ENVIRONMENTAL SCOPING DOCUMENT

Proposal name:	**Worsley Mine Expansion – Revised Proposal**
Proponent:	**South32 Worsley Alumina Pty Ltd**
Assessment number:	**2216**
Location:	**Approximately 5 km west-south-west of Boddington and approximately 15 km north-west of Collie**
Local Government Area:	**Shires of Boddington, Collie and Harvey**
Public review period:	**Environmental Review Document – 8 weeks**
EPBC reference no:	**2019/8437**

1. Introduction

The Environmental Protection Authority (EPA) has determined that the above proposal is to be assessed under Part IV of the *Environmental Protection Act 1986* (EP Act).

The purpose of the Environmental Scoping Document (ESD) is to define the form, content, timing and procedure of the environmental review, required by s. 40(3) of the EP Act. This ESD has been prepared by the EPA in consultation with the proponent, decision-making authorities and interested agencies consistent with the EPA's *Procedures Manual*.

Form

The EPA requires that the form of the report on the environmental review required under s. 40 (Environmental Review Document, ERD) is according to the Environmental Review Document template.

Content

The EPA requires that the environmental review includes the content outlined in sections 2 to 6 of this ESD.

Timing

Table 1 sets out the timeline for the assessment of the proposal agreed between the EPA and the proponent.

Table 1 Assessment timeline

Key assessment milestones	Completion Date*
EPA approves Environmental Scoping Document	23 January 2020
Proponent submits first draft Environmental Review Document	6 July 2020
EPA provides comment on first draft Environmental Review Document *(6 weeks from receipt of ERD)*	17 August 2020
Proponent submits revised draft Environmental Review Document	4 September 2020
EPA authorises release of Environmental Review Document for public review *(2 weeks from EPA approval of ERD)*	30 October 2020
Proponent releases Environmental Review Document for public review for 8 weeks	1 November 2020
Close of public review period	30 December 2020
Summary of Submissions ** and Response to Submissions	22 January 2021
EPA reviews the Response to Submissions *(4 weeks from receipt of Response to Submissions)*	19 February 2021
EPA prepares draft assessment report and completes assessment *(6 weeks from EPA accepting Response to Submissions)*	2 April 2021
EPA finalises assessment report (including two weeks consultation on draft conditions) and gives report to Minister *(6 weeks from completion of assessment)*	14 May 2021

*Dates are indicative

**Task to be completed by the proponent

Procedure

The EPA requires the proponent to undertake the environmental review according to the procedures in the *Administrative Procedures* and the *Procedures Manual*, including requirements for public review.

This ESD has not been released for public review. The ESD will be available on the EPA website (www.epa.wa.gov.au) upon endorsement and must be appended to the Environmental Review document.

Matters of National Environmental Significance

The proposal was referred to the Commonwealth Minister for Environment under section 74 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in May 2019. The delegate for the Commonwealth Minister for Environment determined on 24 October

2019, that this proposal is a controlled action under the EPBC Act as it may impact on the following Matters of National Environmental Significance (MNES):

- Listed threatened species and communities (sections 18 and 18A).

The EPA acknowledges that the proposal will need to be assessed by accredited assessment under Part IV of the EP Act, and will proceed with the assessment on this basis.

This ESD includes work required to be carried out and reported on in the ERD in relation to MNES as identified in sections 18 and 18A of the EPBC Act. The ERD will also address the matters in Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000*.

MNES that may be impacted by the proposal will be identified, and the potential impacts on these matters addressed within each relevant preliminary environmental factor as identified in Table 4. The ERD will include a separate section which summarises the potential impacts on MNES and describes, to the extent practicable, any feasible alternatives to the proposed action and mitigation measures. Proposed offsets to address significant residual impacts on MNES are also to be discussed, and demonstrate how any proposed offsets are consistent with the *EPBC Act Environmental Offsets Policy*, October 2012.

2. The proposal

Background

South32 Worsley Alumina Pty Ltd (South32) currently operates the Boddington Bauxite Mine, the Worsley Alumina Refinery and the Port Facility, which is pursuant to the *Alumina Refinery (Worsley) Agreement Act 1973* (Worsley State Agreement). The Boddington Bauxite Mine is primarily located on Mining Lease ML258SA, which was granted through the Worsley State Agreement.

The Boddington Bauxite Mine is located approximately 5 kilometres (km) west-south-west of Boddington, and the Worsley Alumina Refinery is located approximately 15 km north-west of Collie (Figure 1).

The existing bauxite mining activities are undertaken in what is referred to as the "Primary Bauxite Area" (PBA), which is comprised of the Saddleback, Marradong and Hotham North areas. The refinery is currently licensed to produce up to 4.7 million tonnes per annum (Mtpa) of alumina.

The current Worsley Bauxite-Alumina operation is a long-term operation with a current expected ore reserve life of 17 years (as at 30 June 2018) based on a total ore reserve of 298 Mt. The Worsley Bauxite-Alumina operation has a Mineral Resource of 11,170 Mt from which additional ore reserves may be estimated beyond the current ore reserves.

The current mining and refinery operations are managed through conditions in Part A of Ministerial Statement No. 719 (MS 719) (Part IV of the *Environmental Protection Act 1986*), Licencing through the *Environmental Protection Regulations 1987*, and exemptions through the Commonwealth EPBC Act.

Part B of MS 719 relates to what is referred to as the "Extended Mining Areas" and is comprised of the Brookton, Central, Hotham North Extension, Morgans and East Quindanning areas. Development in these areas does not form part of this Revised Proposal.

The existing bauxite mining areas and refinery are connected by an overland conveyor and series of roads. Ore is crushed at the mine and processed at the refinery, then the alumina is transported by rail to the Port of Bunbury for export. Port facilities do not form part of this Revised Proposal.

During preparation of the ESD, the proponent revised the indicative footprint and the native vegetation clearing that would be required for the proposal. On the 11 December 2019, the proponent provided an application and supporting information for a Change to Proposal via section 43A (s43A) of the EP Act. The s43A application was approved by the EPA Chairman on 6 January 2020.

Revised proposal

The key activities of the Worsley Mine Expansion - Revised Proposal (the proposal) are:

- Increase of the existing mining envelope (i.e. PBA) to incorporate new and expanded resource areas, inside and adjacent to, the current operational and already approved areas. The proposal will encompass and expand the existing mining envelope from 22,102[1] hectares (ha) to 27,796 ha, and be known as the Worsley Mining Development Envelope (WMDE);
- The establishment of a Bauxite Transport Corridor (BTC) of 4,146 ha[2], which will link the existing mining areas at Saddleback and Marradong to new and future mining areas, including two crossings over the Hotham River;
- Development of a Contingency Bauxite Mining Envelope (CBME) of 747 ha within the Refinery Lease Area, which includes additional clearing within the Refinery Lease Area for maintenance purposes;
- Accessing existing bauxite mining stockpiles within the BGM mining areas (the stockpiling has been approved under MS 971 and EPBC Act No 2012/6370 issued to Newmont Boddington Gold Pty Ltd); and
- Construction activities and temporary support facilities associated with the proposal.

