of which are that attention should be paid to how the foraging ranges of individual flocks impact the likelihood of them 'counterbalancing' their immediate habitat losses by being able to access offset areas.

The conservation actions/offset projects in these areas will include: permanent drinking water for Black Cockatoos, remnant vegetation rehabilitation, riparian vegetation enhancement, predator and feral animal control, fire mitigation/rapid response technologies, population structure and habitat usage surveys (EX 14-12, MMP 726).

For the Expansion, the aim is 'a one point increase in the weighted average habitat quality score' within 5 years, maintained until the end of the offset period (EX 4-11-12).

Offset areas are to be in State Forest, close to mined areas as possible and with 'high environmental values that would benefit from additional conservation actions' (EX 14-12). Two areas have been identified for the Expansion: parts of the already proclaimed Mining Avoidance Zones (MAZs) in Jarrahdale (2,647 ha adjoining Serpentine National Park) and Dwellingup (5,087 ha adjoining Lane Poole Conservation Reserve) (see Map 1). There are no offset areas specified yet for the MMP.

MMP processes to date have not required offsets, compounding the cumulative impacts of historical clearing.

Alcoa proposes to consult and engage with the WA Government to seek agreement to **add its proposed offset conservation areas into the conservation reserve system** for future protection (EX 14-13), particularly when 'near to an existing conservation reserve or area proposed for addition into the conservation reserve system under the Forest Management Plan' (Alcoa 2025a, 20). Both the WA and Federal Government require long-term security of offsets. While Alcoa indicates a willingness to oblige, achieving this will 'require new legal solutions' to ensure permanent protection from all future mining and development activities (WABSI 2025, 14).

Risks and recommendations

1. Restoration offsets present 'the lowest risk in terms of confidence in meeting government and best practice offset criteria as well as regulator and stakeholder acceptability' (WABSI 2025). However, even restoration **offsets are unacceptable if they allow an ongoing net loss of fauna habitat**, as both Proposals do. Habitat enhancement measures do not 'counterbalance' this ongoing net loss. Forest protection through offsets that allow habitat removal still results in a net loss of habitat.

2. The lack of detail on the remaining offset areas to be selected means the EPA cannot do a proper assessment of the Proposals.

3. Alcoa has a long history of blocking forest protection in the NJF (Forestry Australia 2020). It cannot be left to Alcoa to select its restoration offset areas. Alcoa's offset plans lack specific commitments to independent expert assessment of offset areas' suitability for protection. Future protected areas need to address current CAR criteria shortfalls for the NJF and not be left to Alcoa to select. Dracula cannot be left to run the blood bank.

4. Alcoa's proposal to not mine offset areas means little if the State government does not agree to end all other future mining and development in the offset areas.

5. The offset calculator does take into account the net habitat loss (or gain) for specific flocks of Black Cockatoos, yet they are known to have specific ranges, especially when breeding. Instead Black Cockatoos are treated as amorphous and entirely mobile.

6. There is no evidence of quality equivalence between Alcoa's proposed offsets and the habitat destroyed.

7. The offset area calculations do not take into account impacts of forest fragmentation - which Alcoa considers to be about another 32 percent of the area cleared - and indirect impacts such as dust, light and noise.

8. The offset area calculations do not take into account cumulative stressors on fauna habitat such as climate change.

9. Assessment of the Proposals must be paused until offsets are calculated with the IUCN Critically Endangered status for Baudin's Black Cockatoos, the other factors above are taken into account, and the details of remaining offsets areas are provided.

10. **WAFA urges the EPA to exercise its precautionary principle in relation to the unacceptable nature and lack of security of the proposed offsets and recommend non-approval of the Proposals.**

Baudin's Black Cockatoos. Photo: Keith Lightbody

Terrestrial Environmental Quality

EPA Objective: To maintain the quality of land and soils so that environmental values are protected.

The Proposals can result in the following effects on Terrestrial Environmental Quality:

- Soil salinisation as a result of mining-induced saline groundwater rise
- Disturbance of potential acid sulfate soils (ASS).
- Erosion of post-mining landforms.
- Contamination from spills and/or leaks from storage and handling of hazardous materials and waste.

Bauxite mining removes 4-6m of lateritic bauxite. Rehabilitation replaces this with ~1.5 m of friable material (topsoil, overburden, ripped substrate) (EX 7-26), which is substantially less than the original profile depth and may reduce water-holding capacity, especially for deeper-rooted species.

Jarrah trees, for example, have a dimorphic root system. They have dense lateral roots in the topsoil and overburden combined with 'sinker' roots penetrating the caprock below and relying on deep ancient root channels (up to 40 m deep) for water access; these root channels are **permanent features** used by successive generations (Dell et al 1983) (EX 7-27). Alcoa expects a partial loss of soil water capacity, due to the removal of bauxite. This bauxite layer comprises about 2m of loamy soils in which deep and medium rooted vegetation usually root and the removal is therefore likely to affect long-term and healthy forest regeneration. However, despite clear contradicting evidence (see Rehabilitation) the company continues to make the unsupported claim that: the 'loss of the bauxite friable fragmental layer has not been observed to result in impaired growth or health of rehabilitation' (EX 7-27, MMP 422).

