



ASHBURTON INFRASTRUCTURE PROJECT

Section 38 Referral Supporting Document

Proponent: Onslow Iron Pty Ltd
EPA Assessment No.: 2320
Prepared by: Mineral Resources Limited, Ecological Australia and O2 Marine
Date: 27 June 2022

Report Reference: ENV-TS-RP-0334 Rev 1

INFORMATION

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Report Declaration

I declare that I am authorised to refer this Proposal on behalf of Mineral Resources Limited

Name: Les Purves

Signature:

Role: General Manager - Environment, Approvals and Land Access



Revision History

Rev	Issue Date	Prepared By	Reviewed by	Approved By	Document Purpose
0	25/10/2021	Mineral Resources, Eco Logical Australia and O2 Marine	Tim Berryman Les Purves	Les Purves General Manager - Environment, Approvals and Land Access	Final – for submission to EPA
1	27/06/2022	Mineral Resources, Matilda Greenslade, Jonathan Salt, Eco Logical Australia and O2 Marine	Sarah Osborne Adam Parker Tim Berryman Darren Walsh	Les Purves General Manager - Environment, Approvals and Land Access Signature 	Final addressing EPA requests for information– for submission to EPA

STATUS OF ASSESSMENT

Onslow Iron Pty Ltd (ACN 612 668 201, herein the Proponent), a wholly owned subsidiary of Mineral Resources Limited (MinRes) (ACN 118 549 910) under Section 38 (s.38) of the *Environmental Protection Act 1986* (EP Act) referred the Ashburton Infrastructure Project (AIP, herein referred to as the Proposal) to the Western Australian (WA) Environmental Protection Authority (EPA) on 26 October 2021. The Proposal was referred due to the potential to significantly affect key environmental factors, as defined by the EPA.

A Referral Supporting Document (RSD Version 0) was provided with the s.38. referral form to present sufficient information on the Proposal and its potential effects on the environment, to allow assessment of the Proposal under Part IV of the EP Act. The RSD V0 presented detailed information on each of the environmental factors nominated as 'key' environmental factors that the Proposal's implementation could significantly impact. In RSD V0 all phases of Proposal implementation were considered, including construction, commissioning, operation and closure. Cumulative impacts with other projects, and holistic impacts of how key environmental factors interact was also addressed.

The s.38 referral form and RSD V0 were published for public review from 3 December to 9 December 2021 - with 14 comments received on the Proposal. On 23 February, considering the 14 public review comments, the EPA determined that the Proposal would be Assessed on Referred Information (ARI) as it considered the 'likely environmental effects of the Proposal are significant'. The EPA level of assessment requested additional information and a two week public review period (following the receipt of additional information). In its assessment decision, the EPA outlined that eight Key Environmental Factors are applicable for the Proposal, an increase from the five identified in the referral.

At this point in time MinRes notified the EPA that the Proposal would be assessed individually under both the EP Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), therefore no impacts to Matters of National Environmental Significance (MNES) would need to be considered in the EPA Assessment of the Proposal.

On 14 March 2022, under Section 40(2)(a) of the EP Act, MinRes received a notice requiring additional information for assessment of the Proposal from the EPA. This notice outlined several key areas of information that MinRes was to address in a revised RSD document and associated letter summarising how these requests are actioned. MinRes provided the associated letter to the EPA on 18 May 2022, and this document acts as the revised RSD Version 1 (V1).

A summary of the EPA assessment process for Proposals undergoing public review is outlined on **Figure SA-1**.

The additional information requested and actions from MinRes are summarised in **Table SA-1**. In this table, structural and formatting, additional technical inputs, and project changes (e.g., project construction schedule) are summarised to outline changes between RSD V0 and RSD V1.

The revised RSD (V1) was prepared in accordance with the '*Instructions for the referral of a Proposal to the Environmental Protection Authority under Section 38 of the Environmental Protection Act 1986* (EPA 2021a) and Instructions on how to prepare an Environmental Review Document (EPA 2021b). Whereas RSD (V0) was prepared in accordance with equivalent draft instructions released by the EPA for consultation in May 2021, following amendments to the EP Act passed by the WA Parliament in November 2020. These draft instructions were adopted as final and published on 29 October 2021 (three days after referral of the Proposal), therefore this document has been updated in accordance with the finalised instructions.