The assessment area is comprised of the WMDE, BTC and CBME – referred to as the Primary Assessment Area – which totals 29,357 ha (Figures 2 and 3). Note, this number excludes the overlap (3,332 ha) of the WMDE and BTC.

The proposal involves new clearing of up to 5,841 ha of native vegetation and fauna habitat for the mine, transport corridor, contingency bauxite mining at the refinery, and mining related activities. The proposal also involves disturbance to the beds and banks of the Hotham River for two river crossings for the purposes of the BTC and other river crossing as needed for mine haul roads in the WMDE.

[1] Based on the 2005 ERMP/MS 719

[2] The WMDE and the Bauxite Transport Corridor have a 3,332 ha overlap area

No dewatering of the mining area is required for the proposal, but an increase of 400 megalitres per annum (MLpa) of water is required for continuation of all mining activities, totalling 900 MLpa for mining operations. It is expected that up to 580 MLpa of water will be required during the construction period, in addition to water requirements for the ongoing operation of the mine.

The mining rate would continue at the current rate of 18.8 Mtpa (dry). No changes to the refinery are proposed and the alumina production rate would remain at 4.7 Mtpa. No modifications to the existing conveyor networks or Port of Bunbury handling facilities are required for the proposal.

As part of the proposal, the proponent has committed to release an isolated portion of the PBA (referred to as the Release Area). Relinquishment of the Release Area is to counterbalance historical clearing of native vegetation (i.e. approximately 40 ha of good to excellent condition) which occurred by accident, inside one or more of the historical PBA boundaries (and was subject to MS 719). This area is outside the now amalgamated, confined pre-existing approval area, which the proponent has implemented to avoid confusion related to the past PBA boundary changes. The Release Area is undisturbed, and is comprised of 101 ha of good to excellent condition native vegetation.

As part of this assessment, being consistent with the assessment of revised proposals, the conditions will be revised and replaced with contemporary conditions for both MS 719 and Ministerial Statement No. 751 (MS 751).

Project justification

Worsley has considered a number of alternative designs and approaches throughout the planning and development of the proposal.

The proposal will allow mining to proceed in and adjacent to already disturbed areas (including farmland), and to be progressively rehabilitated in a way that has the potential to reduce the overall impact of having many areas open at one time. Furthermore, it will allow for the expansion and the continuation of existing activities at the refinery (approved production capacity of 4.7 Mtpa), while allowing impacts to be assessed holistically, and increase the efficiency and effectiveness of environmental management.

The key characteristics of the proposal are set out in Tables 2 and 3. The key proposal characteristics may change as a result of the findings of studies and investigations conducted and the application of the mitigation hierarchy by the proponent.

Table 2 Summary of the proposal

Proposal title	Worsley Mine Expansion – Revised Proposal
Proponent name	South32 Worsley Alumina Pty Ltd
Short description	South32 Worsley Alumina Pty Ltd currently operates the Boddington Bauxite Mine, Worsley Refinery and port operations at the Bunbury Port.

	The current mining and refinery operations are subject to Ministerial Statement 719 (13 April 2006) and Ministerial Statement 751 (24 September 2007). The proposal is for the: • mining within the WMDE, which expands the existing approved mining area and incorporates new mining areas; • development of a bauxite transport corridor; • development of a contingency mining area and maintenance work at the refinery; • accessing existing bauxite mining stockpiles within the BGM mining areas; and • development of associated mine/support infrastructure. The proposal involves clearing of up to 5,841 ha of native vegetation for the mine and mining related activities. The proposal also requires two river crossings over the Hotham River for the purposes of the BTC and other river crossing as needed for mine haul roads in the WMDE.

Table 3 Location and proposed extent of the change to the physical and operational elements

Element	Existing Authorised Extent	Proposed Authorised Extent (This proposal)	Proposed Authorised Extent (Revised proposal)
Bauxite Alumina Project			
Alumina Production	4.7 Mtpa	No change on an annual basis	4.7 Mtpa
Greenhouse Gases	3.75 Mtpa $CO_{2\text{-}e}$	No change on an annual basis	3.75 Mtpa $CO_{2\text{-}e}$
Bauxite Mining			
Mining development envelopes	1. Mining Development Envelope (previously referred to as the Primary Bauxite Area) (Figure 2) 2. Extended mining areas (74,918 ha)	1. Expansion of the Mining Development Envelope to 27,796 ha (referred to now as the Worsley Mining Development Envelope) 2. No change to extended mining areas	1. Worsley Mining Development Envelope (27,796 ha – including pre-existing approval area) 2. Extended mining areas (74,918 ha)
Mining rate	Up to 18.8 Mtpa	No change per year	Up to 18.8 Mtpa

Areas of clearing of native vegetation for mining activities:	1. Areas of bauxite reserves (unchanged) as specified in the 1995 Consultative Environmental Review (CER) – up to 5,263 ha of clearing of native vegetation[3] 2. Up to 8,400 ha of clearing of native vegetation within Extended Mining Areas	1. Up to 5,375 ha of additional clearing of native vegetation within the Worsley Mining Development Envelope (Figure 2) 2. No change to extended mining areas	1. Up to 10,638 ha of clearing of native vegetation within the Worsley Mining Development Envelope (27,796 ha) (Figure 2) 2. Up to 8,400 ha of clearing of native vegetation within Extended Mining Areas
Water supply sources	Groundwater and surface water in the vicinity of mining areas	No change	Groundwater and surface water in the vicinity of mining areas
Water usage (average)	500 ML/a	Additional 400 ML/a	900 ML/a
Crushing facilities	4 primary crushers, 2 secondary crushers	No change	4 primary crushers, 2 secondary crushers
Bauxite Transport			
Bauxite Transport Corridor to service mining in Extended Mining Areas	Conventional idler-type conveyors and/or truck transport	No change	Conventional idler-type conveyors and/or truck transport
Bauxite Transport Corridor to service mining in the Worsley Mining Development Envelope	N/A	Transport of bauxite via truck haulage and/or conveyor to service mining in the Worsley Mining Development Envelope and its connection to Extended Mining Areas.	Transport of bauxite via truck haulage and/or conveyor to service mining in the Worsley Mining Development Envelope and its connection to Extended Mining Areas.