Rehabilitated mine pits are furthermore at risk of erosion, particularly in the first 2-3 years (EX 7-28). For that higher risk period, main erosion causes were excessive on-site runoff, poor surface completion and returned topsoil/overburden being too shallow (EX 7-28-29).

For the Expansion, Alcoa proposes to 'minimise' erosion risks, essentially by doing what it says it already does (EX 7-34), with reporting on self-certification failures, and occasional inspections by DBCA resulting in remediation (EX 7-37, MMP 429). However, on-ground reports indicate site preparation is not effective in minimising erosion (see photos below). The ERD acknowledges **limited long-term data** comparing erodibility of rehabilitation vs unmined Jarrah forest. The **lack of long-term comparative data** is a real evidence gap — particularly important because post-rehab landforms will be relied upon to prevent sedimentation of downstream reservoirs and waterways.

For the MMP, there are specific commitments for the creation of slopes: 'Slopes must always be less than 18 degrees. No landscaped pit is to have a slope greater than 15 degrees for more than 20 metres unless it is on contour of the surrounding forest floor' (MMP 427). **The photos below indicate recent noncompliance with this.**

Photos of steep mine pits supplied anonymously to WAFA.

Groundwater mounding

Groundwater modelling predicts **groundwater level mounding of ~1–10 m** beneath and adjacent to pits (Myara North, Holyoake, O'Neil) as mining proceeds. The ERD acknowledges potentially large hydrological change (up to 10 m) but relies on the claim that salinity will 'return to past levels' without presenting sufficient empirical evidence showing vegetation resilience to the described rate/magnitude of change or the spatial mismatch between mounding locations and sensitive receptor areas. The ecological consequences of a 1–10 m groundwater rise (especially where groundwater becomes shallow) are not adequately quantified.

Risks and recommendations

1. Alcoa's pit preparation for rehabilitation, erosion risk management, and promised remediation has been found to be inadequate on several occasions. Alcoa should be held immediately accountable for any breaches.

2. The EPA should require long-term (≥10 year) monitoring comparing rehabilitated and unmined sites for soil water holding capacity, nutrient cycling and root penetration, with data made public.

3. Alcoa has not addressed the performance of rehabilitated soils and vegetation under drier, hotter future climate scenarios. The EPA should require stress-testing of rehabilitation under projected climate scenarios.

4. Given the reliance on self-certification and internal monitoring, the EPA should require regular independent audits of groundwater, ASS, erosion, and rehabilitation performance, with results made publicly available.

5. **WAFA urges the EPA to exercise its precautionary principle in relation to post pit preparation and its impact on erosion and rehabilitation performance and recommend non-approval of the Expansion. Strict conditions must be placed on the MMP to ensure compliance with pit preparation and erosion risk management and all breaches are immediately remediated.**

Inland Waters

EPA Objective: To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.

Water catchments

'Bauxite mining operations represent the single most significant risk to water quality in Perth Metropolitan and Southwest drinking water catchments' (Water Corporation 2022).

Disturbance from the Expansion will predominately occur in Serpentine and South Dandalup Dam catchments (80 percent to 2044) (EX 8-74). For the MMP, 43 percent of Huntly Mine disturbance will be in the Serpentine Dam catchment while Willowdale is predominately in the Murray River catchment (MMP 485-86).

Reservoir Protection Zones (RPZ) are 2km buffers around a reservoir to protect it from contamination. Members of the public are not allowed in for any reason, yet Alcoa has been clearing forests for mining and infrastructure in these areas. Alcoa's current mining was pulled back 1km from the Serpentine Dam in late 2023 by the WA Government. Mining activities, except for infrastructure in the RPZs have been 'deferred' for the Expansion; for the MMP, mining is proposed to continue in a number of RPZs but within 1-2km zone for Serpentine Dam (MMP 498). Over 8,800 ha of the Exploration DE will occur in drinking water dam RPZs, 1 km from the water level (MMP 703-04).

For the Water Corporation, the 'probability of contamination of reservoirs' is 'certain' (Water Corporation 2022, 7). Sediment/turbid water from mining and rehabilitation can enter reservoirs. While not hazardous in itself, turbidity reduces the efficacy of treatment processes in inactivating or removing pathogens. Alcoa's Huntly and Willowdale mines had an average of 45 drainage failures/year in 2017-2022 (EX 8-118). The cost of treatment for all dams for the 2023-27 MMP would be 'in the order of $3.25 billion' (Water Corporation 2022, 7).

As part of the Ministerial Approval Conditions for the MMP, Alcoa was required to prepare draft methodologies for a full mining cycle planning approach and cumulative catchment scale risk assessment. The initial draft was rejected as it 'did not meet the metrics the Water Corporation used to assess the Cumulative Catchment Risk Assessment Methodology. The Water Corporation suggested a conceptual model rather than a quantitative approach' (Ramboll 2025). As of June 2025 subsequent drafts have not been approved.