Figure SA-1 Public review of Additional Assessment Information (EPA 2022)

Table SA-1: Key Changes between Revision 0 and Revision 1 of Referral Supporting Document

Type of Change	Updates from RSD Rev 0	Justification	Location in document
Addition of information	“Status of Assessment”	Section included to provide the EPA and public readers clarity on the current status of the Proposal assessment status and process.	Section “STATUS OF ASSESSMENT”
Update of corporate address	Update of MinRes Address and Postal Address throughout document	At the time of referral (26 October 2021) MinRes was located at 1 Sleat Road, Applecross WA 6153. However, in June 2022 MinRes moved its corporate office to 20 Walters Drive, Osborne Park WA 6017. This change has been updated throughout RSD V1.	Throughout document
Update of commercial arrangements	The Proponent and Australian Premium Iron Management (APIM) entered into a Commercial Agreement to progress the West Pilbara Iron Ore Project (WPIOP) under the Red Hill Iron Ore Joint Venture.	Given the original WPIOP included the development of a rail line to a proposed new port development (Anketell Port), the Proposal Haul Road and Port facilities may provide a more efficient and sounder alternative for the delivery of WPIOP ore for export.	Section 2.2.1
Structural Change	<p>In Rev 0 of the RSD, the following environmental factors were considered ‘key’ factors:</p> <ul style="list-style-type: none"> • Flora and Vegetation • Terrestrial Fauna • Marine Fauna • Social Surroundings • Greenhouse Gas <p>The following were considered ‘other’ factors:</p> <ul style="list-style-type: none"> • Marine Environmental Quality • Benthic Communities and Habitat • Inland Waters • Coastal Processes • Air Quality 	<p>On 23 February, the EPA determined that the Proposal would be Assessed on Referred Information as it considered the ‘likely environmental effects of the Proposal are significant’. This decision notice outlined that eight Key Environmental Factors are applicable for the Proposal:</p> <ul style="list-style-type: none"> • Flora and Vegetation • Terrestrial Fauna • Marine Fauna • Social Surroundings • Greenhouse Gas • Marine Environmental Quality • Benthic Communities and Habitat <p>Therefore, the Proponent has restructured and revised RSD V1 to include Marine Environmental Quality and Benthic Communities and Habitat as key factors, as opposed to other factors as originally proposed in RSD V0. Air Quality and Coastal Processes remain ‘other’ factors.</p>	<p>Key Environmental Factors are discussed in Sections 5 to 13.</p> <p>Other Factors are discussed in Section 14.1 and Section 14.2.</p>
Update of technical studies	Reduction in disturbance of Bare Substrate Benthic Communities and Habitat from 5 ha to 3 ha in the Nearshore Development Envelope.	Dredge Plume Modelling was revised following the Proposal Construction Schedule being altered from Q4 to Q1 (to avoid sensitive ecological windows for Marine Fauna). Outcomes of the modelling found that disturbance to Bare Substrate Benthic Communities and Habitat would be reduced from 5 ha to 3 ha due to seasonal variability. This reduction has been updated throughout RSD V1.	Throughout document
Update of technical studies	Flora and Vegetation, and Fauna Surveys did not extend over a portion of the Haul Road Development Envelope due to access constraints at the time of field work.	<p>Since the preliminary surveys in 2021, additional surveys have been undertaken over this portion. Therefore, results from all surveys have been included within RSD Rev 1.</p> <p>The assessment of any direct or indirect impacts to identified species have updated for the Haul Road Development Envelope. This assessment of impact has extended to cumulative impacts for priority species within 50 km of the Haul Road – as requested by EPA the decision notice.</p>	<p>Flora and Vegetation - Section 9</p> <p>Terrestrial Fauna - Section 10</p>
Addition of information	Rev 0 of the RSD included discussion of potential impacts on Terrestrial Fauna by operation of the Haul Road during the construction phase only.	As requested by EPA in their decision notice, the Proponent has updated RSD V1 to discuss the impacts and mitigation measures associated within the operation of the Haul Road during all phases of operation (i.e., construction, operations).	Section 10.4, Section 10.5, Section 10.6.
Addition of information	The impacts on Terrestrial Fauna were not detailed as an amount or percentage in RSD V0.	As requested by EPA in their decision notice, MinRes has included an updated table to provide clarification on the additional impact to the habitat for each significant species as an amount and percentage (Table 10-12 and Table 10-17).	Section 10.3.6.2, Section 10.7.2
Addition of information	RSD V0 did not assess the impact of construction and operation of the Haul Road on existing access to other infrastructure.	As requested by EPA in their decision notice, MinRes has revised RSD V1 to include the assessment of impact on existing access to other infrastructure during Haul Road construction and operation. This potential impact has now been included.	Section 11.6.1.1, Section 11.7, Section 13.4