[3] At the time of the Worsley Mine Expansion Revised Proposal Referral, 4,321 ha of native vegetation has been cleared, with up to 942 ha of native vegetation remaining to be cleared within the Pre-existing approval area

		Continued use of existing conveyor and transport infrastructure	Continued use of existing conveyor and transport infrastructure.
Clearing Associated with Bauxite Transport Corridor to service mining in the Worsley Development Envelope	N/A	Clearing of up to 210 ha of native vegetation within the Bauxite Transport Corridor	Clearing of up to 210 ha of native vegetation within the Bauxite Transport Corridor (BTC development envelope[4] 4,146 ha)
Refinery			
Refinery lease area (RLA)	2,500 ha	No change	2,500 ha
Clearing within Wellington National Park	Clearing of up to 8 ha for Wellington Dam Pipeline	No change	Clearing of up to 8 ha for Wellington Dam Pipeline
Clearing within Refinery Lease Area	66.6 ha	5 ha	71.6 ha
Digestion process area emissions control	Regenerative thermal oxidiser	No change	Regenerative thermal oxidiser
Calciners – fuel Particulate emissions control	Natural gas Electrostatic precipitators on five calciners, baghouse system on one calciner	No change	Natural gas Electrostatic precipitators on five calciners, baghouse system on one calciner
Liquid burner emission control	Baghouse, regenerative thermal oxidiser and wet scrubber	No change	Baghouse, regenerative thermal oxidiser and wet scrubber
Bauxite stockpiles	1.92 Mt approximately	No change	1.92 Mt approximately
Contingency bauxite mining	N/A	Up to 251 ha of clearing of native vegetation for the purpose of	Up to 251 ha of clearing of native vegetation for the purpose of contingency bauxite

[4] The WMDE and the Bauxite Transport Corridor have a 3,332 ha overlap area

		contingency bauxite mining within the Contingency Bauxite Mining Envelope (747 ha)	mining within the Contingency Bauxite Mining Envelope (747 ha)
Power and steam raising facilities			
Gas fired cogeneration – capacity	120 MW	No change	120 MW
Gas fired cogeneration (alternative) – capacity	120 MW	No change	120 MW
Coal fired facility – capacity Particulate emission control	110 MW (electrical) Electrostatic precipitators on three boilers	No change	110 MW (electrical) Electrostatic precipitators on three boilers
Coal fired boiler – normal capacity Emission control	Two circulating fluidized bed multi-fuel co-generation boilers. 100 MW (electrical) 400 MW (thermal) Limestone injection and baghouse filters	No change	Two circulating fluidized bed multi-fuel co-generation boilers. 100 MW (electrical) 400 MW (thermal) Limestone injection and baghouse filters
Bauxite Residue Disposal Areas (BRDA)			
Deposition rate, footprint and location	18.5 Mtpa (wet) (no change to footprint of BRDA)	No change on an annual basis	18.5 Mtpa (wet) (no change to footprint of BRDA)
Raw Water Supply			
Sources usage (average)	Freshwater lake (Augustus River) and offsite purchase from water provider as required 2.6 GL (from Freshwater lake)	No change	Freshwater lake (Augustus River) and offsite purchase from water provider as required 2.6 GL (from Freshwater lake)
Air Emissions			
Sulphur dioxide (SO2) from coal fired facilities	Up to 13,370 tpa from combustion, liquor burner and calciner sources	No change on an annual basis	Up to 13,370 tpa from combustion, liquor burner and calciner sources
Nitrogen oxides (NOx) from	Up to 6,890 tpa	No change on an annual basis	Up to 6,890 tpa

combustion, liquor burner and calciner sources			
Particulates (PM10) from combustion, liquor burner and calciner sources	Up to 520 tpa	No change on an annual basis	Up to 520 tpa
Carbon monoxide (CO) from combustion, liquor burner and calciner sources	Up to 1,350 tpa	No change on an annual basis	Up to 1,350 tpa
Total volatile organic compounds (VOCs) from all sources	Up to 300 tpa	No change on an annual basis	Up to 300 tpa
Construction and support facilities			
Water supply	N/A	Temporary water supply of approximately 580 MLpa from local water sources for the duration of the construction period	Temporary water supply of approximately 580 MLpa from local water sources for the duration of the construction period

3. Preliminary key environmental factors and required work

The preliminary key environmental factors for the environmental review are:

1. Flora and Vegetation;
2. Terrestrial Fauna;
3. Terrestrial Environmental Quality;
4. Inland Waters;
5. Social Surroundings; and
6. Air Quality.

Table 4 outlines the work required for each preliminary key environmental factor and contains the following elements for each factor:

- **EPA factor** and **EPA objective** for that factor.
- **Relevant activities** – the proposal activities that may have a significant impact on that factor.
- **Potential impacts and risks** to that factor.
- **Required work** for that factor.
- **Relevant policy and guidance** – EPA (and other) guidance and policy relevant to the assessment.

Table 4 Preliminary key environmental factors and required work

Flora and Vegetation	
EPA objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Relevant activities	The mine expansion involves an increase of the mine and infrastructure footprints, and clearing of up to 5,841 ha of native vegetation.
Potential impacts and risks	• Further loss and fragmentation of native vegetation in the local area from clearing. • Spread of weeds and dieback, and introduction of pathogens into new unaffected areas. • Changes to vegetation structure and composition through altered surface drainage flow patterns. • Potential impacts on ecological and social values of forests, including within public reserves, through increased water use associated with the proposal.
Required work	1. Identify and characterise flora and vegetation in the Primary Assessment Area (WMDE, BTC and CBME) in accordance with the requirements of EPA guidance. Survey should include all areas that are likely to be directly or indirectly impacted (including by changes to groundwater, or surface water flow) as a result of the proposal. In areas where land is not accessible and surveys have not been undertaken, describe actions to avoid direct and indirect impact to these areas. 2. Demonstrate how surveys are relevant, representative and demonstrate consistency with current EPA guidance. Ensure database searches and taxonomic identifications are up-to-date. If multiple surveys have been undertaken to support the assessment, a consolidated report should be provided including the integrated results of the surveys. All surveys may be appended to the environmental review documentation. 3. Reports provided should be accompanied by IBSA Data Packages prepared following EPA Guidance. 4. Undertake baseline weed mapping in areas likely to be directly or indirectly impacted by the proposal.