The WA Department of Health has stated that the 2023 Alcoa Transitional Approvals Framework[4] 'is not consistent with the published DWSP [Drinking Water Safety Plan] risk management objectives and Australian Drinking Water Guidelines' (WA DoH, 2024).

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4 https://www.wa.gov.au/service/environment/environment-information-services/alcoa-transitional-approvals-framework-and-assurance-program

Three key risk factors increase the likelihood of sediment/turbid water entering reservoirs: clearing more than 30 percent of a subcatchment, in areas greater than 16 percent slope, and in areas of potential shallow groundwater (EX 8-118). For the Expansion, Alcoa states that no more than 30 percent of a subcatchment will be cleared, *with the exception of the Myara North infrastructure corridor* (EX 8-161). Clearing will also abide by the 16 percent slope limit (EX 8-161), but for the MMP, this limit will only apply to the RPZs, *not the wider catchment* (MMP 510). However, Water Corporation states its assessment of existing drainage failures 'indicates risks escalate when the area of clearing exceeds 25-30 percent of sub catchment areas' and 'that 50 percent of drainage failures were associated with areas exceeding 16percent slope' (2022, 53, 27).

The Expansion will involve construction of river crossings over the Serpentine and South Dandalup rivers for haul and mine access roads and a conveyor (EX 8-98). These crossings are in the RPZs and have potential to impact water quality. They will also require controversial Section 18 applications under the Aboriginal Heritage Act 1972. A pumping station and pipeline will also be constructed through the RPZ to source water from the Serpentine Dam (EX 1-48).

PFAS

Alcoa used PFAS from 2013 to 2021 as a fire suppressant. Low concentrations have been detected in some groundwater bores within Alcoa's mining areas (MMP, 479 and 501). Alcoa states that water for dust suppression is largely sourced from local reservoirs, storm water run-off and treated wastewater. They do not acknowledge the recently revealed use of water contaminated with PFAS for dust suppression, which was not approved by the Department of Water and Environmental Regulation (DWER) (Mitsopoulos 2025).

Runoff

An increase of inflow to the reservoirs is expected during Alcoa's mining, but then a decrease (compared to non-mined areas) once rehabilitation begins (EX 8-146). Rainfall is expected to decline due to climate change, cumulatively reducing the streamflow in future years. Groundwater has already declined up to 15m within the Mine DEs. (MMP 477)

Water use

It is difficult to determine the total water use by Alcoa, with various figures used throughout the documents. It appears the Pinjarra Refinery uses on average approximately 7.43 gigalitres (billion litres) of water per year (GL/year) from ground and surface sources. Alcoa expects this to increase by 0.5-1 GL/year when the refinery is upgraded to 5.25 Mtpa, but is still investigating how this additional water will be sourced (EX 8-151-153).

Alcoa's existing mine operations use approximately 1 GL of water per year, primarily for dust suppression, sourced via water abstraction licences, harvested stormwater and recycled treated water. Alcoa expects this to increase to up to 3.7 GL/year (MMP 75).

For the Expansion, Myara North is expected to use up to about 3 GL/year and Holyoake 1 GL/year: an estimated use for O'Neil is not stated, but could be assumed to be similar to the 1 GL/year for current mining in the region. An additional 1.6 GL/year will be required for 18-months for the Expansion construction. Water is to be sourced from treated stormwater run-off and water from the Serpentine and South Dandalup Dams with supply still to be negotiated by Watercorp (EX 8-147 and 1-56).

In total approximately 17 GL of surface, groundwater and dam water will be used by Alcoa each year on average, for mining and refining, with additional water sourced from rainfall harvesting and process inputs. For comparison, the maximum output of the Kwiana Desalination Plant is 50 GL/year.

For both Proposals, particularly the MMP, there are a large number of knowledge and or data gaps. These include:

- groundwater monitoring data and analysis (MMP 436, EX 8-27, 8-56, 8-66),
- quantitative risk assessment for drinking water and contaminant modelling (MMP 437),
- water quality monitoring stations (MMP 453),
- surface water quality, flow and salinity (MMP 436, 454),
- water quality sampling for potential contaminants (including PFAS) (MMP 458),
- hydraulic modelling for reservoirs (MMP 465),
- surveys of wetland systems (MMP 474) and
- detailed sedimentation assessments (MMP 498).

Risks and recommendations

1. **An immediate and permanent ban must be placed on all mining and exploration activities except rehabilitation in RPZs to minimize the risk to drinking water. Planned infrastructure corridors in RPZs must find alternative routes.**

2. In addition, all mining in drinking water catchments should be phased out by 2028, at the end of the window of the currently approved 2024-2028 MMP. **WAFA urges the EPA to recommend non-approval of the Expansion in order to achieve this.**

3. In line with Water Corporation's (2022, 8) recommendations, there should be no exceptions to the 30 percent clearing limit in a sub catchment and to the mining prohibition in areas of greater than 16 percent slope.

4. Alcoa's existing significant water use in a drying climate must be taken into consideration by Water Corporation when negotiating supply from the Serpentine and South Dandalup Dams, and by the EPA when assessing the impact of a pipeline being built through the RPZ to access the water.