Type of Change	Updates from RSD Rev 0	Justification	Location in document
Addition of information	RSD V0 did not detail if Priority 1 Drinking Water Supply Areas or Pastoral Bores could be impacted by the Proposal.	As requested by EPA in their decision notice, MinRes has updated RSD V1 to include more discussion on the Pilbara Groundwater Area, dominant regional land uses, production bores proximal to the Haul Road and expected water supply amounts. The RSD V1 has been updated to provide clarity on potential impacts.	Section 2.3.1, Section 11.4.1, Section 11.5
Addition of information	Details of dust and noise risks to Onslow Salt Ponds and Wheatstone Accommodation Camp were not explicitly discussed in RSD V0.	As requested by EPA in their decision notice, the Air Quality and Social Surrounds Sections have been updated to provide further clarity on dust risk to the Onslow Salt Ponds and Wheatstone Accommodation Camp, and the Social Surrounds Sections has been updated to provide further clarity on noise risk to the Onslow Salt Ponds and Wheatstone Accommodation Camp.	Social Surroundings - Section 13 Air Quality - Section 14.2
Addition of information	Consultation with Haul Road neighbours, PPA and Traditional Owner groups required confirmation and additional detail.	As requested by EPA in their decision notice, RSD V1 was updated to detail consultation with neighbours, pastoral lease holders, Pilbara Ports Authority and Traditional Owner Groups.	Stakeholder Engagement - Section 4.3 Social Surroundings - Section 13
Update of technical studies	The construction schedule proposed in RSD V0 has since changed, and the risks associated with this change on sensitive periods for Marine Fauna and hydrodynamic modelling simulations.	MinRes engaged O2 Marine to undertake revised dredge plume modelling for the revised construction schedule (Q4 to Q1). Outcomes of the revised dredge plume modelling have been incorporated into revised BCH mapping and RSD V1.	Section 5, Section 8
Addition of information	A cumulative assessment of multiple wastewater discharges has been included.	A qualitative cumulative assessment of multiple wastewater discharge plumes to the nearshore marine environment has been undertaken, and this assessment and its outcomes will be included within the revised RSD. No additional modelling has been undertaken as there is no publicly available information regarding the characteristics and performance of the existing wastewater outfall located in the Port of Ashburton.	Section 7
Update of technical studies, addition of information	Justification as to why a 70 m Low EP was proposed around the brine outfall which contradicts modelling outcomes has been included.	The Low Ecological Protection Area (LEPA) / Moderate Ecological Protection Area (MEPA) boundary has been modified to be a 30 m boundary, any less than 30 m is impractical to accurately monitor and manage. The revised RSD chapter will be updated to reflect these changes as will the appended MOEMMP (updated figure within MOEMMP).	Section 7 Appendix D
Addition of information	Existing BCH mapping notes the area adjacent to Spoil Ground C is barely populated was found to be over 10 years old. New revision includes survey data from O2 Marine gathered in the last year.	As requested by the EPA in their decision notice, there was not sufficient information in the Dredge Plume Modelling report. The objectives of the survey undertaken were to identify and characterise key BCH throughout Spoil Ground C, including a buffer area around the perimeter, via a drop camera survey, update the existing BCH mapping of Spoil Ground C and surrounding Local Assessment Unit and to assess the potential impacts to BCH associated with disposing dredge material at Spoil Ground C.	Figure 5-2, Table 6-2, Table 7-2, Section 6.3.2, Section 3.3, Section 5.3.3
Addition of information	Include discussion of the operation of the anchorage points and discussion of whether moorings were considered.	As requested by the EPA in their decision notice, additional information has been added to detail the iterative process to determine anchorage locations and the consideration of mooring locations.	Section 2.2.3.3, Section 6.6.3
Addition of information	The Greenhouse Gas Chapter has been updated in accordance with EPA Factor Guidance.	As requested by the EPA in their decision notice, additional information has been added including – estimates of Scope 1, 2 and 3 emissions, source of emissions and a project emissions intensity for the Proposal and benchmarking where possible.	Section 12.4.1, Section 12.5, Section 12.6.1, Section 12.6.2