	5. Provide a map of the survey effort applied in relation to the Primary Assessment Area, identifying the direct and indirect impact areas. 6. Determine whether any flora species recorded are significant, and provide an analysis of local and regional context, (refer to *Environmental Factor Guideline – Flora and Vegetation* for definition of significant flora). 7. Undertake targeted searches for conservation significant flora in accordance with EPA and Commonwealth guidance (EPBC Act). Include an assessment of all MNES within a 5 km radius surrounding the proposal area. 8. Determine whether any vegetation identified is significant, including old growth areas, and provide an analysis of local and regional context (refer to *Environmental Factor Guideline – Flora and Vegetation* for definition of significant vegetation). 9. Provide figures of the proposed clearing and predicted indirect impact to vegetation and significant flora species including but not limited to threatened/priority ecological communities, threatened/priority flora, old growth forest areas, and significant flora and significant vegetation as defined by EPA guidance. 10. Provide a quantitative assessment of impact for: a. significant flora, including: i. number of individuals and populations in a local and regional context; ii. numbers and proportions of individuals and populations directly or potentially indirectly impacted; and iii. numbers/proportions/populations currently protected within the conservation estate (where known). b. vegetation units (noting threatened and priority ecological communities and significant vegetation) including: i. area (in hectares) and proportions directly or potentially indirectly impacted; and ii. proportions/hectares of the vegetation unit currently protected within conservation estate (where known). 11. Analyse the direct and indirect impacts from the proposed mining, and discuss the significance of the direct and indirect impacts to flora and vegetation at a local and regional level. This may include reference to Scheduled species in other approved areas (MS 719). 12. Assess the impact(s) of increased water consumption for operations and dust suppression on flora and vegetation, including the ecological values it supports. 13. Analyse risk of *Phytophthora cinnamomi* and *Armillaria luteobubalina* within the development envelope, undertake surveys (if relevant) and describe management actions to prevent introduction to protectable areas within the proposal area and to adjacent conservation areas.

	14. Demonstrate that the proposal has been designed to avoid and minimise impacts regarding placement of access roads and infrastructure within vegetated areas, and that placement has had regard to utilising existing areas of disturbance. 15. Discuss proposed management, monitoring and mitigation methods to be implemented demonstrating that the proposal has addressed the mitigation hierarchy, and ensure residual impacts (direct and indirect) are not greater than predicted. 16. Discuss the regional and cumulative impacts of other existing or reasonably foreseeable development in the vicinity of the proposal with the potential to impact the flora and vegetation values, particularly the Jarrah Forest. These may include rehabilitation, fire, mining, timber harvesting, disease, weed invasion, impacts to biodiversity, recreation and water management. 17. Determine and quantify any significant residual impacts by considering the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) in the *WA Environmental Offsets Guidelines* (2014) and include reference to the Commonwealth Assessment Guide for any MNES. 18. Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the *WA Environmental Offsets Policy and Guidelines.* Spatial data defining the area of significant residual impacts should also be provided. 19. Describe the proposed rehabilitation methodology, using current practice, evidence and demonstrated outcomes, including but not limited to: a. physical and chemical characteristics of soil and soil profile; b. topsoil management; c. retention or reuse of vegetative material; d. return of species and communities consistent with the pre-existing composition of the affected area; and e. timeframes for rehabilitation, including sequencing of excavation and progressive rehabilitation. 20. Prepare a Rehabilitation and Closure Plan consistent with the DMP and EPA (2015) *Guidelines for Preparing Mine Closure Plans*. The plan should include but not be limited to: a. closure objectives and completion criteria (quantitative or qualitative) addressing post mining landforms and soil profile reconstruction, native vegetation and habitat for conservation significant flora and fauna; and b. establish and where possible measure, vegetation and fauna reference and analogue sites, to inform completion criteria. 21. Demonstrate and document in the ERD how the EPA's objective for this factor can be met.

Relevant policy and guidance	***EPA policy and guidance*** Environmental Factor Guideline – *Flora and Vegetation* (EPA, 2016). Technical Guidance – *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016). Guidance Statement No. 6 – *Rehabilitation of Terrestrial Ecosystems* (EPA, 2006). Guidelines for Preparing Mine Closure Plans (DMP and EPA, 2015). Instructions on how to prepare an Environmental Review Document (EPA, 2018). Instructions on how to prepare *Environmental Protection Act 1986* Part IV Environmental Management Plans (EPA, 2017). ***Commonwealth policies and guidance*** Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi* (Commonwealth Department of the Environment, 2014). *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities, 2012). ***Other policy and guidance*** *WA Environmental Offsets Policy* (Government of Western Australia, 2011). *WA Environmental Offsets Guidelines* (Government of Western Australia, 2014). *Forest Management Plan 2014-2023* (Conservation Commission of Western Australia, 2013). *Biodiversity and Forest Management Plan – MS719 Management Plan* (South32 Worsley Alumina, 2016).

Terrestrial Fauna	
EPA objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Relevant activities	The mine expansion involves an increase of the mine and infrastructure footprints, and clearing of up to 5,841 ha of fauna habitat.
Potential impacts and risks	• Further loss and fragmentation of habitat from vegetation clearing and disturbance of riparian areas. • Death, injury and displacement from construction and mining operations, and vehicle strikes.

	• Secondary impact from dust, noise and vibration during construction and mining operations.
Required work	22. Conduct a desktop study, including a literature review, in accordance with EPA guidance. The desktop study should identify knowledge gaps and identify fauna, including aquatic fauna and short-range endemic (SRE) invertebrate fauna, recorded in the Primary Assessment Area (WMDE, BTC and CBME), in the context of the fauna habitat and approved areas (MS 719). 23. Based on the outcomes of the desktop study, identify areas in the Primary Assessment Area where fauna surveys have not been previously undertaken, or surveys are not recent and/or do not meet the requirements of EPA guidance, and undertake the appropriate surveys in these areas in accordance with EPA guidance. The consolidated data from historical and new surveys should be sufficient to place the impacts of the proposal into local and regional contexts. 24. Undertake a fauna habitat assessment to identify the types and quality of fauna habitats and map the extent. 25. Undertake targeted surveys for conservation significant fauna species, including but not limited to those listed below, in accordance with EPA and Commonwealth guidance (EPBC Act): a. Forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*); b. Baudin's black cockatoo (*Calyptorhynchus baudinii*); c. Carnaby's black cockatoo (*Calyptorhynchus latirostris*); d. Peregrine falcon (*Falco peregrinus*); e. Woylie (*Bettongia penicillata ogilbyi*); f. Chuditch (*Dasyurus geoffroii*); g. Red-tailed phascogale (*Phascogale calura*); h. Western ringtail possum (*Pseudocheirus occidentalis*); i. Quokka (*Setonix brachyurus*); j. Carter's freshwater mussel (*Westralunio carteri*). 26. Provide figures and maps illustrating the locations of all relevant survey sites, including those identified in the desktop study, in relation to the proposal areas and fauna habitats. 27. Based on the outcomes of the desktop study and field surveys, list and evaluate the likelihood of occurrence of all other significant vertebrates and SRE invertebrates potentially occurring in the Primary Assessment Area and conduct additional targeted surveys for significant species, as appropriate. Map the known locations of significant species, with reference to their occurrence in the Primary Assessment Area and in relation to the fauna habitat.