5. As there are a lot of knowledge and data gaps, the precautionary principle must be upheld. Without robust baseline data, key risks to drinking water safety and water-dependent ecosystems cannot be reliably evaluated.

Air quality

EPA Objective: To maintain air quality and minimise emissions so that environmental values are protected.

Refinery

Refinery emissions come from combustion and metallurgical processes and dust is emitted from residue storage.

Air quality modelling for the refinery was done in 2021 (EX 9-17, Appendix B-12), but there is no assessment of cumulative impacts of the proposed production increase.

Alcoa's assertion the Refinery Air Quality Management Plan is an effective established practice with high certainty is not validated or supported by any evidence. No clear plan exists for monitoring near sensitive receptors or responding to exceedances.

Alcoa's claim of 'demonstrated compliance in air quality under both MS646 and L5271/1983/14' is unjustified. The DWER webpage currently lists 4 environmental incidents for Alcoa and one for ongoing dust monitoring. Alcoa's Air Quality Management Plan, required under MS646, is not available to the public. It does not include any avoidance or mitigation measures which are essential. Alcoa also seeks to remove MS646 dust conditions and fold them into the Refinery licence (L5271/1983/14), which does not cover mine sites, thereby significantly weakening oversight. Alcoa must be required to publicly release its Air Quality Management Plan and any compliance data under MS646.

Mining

The main emission from mining is dust as a particulate matter. There are potential, and already recorded, impacts for human health and social amenity, but also to flora and vegetation, inland waters, terrestrial environmental quality and possibly fauna.

Dust emissions sources are extensive: clearing, mine pit development, mining, rehabilitation, transportation of extracted materials, material processing and exposed areas (MMP 603).

Expansion

Mining in the Myara North mine region has potential to cause exceedance of 24-hour Total Suspended Particulate (TSP) and PM10 criteria at sensitive receptors for up to 20 days and 10 days respectively per year, particularly in the later years of mining (EX 9-61). Exceedances of 24-hour assessment criteria for TSP and PM10 are predicted in three different scenarios at multiple receptors including Jarrahdale, Mondadnocks, Mt Cooke and Wungong campsites.

Significant exceedances of relevant air quality standards are predicted at Myara North. While the consultant that did the modelling, GHD Pty Ltd, called these **'major exceedances' and attributed them to acting mining nearby** (B11-1, Executive Summary), **Alcoa downplays predicted exceedances** of relevant air quality standards at Myara North, claiming they are due to 'a degree of double counting of dust from

mine operations' and would only occur on fewer than 18 days per year (EX 9-28). Yet, the dispersion modelling **did not include emissions from the existing Myara ore crusher** as a source, assuming it was already reflected in Yamba dust monitoring data (B11-1, 36). This undermines the reliability of Alcoa's modelling and minimisation of impacts.

Proposed controls are basic (EX 9-59–60), rely on distance rather than emission reduction, and assume up to 75 percent suppression from unsustainable watering rates which won't work during dry, high-traffic periods.

MMP

Two Air Quality Impact Assessments were undertaken; one for the Myara mining area and one for the O'Neil area. No air or dust impact assessment was undertaken for the remaining Huntly Mine DE (Huntly and Del Park) (MMP 603). For the Myara area: "In all scenarios 24-hour PM10 concentration limits were exceeded at most sensitive receptors (MMP 604).

Cumulative dust impacts

Alcoa describes the Expansion's contributions to dust as "minor" compared to other sources (EX 9-29, 9-40), yet notes contributions up to 32 percent. Alcoa states that, in isolation, the dust generation potential of the MMP is unlikely to have a significant impact on air quality in the area, yet notes contributions as up to 50 percent at Karnet Prison (MMP 604), nearly 33 percent of concentration limits at nearby residential receptors, and TSP and PM10 concentrations 54 percent and 45 percent respectively of the limits at Serpentine Dam recreational facilities in one scenario.

By not factoring in the background concentration of airborne dust, Alcoa is ignoring the potential for cumulative exceedances of guideline concentration values at most sensitive receptors. Cumulative 24-hour PM10 concentrations are predicted to be exceeded at a number of sensitive receptors over the life of the Proposal as a result of high background concentrations, with receptors in closest proximity to the Huntly Mine DE having the greatest potential impact.

No cumulative dust deposition modelling was undertaken for Myara North or O'Neil due to lack of background data (EX 9-30, 9-36, 9-40). At Holyoake (EX 9-10) and O'Neil, only incremental results were modelled, leaving actual cumulative impacts unknown and based on assumptions rather than evidence. Without measured background data, exceedance predictions remain speculative. Background air quality data has not been provided for a large area of the Huntly Mine DE (MMP 603).

Alcoa claims that dust from current Myara operations will not significantly contribute to background levels, as the site is transitioning to rehabilitation. However, it provides no clear timeline for when rehabilitation will begin, nor any estimates of dust likely to be generated during rehabilitation.

At Holyoake, Alcoa acknowledges that 24-hour TSP concentrations *may* exceed the criterion during periods of elevated background dust (e.g., wildfires, dry weather), yet no direct cumulative modelling was undertaken to quantify this risk (EX 9-36).