EXECUTIVE SUMMARY

Onslow Iron Pty Ltd (ACN 612 668 201, herein the Proponent), a wholly owned subsidiary of Mineral Resources Limited (MinRes) (ACN 118 549 910), is undertaking planning for the Ashburton Infrastructure Project (AIP, herein referred to as the Proposal) to service iron ore mining and export developments in the West Pilbara region of Western Australia (WA) (**Figure ES-1**).

The Proposal includes a fully sealed private haul road, commencing at the boundary of the approved Buckland Project haul road (herein referred to as Bungaroo South) (Ministerial Statement [MS] 960 and MS1147), and will continue approximately 125 km west to the Onslow Road (**Figure ES-2** and **Figure ES-3**). At the Pilbara Port Authority's (PPA), Port of Ashburton (Port), landside and marine facilities are proposed to be developed as part of this Proposal, to export ore (**Figure ES-2**, **Figure ES-4** and **Figure ES-5**).

Proposal Elements

A Proposal Content Document for the Proposal has been prepared and is provided as **Addendum 1**. A summary of the Proposal and its elements are included in **Table ES-1**, **Table ES-2** and **Figure ES-2**. The Proposal would be implemented within a development envelope of approximately 16,327 ha for land-based elements (**Figure ES-3** and **Figure ES-4**) and 4,494 ha for marine-based elements (**Figure ES-5** and **Figure ES-6**).

Table ES-1: General Description of Proposal

Proposal Title	Ashburton Infrastructure Project (AIP)
Proponent Name	Onslow Iron Pty Ltd (ACN 612 668 201, herein the Proponent), a wholly owned subsidiary of Mineral Resources Limited (MinRes) (ACN 118 549 910).
Short Description	<p>The Proposal is to develop a fully sealed private haul road, approximately 125 km in length, starting from about 45 km southwest of Pannawonica to access the Port of Ashburton (Figure ES-1). Within the Port, landside and marine facilities will be developed to support export of up to 40 million tonnes of ore per annum (Mtpa) over a minimum 30-year period (Figure ES-2).</p> <p>This Proposal includes:</p> <ul style="list-style-type: none"> • Development of a fully sealed private Haul Road; • Gas pipeline and ancillary haul road infrastructure; • Operation of storage and bulk handling of ore at the Port of Ashburton (the Port); • Dredging a dedicated berthing pocket adjacent to the existing Ashburton Cargo Wharf (ACW) and offshore disposal of dredge spoil to existing spoil disposal areas; • Development and operation of a modular jetty wharf and ship loader; • Use of five offshore anchorage areas for transshipment of ore to Ocean Going Vessels: and • Ancillary landside infrastructure (seawater desalination plant, power station, bulk storage of fuel wastewater treatment plan (WWTP) etc). <p>The Proposal will be implemented within a 20,821 ha Development Envelope (DE) (Figure ES-2), including 16,327 ha for land-based elements (Figure ES-3 and Figure ES-4) and 4,494 ha for marine-based elements (Figure ES-5 and Figure ES-6).</p> <p>The Proposal is located within an area of existing pastoral, mining and industrial land use. The Proposal's DE transects two pastoral stations, mining tenure and the operational Port of Ashburton.</p>