	28. Justify that the desktop study, field surveys and habitat assessment have addressed all baseline knowledge gaps; are representative of the current conditions in the Primary Assessment Area; provide current information on populations and locations of significant fauna; and have been carried out using methods consistent with EPA guidance. 29. Quantify, map and discuss the cumulative impacts of past, current and approved exploration and mining activities in all approved areas (MS 719), with respect to significant habitats, significant fauna, and fauna that are known or likely to occupy restricted habitats (including SRE), based on data from relevant, contemporary local and regional surveys. 30. Describe and assess the direct and indirect impacts of implementation of the proposal to fauna, significant fauna including SREs and matters of national environmental significance (MNES) (include an assessment of all MNES within a 5 km radius surrounding the proposal area), and fauna habitats. Provide figures illustrating the likely extent of loss of habitat types and the extent of habitat areas predicted to recover from both direct and indirect impacts. Quantify the extent of direct, indirect and cumulative impacts, including percentages of habitat types to be disturbed or otherwise impacted. 31. Determine the likelihoods of the fauna habitats to supporting SRE invertebrate species. Provide figures identifying the locations of known, likely and potential SRE species in relation to the fauna habitat and predicted areas of impact clearly showing impacts to SREs. 32. Demonstrate that the proposal has been designed to avoid and minimise impacts to fauna and significant fauna habitat, including the placement of any access roads and infrastructure, within fauna habitat areas and that placement has had regard to utilising existing areas of disturbance. 33. Describe the proposed management, monitoring and mitigation methods to be implemented to address direct and indirect impact on fauna, including actions to prevent fauna death, injury and displacement as a result of the proposal. 34. Demonstrate that the proposed management, monitoring and mitigation methods to be implemented address the mitigation hierarchy, and ensure residual impacts (direct and indirect) are not greater than predicted. 35. Determine and quantify any significant residual impacts by considering the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) in the *WA Environmental Offsets Guidelines* (2014) and include reference to the Commonwealth Assessment Guide for any MNES. 36. Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the *WA Environmental Offsets*

	Policy and Guidelines. Spatial data defining the area of significant residual impacts should also be provided. 37. Demonstrate and document in the ERD how the EPA's objective for these factors can be met.
Relevant policy and guidance	***EPA policy and guidance*** Environmental Factor Guideline – *Terrestrial Fauna* (EPA, 2016). Technical Guidance - *Terrestrial fauna surveys* (EPA, 2016). Technical Guidance - *Sampling methods for terrestrial vertebrate fauna* (EPA, 2010). Technical Guidance - *Sampling of short range endemic invertebrate fauna* (EPA, 2009). ***Commonwealth policies and guidance*** Survey guidelines for Australia's threatened birds (Commonwealth Department of the Environment, Water, Heritage and the Arts, 2010). Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan: Western Australian Wildlife Management Program No. 52, (Department of Parks and Wildlife, October 2013). Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan, (Department of Environment and Conservation, 2008). Survey guidelines for Australia's threatened mammals (Commonwealth Department of the Sustainability, Environment, Water, Population and Communities, 2011). Chuditch (*Dasyurus geoffroii*) National Recovery Plan: Wildlife Management Program No. 54, (Department of Environment and Conservation, 2012). National Recovery Plan for the Woylie (*Bettongia penicillata ogilbyi*): Wildlife Management Program No. 51, (Department of Environment and Conservation, 2012). Threat abatement plan for predation by feral cats, (Commonwealth Department of the Environment, 2015). Threat abatement plan for competition and land degradation by rabbits, (Commonwealth Department of the Environment and Energy, 2016). Threat abatement plan for predation by the European red fox, (Commonwealth Department of Environment, Water, Heritage and the Arts, 2008). *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities, 2012).

	Other policy and guidance *WA Environmental Offsets Policy* (Government of Western Australia, 2011). *WA Environmental Offsets Guidelines* (Government of Western Australia, 2014).

Terrestrial Environmental Quality	
EPA objective	To maintain quality of land and soils so that environmental values are protected.
Relevant activities	Clearing of vegetation and disturbance to soils from increased mine and infrastructure footprints, and mining activities.
Potential impacts and risks	• Erosion leading to loss of topsoil, poor soil structure, reduced water infiltration and loss of general soil health from clearing and excavation activities. • Salinisation of soils (dryland salinity) leading to vegetation death and decreased quality of water resources. • Contamination of land and soils from fuel and chemical storage leaks, waste products being released into the receiving environment and acid sulfate soils as a result of disturbance for river crossings.
Required work	38. Present a baseline soil quality assessment of the Primary Assessment Area (WMDE, BTC and CBME), with reference to the soil quality. 39. Include in the ERD, figures of the mapped soil units and soil profile. 40. Described the proposed management, monitoring and mitigation methods to be implemented to address direct and indirect impact on soils/lands/receiving environment. This description is to include soil handling methods to mitigate erosion, compaction, contamination, and salinization of soils. 41. Outline the outcomes/objectives, trigger and contingency actions to ensure impacts (direct and indirect) are not greater than predicted. 42. Demonstrate that the proposal has been designed to avoid and minimise impacts including the placement of any access roads and infrastructure within fauna habitat areas and that placement has had regard to utilising existing areas of disturbance. 43. Demonstrate that the proposed management, monitoring and mitigation methods to be implemented addressed the mitigation hierarchy, and ensure residual impacts (direct and indirect) are not greater than predicted. 44. Demonstrate and document in the ERD how the EPA's objective for these factors can be met.

Relevant policy and guidance	***EPA policy and guidance*** Environmental Factor Guideline - *Terrestrial Environmental Quality* (EPA, 2016). ***Other policy and guidance*** *WA Environmental Offsets Policy* (Government of Western Australia, 2011). *WA Environmental Offsets Guidelines* (Government of Western Australia, 2014).