Flora and fauna

Fauna are listed as sensitive receptors (EX 9-11) but no risk assessment is provided despite their sensitivity to dust. Dust can reduce food availability and quality, clog respiratory systems, alter habitat conditions, and impact invertebrate populations, all of which are critical for fauna.

Vegetation impacts are unquantified despite acknowledged research showing dust harms photosynthesis, temperature, and growth (MMP 251–252). Broader ecological consequences, including effects on groundwater and fauna, remain unassessed.

Health and amenity

Local residents have expressed concern for their health and reported that dust events frequently disrupt daily life and diminish local amenity. Alcoa recognises that noise and dust 'may affect one's experience of the area' but are not considered significant. Predicted short-term exceedances (5–18 days/year) near communities and recreation areas are downplayed as minor, despite representing repeated breaches of standards and impacts on local health and amenity.

Mining activities are also likely to impact the experience of visitors utilising recreational areas or nearby residential properties under worst case operational conditions, should the Proposal activities be undertaken in close proximity.

Risks and recommendations

1. The precautionary principle must be upheld due to major data gaps and the lack of properly quantified cumulative impacts. This, in combination with multiple exceedances of air quality limits, are ground for rejecting the proposal.

2. Alcoa must be required to publicly release its Air Quality Management Plan and any compliance data under MS646.

3. A far better standard for dust mitigation must be implemented for the Proposals, including blast stemming and active practice controls of dust emissions for haul roads, conveyors, stockpiles, crushers, transfer points and open areas.

4. Alcoa must provide further information for assessment outlining how it will monitor air quality near sensitive receptors and respond to exceedances. This must include threshold definitions, specified response times, and formal triggers for action.

5. The EPA should investigate the complaints of excess dust from residents local to mines and refineries.

Greenhouse Gas Emissions

EPA Objective: To minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable.

'The EPA recognises that there are inherent links between the Greenhouse Gas (GHG) Emissions factor and other environmental factors through effects on climate. This is evidenced in part by the significant drying of the state's south-west. This drying in turn places significant additional pressures on water resources, flora and fauna, marine environmental quality, and social surroundings' (EPA 2023).

The EPA should assess the Proposals, not only in relation to the Safeguard Mechanism, but in relation to the consequences for:

- a credible pathway to the achievement of deep and sustained emissions reductions in WA over the next decade
- the State Government's commitment to net zero emissions by 2050
- Australia's Paris Agreement international obligations.

Alcoa expects both Proposals to result in **over 1.41 billion tonnes (t) of CO_2 equivalent (CO_2-e) GHG emissions to 2045** - over 1.0 billion tonnes from the Expansion (2026-45) and over 0.41 billion tonnes CO_2-e from the MMP (2023-27). MMP emissions do not include alumina refining (MMP 634).

Emissions breakdowns are as follows:

Alcoa's Pinjarra Expansion (2026-2045) (EX ix-x)	**Yearly** (CO_2-e)	**2026-2045** (CO_2-e)
Scope 1		
Refinery to 2045	1,874,250 t	37.48 Mt
Mining and Infrastructure	158,000 t	3.16 Mt
Forest carbon	na	5.07 Mt (6.34 Mt to 2050)
Total Scope 1	**2,032,250 t**	**45.72 Mt**
Scope 2		
Refinery to 2045	600,000 t	12.00 Mt
Clearing, Mining and Infrastructure	90,000 t	1.80 Mt
Total Scope 2	**690,000 t**	**13.80 Mt**
Scope 3		
Total Scope 3	47,409,000 t	948.18 Mt
TOTAL	**50.13 Mt**	**1,007.70 Mt**

Alcoa's MMP 2023 – 2027 (MMP 18, 68)	**Yearly (CO_2-e)**	**2022 – 2027 (CO_2-e)**
Scope 1		
Huntly Mine peak gross	124,900 t	624,500 t
Huntly forest carbon	1,827,798 t	1,827,798 t
Willowdale Mine	48,990 t	244,950 t
Willowdale forest carbon	1,175,433 t	1,175,433 t
Total Scope 1		**3.87 Mt**
Scope 2		
Huntly Mine peak gross	65,495 t	325,475 t
Willowdale mine peak gross	13,973 t	69,865 t
Total Scope 2	**79,468 t**	**395,340 t**
Scope 3		
Huntly	Approx 44.9 Mt	224.5 Mt
Willowdale	Approx 20.8 Mt	104.0 Mt
Total Scope 3	**65.7 Mt**	**328.5 Mt**
TOTAL		**332.76 Mt**

Scale of emissions

- Total life-time emissions of the Proposals would be 1.34 billion tonnes CO_2-e. This is equivalent to 11-13 1000 MW coal-fired power stations, each emitting about 1000 Mt per year.
- Total scope 1 and 2 emissions would be 63.78 Mt.
- Scope 1 and 2 GHG emissions from the Expansion alone are over 2.7 Mt per year - which is 3.37 percent of WA's emissions in 2020-21 (DCCEEW 2024).

<u>Forest carbon</u>

Emissions are largely from the Refinery. Nevertheless, forest clearing is unacceptable in a climate crisis.