Table ES-2: Proposal Elements with Potential to Significantly Affect Environment General Description of Proposal

Proposal Element		
Physical Elements		
Haul Road Elements: <ul style="list-style-type: none"> • Sealed Haul Road • AIP Gas Pipeline • Consumer gas pipeline 	Haul Road Figure ES-3	Clearing of no more than 1,564 ha of native vegetation within the 16,209 ha Haul Road DE.
Landside Elements: <ul style="list-style-type: none"> • Materials Handling Systems - Ore Loading and Supply, Fuel Tanker Loading • Product (Ore) Storage 	Landside DE Figure ES-4	30 Mtpa ore product for 30 years, with design and material handling capacity up to 40 Mtpa.
Nearshore Elements: <ul style="list-style-type: none"> • Berth Pocket • Nearshore Infrastructure including Temporary Causeway and Jetty (excluding Dredging) 	Nearshore DE Figure ES-5	TSV berth pocket with a target declared depth of up to 8 m. Direct disturbance of up to 3 ha of Bare Substrate BCH within the Nearshore DE.
Offshore Elements: <ul style="list-style-type: none"> • Anchorage Points • Dredge Material Disposal 	Offshore DE Figure ES-6	Anchorages will be located approximately 35 km offshore. Direct disturbance of up to 1,347 ha of Bare Substrate BCH from OGVs anchoring in the designated area within the Offshore DE. Dredge material disposal within the existing PPA Spoil Grounds. No additional disturbance.
Construction Elements		
Bulk Earthworks	Haul Road DE Figure ES-3	Borrow works with crushing and screening, concrete batching. Culverts, Drains and Levees will be installed and constructed to maintain flows. The Haul Road will be sealed with bitumen.
Temporary Causeway	Nearshore DE Figure ES-5	Construction of the dedicated nearshore berth facility will be undertaken from a temporary impermeable causeway that will be removed after construction and commissioning of the jetty is completed.
Dredging & Dredge Material Disposal	Nearshore Figure ES-5 Offshore DE Figure ES-2	Removal/disturbance of up to 3 ha of Bare Substrate BCH. Capital dredging of up to 165,000m ³ with dredge material disposal into existing Spoil Ground C.

Proposal Element		
Piling for Jetty / Wharf Construction	Nearshore DE Figure ES-5	Installation of approximately 71 piles for jetty/wharf construction. Direct disturbance of up to 0.2 ha of Bare Substrate BCH.
Water supply - Dust Suppression	Haul Road DE Figure ES-3	Water supply from haul road borefield (up to 2GL/annum during construction).
Operational Elements		
Materials Handling and Stockpiling	Landside DE Figure ES-4	Storage of up to 280,000 tonnes of ore product.
Power Generation	Landside DE Figure ES-4	Power generation capacity of up to 14 MW. A 1 MW (peak) roof top solar power system.
Bulk Material Loading	Landside DE Figure ES-4	Operational throughput capacity of up to 100 kt/d of ore.
Dust Collection and Suppression Systems	Landside DE Figure ES-4	Water for operational dust suppression may be sourced from a third party operator to support 2GL/annum.
Seawater Intake	Landside Figure ES-4 Nearshore DE Figure ES-5	Seawater intake of up to 2 GL/annum for desalination and dust suppression.
Brine Outfall	Nearshore DE Figure ES-5	Discharge of up to 2 GL/annum of hypersaline brine. Discharge to ensure water quality meets the High Ecological Protection Level at the boundary of the Low Environmental Protection Area (LEPA).
Transshipment Vessels	Landside DE Figure ES-4 Nearshore DE Figure ES-5 Offshore DE Figure ES-6	Transport of product via TSVs and powered by tugboats on a 24-hours, seven days a week basis to anchorage points to be loaded onto OGVs. The TSVs will operate at a maximum speed of nine knots.
Greenhouse Gas Emissions		
Construction		
Scope 1	Haul Road and Port Construction (Year 1) Total GHG: 95,705 tCO ₂ -e/yr	
Scope 2	None	
Scope 3	None	