Inland Waters	
EPA objective	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.
Relevant activities	Clearing of native vegetation, disturbance of river banks for the construction of river crossings, water use for mining activities and construction from groundwater sources, and excavation for mining activities.
Potential impacts and risks	• Riverbank erosion, sedimentation, scouring of streams or release of excessively turbid water as a result of clearing riparian vegetation. • Decline of aquatic fauna from changes in flow regime and water quality, potentially leading to impediment of upstream pre-spawning migrations of freshwater fishes. • Contamination of ground and/or surface water from potential acid sulphate material and contaminants during removal of soils and sediment at river crossings. • Contamination of surface water as a result of spills or stormwater run-off, and contamination of groundwater as a result of seepage of stored chemicals. • Deterioration or change in background water quality such as salinity due to indirect impact of mining activities. • Impacts to groundwater as a result of clearing, disturbance to soil profile and rehabilitation. • Potential impacts on surface water and groundwater values through increased water use.
Required work	45. Characterise the surface water and groundwater systems in a local and regional context and describe recharge and discharge mechanisms, aquifer connectivity, surface water/groundwater interaction and water chemistry. This should include identifying and mapping groundwater and surface water dependent ecosystems. 46. Undertake surveys to establish water and sediment quality, the biological data collected, and the environmental values identified.

	47. Characterise the hydrology of the Hotham River and describe the impacts from this proposal on the water and sediment quality of the Hotham River (and other relevant tributaries). This is to include a detailed description of the development of river crossings for access/haul roads. 48. Analyse, describe and assess surface water and groundwater impacts, including direct and indirect impacts, from the project. This should include, but not limited to: a. changes to groundwater levels and surface water flows associated with the proposal; b. changes to water quality; c. the nature, extent and duration of impacts; and d. impacts on environmental values of ground and surface water dependent ecosystems. 49. Undertake appropriate investigations into the presence of acid forming materials in the Primary Assessment Area (WMDE, BTC and CBME), such as soils or rocks, in accordance with contemporary guidance. 50. Discuss the proposed management, monitoring and mitigation to ensure impacts on inland water quality and ecological values are not greater than predicted as a result of implementing the proposal. This is to include, but not be limited to, consideration of buffers between mining and related activities to protect waterways and wetland areas. 51. Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) in the *WA Environmental Offsets Guidelines* (2014) and include reference to the Commonwealth Assessment Guide for any MNES. 52. Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the *WA Environmental Offsets Policy and Guidelines*. Spatial data defining the area of significant residual impacts should also be provided. 53. Demonstrate how the mitigation hierarchy of avoid, minimise, mitigate has been applied during the mine planning and design stages of the Project. 54. Demonstrate and document in the ERD how the EPA's objective for this factor can be met.
Relevant policy and guidance	***EPA policy and guidance*** Environmental Factor Guideline – *Inland Waters* (EPA, 2018). ***Other policy and guidance***

	Preventing acid and metalliferous drainage – *Leading practice sustainable development program for the mining industry* (Commonwealth Department of Industry, Innovation and Science, September 2016). *Western Australian water in mining guidelines* (Department of Water, 2013). Water Quality Protection Note 15 - *Extractive Industries near sensitive water resources* (Department of Water, 2013). Water Quality Protection Note 44 - *Roads near sensitive water resources* (Department of Water, 2006). Water Quality Protection Note 52 - *Stormwater management at industrial sites* (Department of Water, 2010). Water Quality Protection Note 81 - *Tracks and trails near sensitive water resources* (Department of Water, 2015). Water Quality Protection Note 83 - *Infrastructure corridors near sensitive water resources* (Department of Water, 2007). WA Environmental Offsets Policy (Government of Western Australia, 2011). WA Environmental Offsets Guidelines (Government of Western Australia, 2014).

Social Surroundings	
EPA objective	To protect social surroundings from significant harm.
Relevant activities	Clearing of vegetation and land disturbance for mining activities within proximity of residences, recreation and heritage sites.
Potential impacts and risks	• Noise from construction and operational activities (including blasting and excavation, haulage, disposal activities, audible warning signals, and off-site transport activities). • Noise and dust impacts at nearby residences. • Dust deposition on native vegetation and agricultural crops. • Disturbance to heritage and tourism areas. • Changes to land use through acquisition arrangements. • Reduced visual amenity.
Required work	55. Characterise the surrounding land use and amenity values in, and adjacent to the Primary Assessment Area (WMDE, BTC and CBME), with a focus on the sensitive receptors and important areas for human use that could be affected by noise and dust emissions, visual amenity issues, and alterations to the land from mining. Include relevant maps to show the locations of the sensitive receptors likely to be affected by the proposal.

	56. Characterise noise impacts on sensitive receptors via a noise assessment in accordance with EPA and contemporary guidance. Demonstrate that noise can be managed such that it complies the *Environmental Protection (Noise) Regulations 1997* at sensitive receptor locations. 57. Characterise impacts on sensitive receptors from ground vibration due to activities including but not limited to blasting. 58. Characterise the environment by providing baseline data of dust emissions and identify diffuse sources of dust. 59. Characterise the environment by providing a description and associated maps/figures of the visual landscape character and scenic quality values. This is to include, but not be limited to: landforms; vegetation; waterways (including wetlands) and can be undertaken by way of 3-dimensional modelling and/or photographs. 60. Discuss the impacts of noise, dust, alteration to landforms and alteration of waterways from the proposal, on sensitive receptors, native vegetation, agricultural crops and important areas for human use. This is to include, but not be limited to, a visual impact assessment (VIA) for before, during and after the proposed excavation activities, to assess the impacts of the proposal on visual amenity in accordance with the Western Australian Planning Commission (2007) *Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design*, and in consultation with the Department of Biodiversity, Conservation and Attractions. 61. For the VIA described in work item 60, it is to identify and describe the aspects of the proposal which may potentially affect the visual landscape character and scenic quality values, both temporarily and permanently, using agreed (by EPA, in consultation with the Department of Biodiversity, Conservation and Attractions) reference and vantage points of surrounding areas including: travel routes and use area's viewer positions and perceptions. 62. Identify the types and sizes of trucks, the road upgrades required to accommodate operations and ensure the safety of other road users. Demonstrate how the road will be maintained to provide for the ongoing safety of road users. 63. Provide a detailed description of the cumulative impacts associated with this proposal on heritage, recreation and other important areas for human use in all approved areas in MS 719. 64. Predict the residual amenity impacts from the proposal on the sensitive receptors and important areas for human use after considering and applying avoidance and minimisation measures. Impact predictions are to include, but not be limited to:

	a. The likely extent, severity and duration of the impacts from noise, dust, light-spill, and alterations to the landscape, landform and to amenity; and b. Simulations/modelling of the predicted residual impacts from the proposal, including changes to the landscape from the agreed reference and vantage points. 65. Identify management and mitigation measures for the proposal including closure and rehabilitation outcomes to ensure residual impacts are not greater than predicted. The ERD is to include: a. A description of the management and mitigation measures; b. Management zones and strategies for managing visual landscape character relative to each stage of the proposed operation; and c. Environmental management plans outlining the environmental outcomes/objectives, other key regulatory requirements; management actions, monitoring (including methodology, frequency, location and rational), trigger criteria, contingency actions, review, reporting and consultation. 66. Demonstrate and document how the EPA's objective for this factor can be met.
Relevant policy and guidance	***EPA policy and guidance*** Environmental Factor Guideline – *Social Surroundings* (EPA, 2016). Guidance Statement No. 3 – *Separation Distance Between Industrial and Sensitive Land Uses* (EPA, 2005). Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA, 2017). ***Other policy and guidance*** *Environmental Protection (Noise) Regulations 1997.* Visual Landscape Planning in Western Australia: *A manual for evaluation, assessment, siting and design* (Western Australian Planning Commission, 2007). WA Environmental Offsets Policy (Government of Western Australia, 2011). WA Environmental Offsets Guidelines (Government of Western Australia, 2014).

Air Quality	
EPA objective	To maintain air quality and minimise emissions so that environmental values are protected.

Relevant activities	Clearing of vegetation and land disturbance for mining activities.
Potential impacts and risks	• Dust generation from mining activities, haulage, and light vehicles on unsealed roads. • Exhaust emissions from light and heavy earthmoving vehicles and generators, and emissions from blasting activities. • Increased greenhouse gases (GHG) and particulate emissions to the Collie airshed.
Required work	67. Compare predicted emissions and ground level concentrations with appropriate standards. 68. Describe how the chosen technology meets industry standards and compares to best practice. 69. Characterise greenhouse gas emission sources from the proposal and estimate the expected Scope 1 (direct) and Scope 2 (energy indirect) greenhouse gas emissions, in accordance with the *National Greenhouse and Energy Reporting Act 2007*. 70. Analyse greenhouse gas intensity (i.e. quantity of carbon dioxide equivalent - CO2-e generated per tonne of product produced) and compare with published current benchmarked world's best practice for bauxite mines, equipment and operations. Develop a Greenhouse Gas Management Plan and detail the management and mitigation measures that will be used to reduce greenhouse gas emissions and improve operational efficiency using the mitigation hierarchy, including the management and mitigation measures that can be implemented over time to achieve a long-term reduction in greenhouse gas emissions. Identify and justify the contemporary best practice management and mitigation measures that will be implemented.
Relevant policy and guidance	***EPA policy and guidance*** Environmental Factor Guideline – *Air Quality* (EPA, 2016). ***Other policies and guidance:*** *National Greenhouse and Energy Reporting Act 2007.* Air Quality Modelling Guidance Notes (Department of Environment, March 2006). *WA Environmental Offsets Policy* (Government of Western Australia, 2011). *WA Environmental Offsets Guidelines* (Government of Western Australia, 2014). *Greenhouse Gas Emissions Policy for Major Projects* (Government of Western Australia, 2019).

4. Other environmental factors or matters

It is important that the proponent be aware that other factors or matters may be identified during the course of the environmental review that were not apparent at the time that this ESD was prepared. If this situation arises, the proponent must consult with the EPA to determine whether these factors and/or matters are to be addressed in the ERD, and if so, to what extent.

5. Stakeholder consultation

The proponent must consult with stakeholders who are affected by, or are interested in the proposal. This includes the decision-making authorities (see section 6), other relevant state (and Commonwealth) government agencies and local government authorities, the local community and environmental non-government organisations.

The proponent must document the following in the ERD:

- identified stakeholders;
- the stakeholder consultation undertaken and the outcomes, including decision-making authorities' specific regulatory approvals and any adjustments to the proposal as a result of consultation; and
- any future plans for consultation.

Additionally, the Department of Planning, Lands and Heritage (DPLH) recommends that the proponent contact the South West Aboriginal Land and Sea Council which represent the Gnaala Karla Booja and seek its comment on the proposal, and that the proponent be aware of its obligations under the *Aboriginal Heritage Act 1972*.

6. Decision-making authorities

At this stage, the EPA has identified the authorities listed in Table 5 as decision-making authorities (DMAs) for the proposal. Additional DMAs may be identified during the course of the assessment.

Table 5 Decision-making authorities

Decision-making authority	Relevant legislation
1. Minister for Environment	*Biodiversity Conservation Act 2016*
2. Minister for Mines and Petroleum	*Mining Act 1978*
3. Minister for Water	*Rights in Water and Irrigation Act 1914*
4. Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972*
5. Minister for State Development	*State Agreement Act – Alumina Refinery (Worsley) Agreement Act 1973*

6. Department of Mines, Industry Regulation and Safety	*Mining Act 1978* *Dangerous Goods Safety Act 2004* *Mines Safety and Inspection Act 1994*
7. Department of Water and Environmental Regulation	Part V Division 3 of the *Environmental Protection Act 1986*
8. Commonwealth Department of the Environment and Energy	*Environment Protection and Biodiversity Conservation Act 1999*
9. Shire of Boddington	*Shire approval*
10. Shire of Collie	*Shire approval*