While the tables above include f**orest carbon emissions from clearing**, Alcoa also gives *net* figures that include sequestration through rehabilitation. On this basis, for the Expansion, GHG emissions from clearing are estimated to be 2,806,640 t CO_2e by 2050; for the MMP they will be 3,278,208 t CO_2e. Importantly, **rehabilitation sequestration is not expected to exceed clearing emissions until, at the earliest, about 2075-2076** (EX 10-8). *This is well beyond the critical decade for Australia and the globe to cut GHG emissions to align with the Paris Agreement.*

Importantly, these numbers are estimates. They assume the same amount of rehabilitation as clearing in a year and rehabilitation success, but this is unjustified due to the known backlog and inadequacies of rehabilitation (see Rehabilitation). The expectation of sequestration exceeding clearing emissions in 50 years takes no account of wildfire.

Alcoa does not explain if timber cleared for mining that goes to Simcoa for burning for charcoal is included in its scope 3 emission calculations. If not, Simcoa's emissions should be included.

Alcoa's rehabilitation after a fire

Risks and recommendations:

1. Net GHG emissions rest on assumptions. As such, the claimed long-term carbon neutrality of the Proposals is highly uncertain and cannot be relied on in environmental decision-making.

2. **With some 1.34 billion t CO_2-e total GHG emissions over the next 20 years, the EPA has a clear mandate to reject the proposals.**

3. WA's GHG emissions already exceed the level required to support the Paris Agreement. Hence, WA must cut its emissions more steeply than other States in the future. **If the proposal is approved, Australia will not be heeding the science and meeting its international climate commitments, and the recognised environmental impacts from climate change will be severe, including in Southwest Western Australia.**

Social Surroundings

EPA Objective: To protect social surroundings from significant harm.

Heritage

WAFA supports any and all concerns raised through public comment by local First Nations people and corporations and the importance of Free, Prior and Informed Consent (FPIC). WAFA also acknowledges the limitations of the Aboriginal Heritage Act 1972 including the controversial section 18. Alcoa proposes multiple section 18 applications, including for river crossings as part of the Expansion.

Alcoa 'has commenced heritage investigations and consultation' with the two relevant Noongar Regional Corporations (MMP 706), but makes no commitment to Free, Prior and Informed Consent - which goes beyond 'consultation'.

Registered Aboriginal heritage sites and those identified during surveys as well as European heritage sites will all receive a 10 m 'Limited Disturbance Area' (LDA). If these heritage areas overlap with the following they will receive greater buffers; 50m for Black Cockatoo suitable and known nest trees, old growth forest and granite outcrops, 100m for stream zone/riparian vegetation and 200m for the top water line of Serpentine Dam. These buffers aim to *minimise* direct impacts to areas of environmental and social value. However, while mine pits are not permitted in the LDAs, haul roads, mine infrastructure and facilities are.

A 10 m buffer doesn't match with what is recommended for European heritage sites in the Historical Archaeological Assessment undertaken for the expansion; 20m buffer for Shield Trees, 50m buffers for the 40 Mile Peg Well, and Log Landings sand 100m for the Jarrahdale Board Mill. (Archae-aus 2021, 183, 189, 191, 197).

For the Expansion, Alcoa states it will avoid direct impacts to the Italian POW (Prisoner Of War) Camp, Water Well, and Holyoake (Log Landing) by establishing mining avoidance zones (EX 11-42), but it does not state the areas of the zones or if buffers apply.

Archeological sites are mostly located within 100 m from the rivers. Alcoa states that these areas may be directly impacted by infrastructure crossings and indirectly by stormwater runoff or sediment discharge from mine pits and haul roads (EX 11-36).

Amenity

According to an online survey commissioned by the WA Government in 2021, **almost everyone in WA uses the forest for personal or business purposes, and having access to WA's native forests is of utmost importance to individuals** (Subroy et al. 2021).

In addition to its environmental values, the NJF's social surroundings, hold a special place in the heart of many Western Australians. Being the closest forests to Perth's metropolitan area, it is where many go to get away and spend time in nature, exercise or relax. This is evident in the support for the protection of forests and the tens of thousands of people who have signed on or made their own submission to this public comment period but also the reach of the broader campaigns to end forest mining and protect forests.

The renowned Bibbulmun Track (BT) and Munda Biddi Trail (MBT), hiking and mountain biking trails respectively, are likely to have audible operations noise and mining, refinery and rehabilitation visible as part of the proposed expansion and current mining.

Alcoa acknowledges that mining will directly impact the amenity of the BT, due to its proximity (see Map 1). Impacts to visual and audio amenity from construction, operational and blasting noise are expected, increasing with proximity to the source (MMP 617).

Blasting will occur on an approximately daily basis during mining, generating air blast noise and vibration. The assessment indicates that the peak air blast level will attenuate within a 1.2 km radius to be below the 120 dB(L) maximum limit prescribed in the Noise Regulations for residential receivers (Wood 2023). Mining will not occur within 1.2 km of Jarrahdale or Dwellingup townsites and is unlikely to occur within 1.2 km of any recreational campsite (EX 12-48).