Proposal Element

Operation

Scope 1	Port Operations (From Year 2 emissions @ 30Mtpa) - Annual baseline GHG: 97,788 tCO2- e/yr*
Scope 2	None
Scope 3	Port Operations (From Year 2 emissions @ 30Mtpa): 54,602,377 tCO2-e/yr**

Rehabilitation

Topsoil will be collected in windrows and stored for rehabilitation of temporary construction areas.

Progressive rehabilitation of temporary disturbance areas along the Haul Road DE will be undertaken (such as borrow pits and temporary construction areas).

Progressive rehabilitation through topsoil respreading will be undertaken as areas become available and this will minimise the extent of cleared areas.

Commissioning

The Port Landside facilities:

- Will progressively undergo Functional Testing and No Load Commissioning; and
- Load Commissioning will be completed in two stages, In-Loading System followed by Out-loading System.

Seawater Desalination Plant: Water sourced from either ocean, bore or potable supply. Discharged to ocean via diffuser.

Decommissioning

End of project life closure strategies include either facilities being handed over to the relevant State or local government authority or decommissioned. Final outcomes will be developed through further consultation with key stakeholders and be undertaken as part of the regular review of closure commitments.

Other Elements which affect Extent of Effects on Environment

Proposal time	Minimum project life	30 years.
Construction phase	Haul road, and Port Nearshore facilities	Approximately 18 months (including early works and construction from multiple approval areas).
Commissioning phase (including commissioning and ramp-up)	Port landside facilities	Approximately 12 months.
Operational Phase	Port nearshore facilities	Approximately 12 months.

Reported Scope 1 emissions for years 11-30 are conservative based on estimates 2021 estimates - the Proponent will be reducing the CO2e during operations in line with its "Roadmap to Net Zero Emissions [Climate Change - Mineral Resources](#) "

** The GHG inventory for port operations includes the predicted emissions for the first 10 years (up to 30 Mtpa) and the next 20 (up to 40 Mtpa). Note that these emissions are conservative and do not include additional future emissions reduction and offset measures to be taken by the Proponent to achieve its target of net zero greenhouse gas emissions by 2050.

The Development Envelope (DE) for the Proposal includes four specific areas and three indicative footprints (IFs) (Table ES-3).

Table ES-3: Development Envelopes and Indicative Footprints*

Location	Development Envelope (DE)	Indicative Footprint (IF)*
Haul Road DE	16, 209 ha	1,564 ha
Landside DE	118 ha*	N/A**
Nearshore DE	11 ha	5 ha
Offshore DE	4,483 ha	0 ha
Total	20,821	1,569

*This Landside DE forms part of MS 1131 held by PPA and is referenced within this proposal for the purpose of describing the location of the proposed port operations

**There is no Landside IF as the entire Landside DE is subject to PPA development approvals.

In addition, approval for the following linear infrastructure to connect with the approved West Pilbara Iron Ore Project (WPIOP) Stage 1 Mine Areas (authorised via MS 1027) is being sought due to overlapping tenure with part of the Haul Road DE:

- WPIOP Gas Pipeline – a 15 km long buried gas pipeline connecting the Goldfields Gas Transmission Pipeline to the approved WPIOP (MS 1027); and
- WPIOP Haul Road Link – a 7.8 km fully sealed haul road to link to haul road with the approved WPIOP (MS 1027).

This Proposal is being referred under Section 38 of the *Environmental Protection Act 1986* (EP Act) as it has the potential to significantly affect key environmental factors, as defined by the Western Australian Environmental Protection Authority (EPA). The Proposal was referred to Department of Agriculture, Water and the Environment (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is currently under assessment (ref. EPBC 2021/9064).