Figure 1 – Regional location

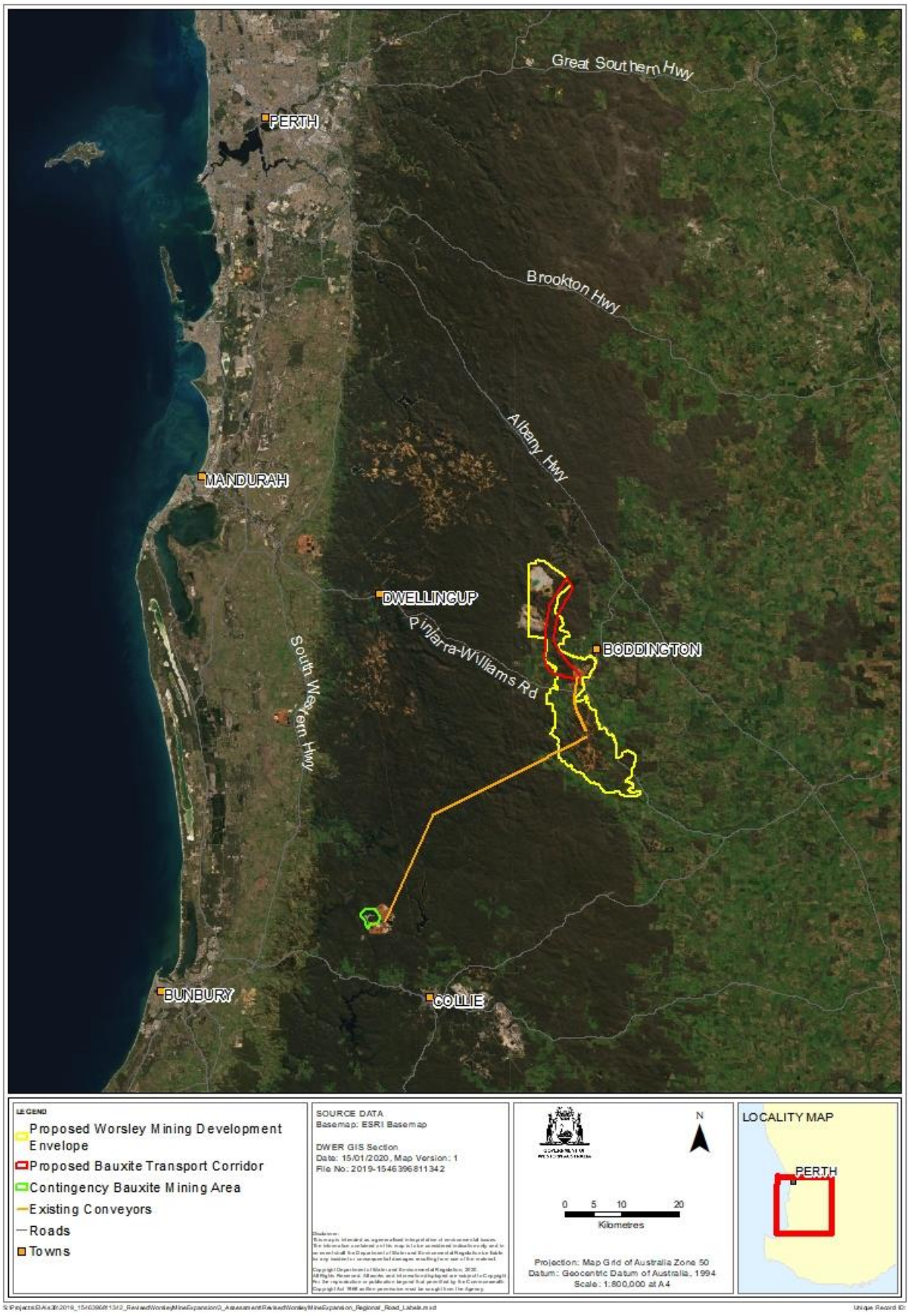

Figure 2 – Worsley Mining Development envelope

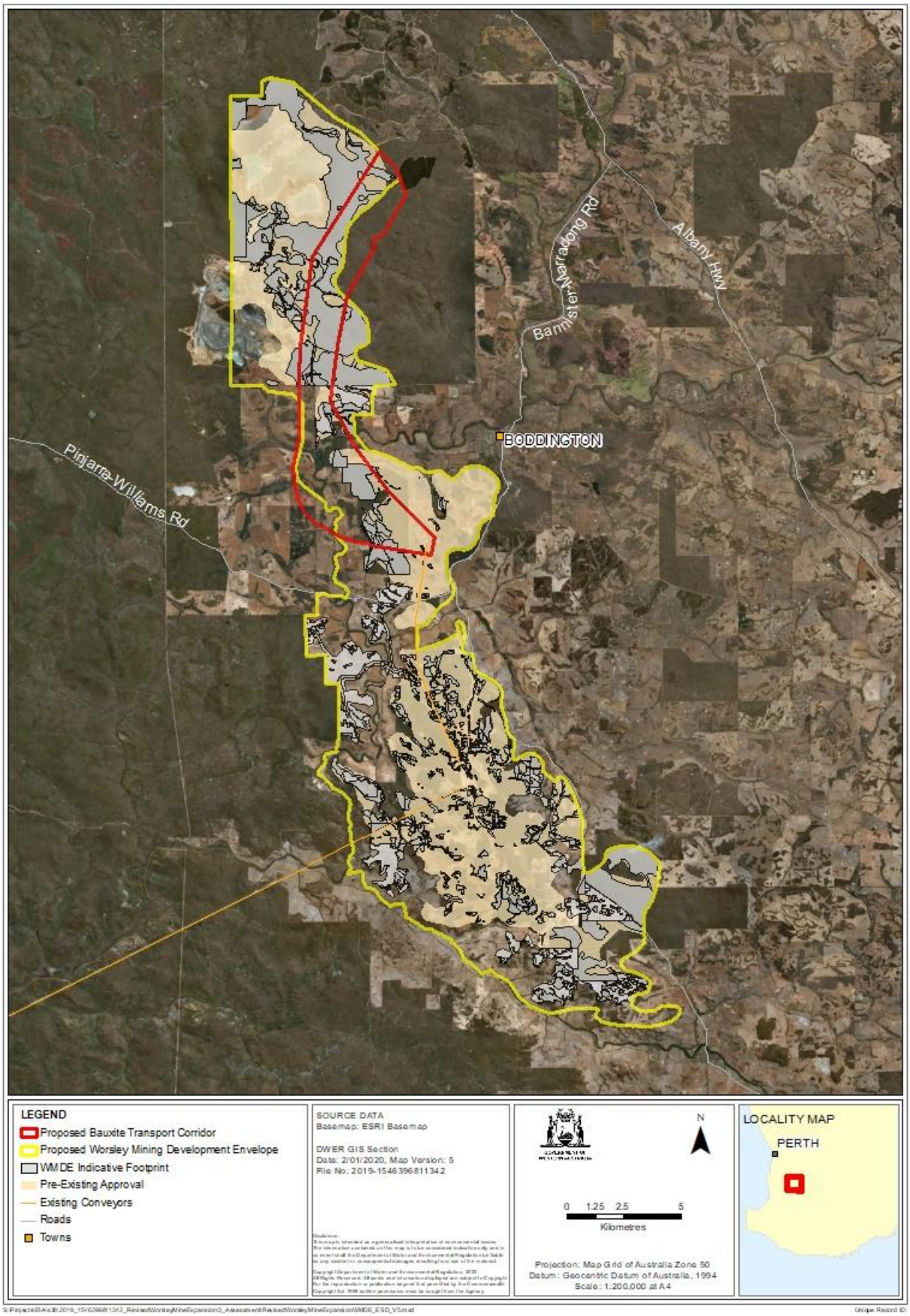

Figure 3 – Contingency Bauxite Mining Envelope