The noise assessment identified that operational noise is likely to be audible at some sensitive receptors under certain mining operations and adverse meteorological conditions in the absence of noise mitigation, including:

- Some rural properties along Balmoral Road
- Some rural properties at Inglehope
- Wungong campsite on the Munda Biddi Trail
- Monadnocks, Mount Cooke and Chadoora campsites on the BT (EX 12-49).

Any audible operational noise at anypoint along the BT would be intrusive and unacceptable as peace and *quiet* is one of the main reasons walkers from WA, Australia and overseas value the track.

The BT has a minimum 200 m buffer on either side applied, in line with its Comprehensive Adequate and Representative (CAR) Informal Reserve designation. Alcoa proposes to comply with an avoidance zone if the mine DE is within 200m of the track.

Mining disturbance will be visible on the BT in the mid to distant ground from Mount Cooke, Mount Vincent, Mount Wells and Boonering Hill and elevated viewpoints within the Monadnocks Conservation Park. Alcoa asserts the visual impact will last until rehabilitation is established (MMP 616), which would take almost two decades (EX 12-91) .

A 200 m buffer will not protect the integrity of the BT's forested areas from edge effects, nor protect the visual and auditory experience of the forest. Therefore a buffer of at least 1000 m should be implemented instead.

The inadequacy of a 200m buffer surrounding the BT is further illustrated by this viewpoint approximately 2 km from the closest mining (Alcoa 2023c). 30 km of the BT is less than 2 km from the Proposal.

Photo 8-10 Photomontage showing view west from Mount Vincent

Most of the impacts on the Munda Bidi Trail have been avoided, not by moving the mining around the trail, but by moving the trail around the mining. The proposed Myara North mine would have covered the Trail, but the MBT was preemptively moved in 2023, before the Expansion has been assessed, let alone approved (see Map 1).

The Balmoral Trail and its extension will be partially closed during mining for a combined 14.1km, with rehabilitation visible from the trail once reopened. This will also affect the POW Camp - Three Mountains Walk. The heritage-listed POW Camp will be accessible by appointment only. Alcoa states that the POW camp will be in an AZ, but does not specify what size buffer will be around the camp. Due to the camp's proximity to mining, dust is likely to be deposited there, at visible levels (EX 12-42, 12-72).

By Alcoa's own admission 'the closure of walking tracks due to mining restricts recreation value and exposure to scenic value' (MMP 591).

The Expansion's proposed Holyoake Mine will also impact the Dwellingup Discovery Forest, proposed by the local community in 2016, particularly Zone 5 - Murray Basin Wilderness Zone, the majority of which is within the mine DE. Alcoa admits the area includes 'Several potential ecological, water catchment, heritage, recreational and scientific values' (Alcoa 2025d 13), yet doesn't address them specifically, relying on broader assessments elsewhere in the ERD.

Risks and recommendations

1. Details of MAZs and LDAs for both heritage, amenity and environmental values, must be provided and clarified to ensure they are aligned with recommendations from Noongar people and corporations with FPIC, as well as relevant experts and Government departments.
2. The buffer between mining and exploration and the Bibbulmun Track must be increased from an inadequate 200 m to at the very least 1000 m to ensure zero noise and visual impacts.
3. Given its significance to the Jarrahdale community, the Balmoral Trail and Extension and POW Camp should all be placed in an avoidance zone of at least 1000 m to safeguard their history, heritage, recreation and environmental values.
4. To protect its environmental, cultural and heritage amenity, Dwellingup Discovery Forest should be removed from the Expansion Proposal.

Matter of National Environmental Significance (MNES)

Only the Expansion within Myara North DE and Holyoake DE were referred and determined a controlled action under the EPBC Act and will be an accredited assessment. O'Neil was referred separately (EX 15-1) yet as of 19 August 2025 is 'Awaiting Delegate Decision'.

The MMP has not been referred, despite the similar environmental impacts as the Expansion and overlapping with O'Neil. WAFA wrote to the Federal Minister for Environment in 2024 requesting the MMP be referred for assessment under the EPBC Act (Appendix A). The response given (Appendix B) was that Alcoa would be reminded of its responsibility to seek approval for actions that may have a significant impact on matters of national environmental significance.

The MNES that 'may' be subject to significant impacts from the Expansion are the nine listed threatened fauna species that are known to be, likely or potentially present in both DEs and potentially one flora species in Myara North DE (EX 15-2-11). The MEs overlap significantly with the Peel-Inlet catchment, an element of the Peel-Yalgorup System Ramsar site (EX 15-12).

Alcoa lists the 'potential' impacts on listed fauna and flora as:

- Direct impacts as a result of clearing and injury/mortality from fauna entrapment or vehicle/equipment collisions;
- Indirect impacts as a result of the introduction/spread of weeds and or Phytophthora dieback, attraction of feral animals, light and noise emissions, spills and/or leaks of hazardous materials and waste, and waterlogging and salinity in valley floors and lower slopes.

Alcoa considers significant impacts are 'unlikely' for the Peel-Yalgorup System Ramsar wetlands (EX 37-39). The potential indirect impacts on the Peel-Yalgorup System Ramsar wetlands are listed as:

- Changes to hydrological regimes that affect inflows to rivers downstream.
- Induced groundwater discharge that increases salinity to rivers downstream.- spills and/or leaks from storage and handling of hazardous materials and waste (EX 15-19).

For the single listed threatened flora species, Alcoa assesses there are 'unlikely' to be significant impacts for the key criterion (EX 15-23-24).

For the threatened Black Cockatoos, Alcoa's assessment of significant impact criterion echoes its EPA assessment. However, there are discrepancies in the figures for total area of habitat impacted for Myara North and Holyoake DEs for each species:

Black Cockatoo	**MNES** **(EX 15-25)**	**Offsets (Myara North & Holyoake)** **(EX 14-4)**
Forest red-tailed	6,199 ha	6,396 ha
Baudin's	6,199 ha	6,418 ha
Carnaby's	6,418 ha	6,413 ha

The 81,200 potential nesting trees for the MNES (EX 15-25) compares with the 86,800 potential nesting trees for Forest Red-tailed Black Cockatoos for Myara North and Holyoake DEs for Terrestrial fauna (EX 6-156).

Alcoa assesses 'likely' significant impacts on area of occupancy, habitat critical to the survival of a species, breeding cycle and recovery of the species, and 'potential' for a long-term decrease in population size and species decline (EX 15-26-27). **For Endangered and Critically endangered species, these impacts are intolerable.**

For Chuditch there are 'likely' significant impacts on area of occupancy, population fragmentation, habitat critical to the survival of a species and breeding cycle, and 'possible' significant impacts for species decline, harmful invasive species and species recovery (EX 15-34-35). For Quokka there are 'likely' significant impacts for survival of a species, and 'possible' significant impacts for area of occupancy, population fragmentation, breeding cycle, species decline and harmful invasive species (EX 15-34-35).

Proposed avoidance and minimisation measures and offsets also echo those for the EPA assessment (EX 15-41-47).

Risks and recommendations

1. Alcoa must refer the MMP to be assessed as a controlled action under the EPBC Act in line with the Expansion.
2. Alcoa's claims that significant impacts are 'unlikely' for the Peel-Yalgorup System Ramsar wetlands must be independently assessed due to the significance of potential impacts.
3. Discrepancies in the loss of habitat and potential nesting trees between the MNES and offsets chapters must be rectified.
4. The Federal Government must reject the Expansion (including O'Neil) due to the unacceptable 'likely' significant impacts on threatened fauna.

Stakeholder Engagement

Alcoa's stakeholder engagement strategy for the MMP is insufficient, at a total of 7 pages long, including the stakeholder engagement register appendix. It does not even include a summary of key issues raised and the company's response, as in the Expansion strategy document. No engagement after the MMP was accepted for assessment by the EPA in late 2023 is recorded.

WAFA was not consulted on the 2022-2026 or 2023-2027 MMPs before they were submitted to the Mining Management Program Liaison Group (MMPLG). WAFA was consulted on the draft clearing maps 2025-2029 MMP just weeks before before submission, at the request of WAFA, and then again on the draft clearing maps for the 2026-2030 MMP. Both times WAFA has submitted written feedback with no response (Appendix C and D). After the meeting for the 26-30 MMP map WAFA also submitted a number of questions in relation to the MMP writing on 25 June 2025, responses were not received until 4 August 2025.

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Abbreviations

AZ – Avoidance Zone	**IPCC** – Intergovernmental Panel on Climate Change
BI – Biodiversity Indicator	**IUCN** – International Union for Conservation of Nature
BT - Bibbulmun Track	**LDA** – Limited Disturbance Area
CAR – Comprehensive, Adequate and Representative (Reserve system)	**MAZ** – Mining Avoidance Zone
CO_2e – Carbon Dioxide Equivalent	**MBT** - Munda Biddi Trail
CWD – Coarse Woody Debris	**MMP** – Mining Management Program
CWR – Critical Weight Range	**MS** – Ministerial Statement
DBCA – Department of Biodiversity, Conservation and Attractions	**Mtpa** – Million tonnes per annum
DEC – Department of Environment and Conservation	**NJF** – Northern Jarrah Forest
DE – Development Envelope	**PER** – Public Environmental Review
DoH – Department of Health	**PFAS** – Per- and Polyfluoroalkyl Substances
DWER – Department of Water and Environmental Regulation	**PM2.5** – Particulate Matter smaller than 2.5 micrometres
EPA – Environmental Protection Authority	**PM10** – Particulate Matter smaller than 10 micrometres
ERD – Environmental Review Document	**POW** – Prisoner of War
EX – Expansion (used as a citation shorthand, e.g., EX 7-26)	**RPZ** – Reservoir Protection Zone
FD – Functional Diversity	**SRE** – Short-Range Endemic
GDE – Groundwater Dependent Ecosystem	**t** – Tonne
GHG – Greenhouse Gas	**TEC** – Threatened Ecological Community
GL – Gigalitre	**WA** – Western Australia
ha – Hectare	**WAFA** – Western Australian Forest Alliance