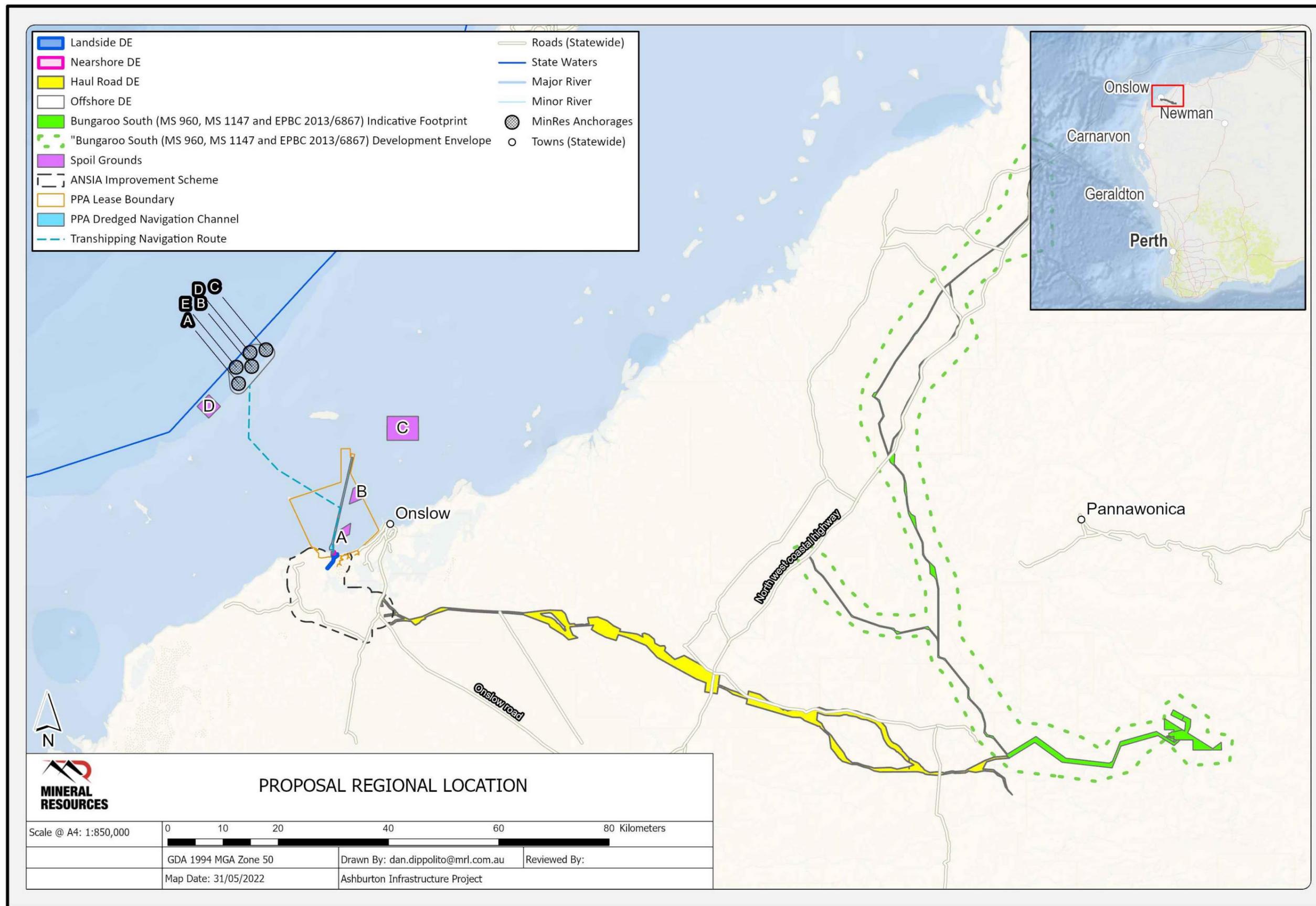


Figure ES-1: Proposal Regional Location

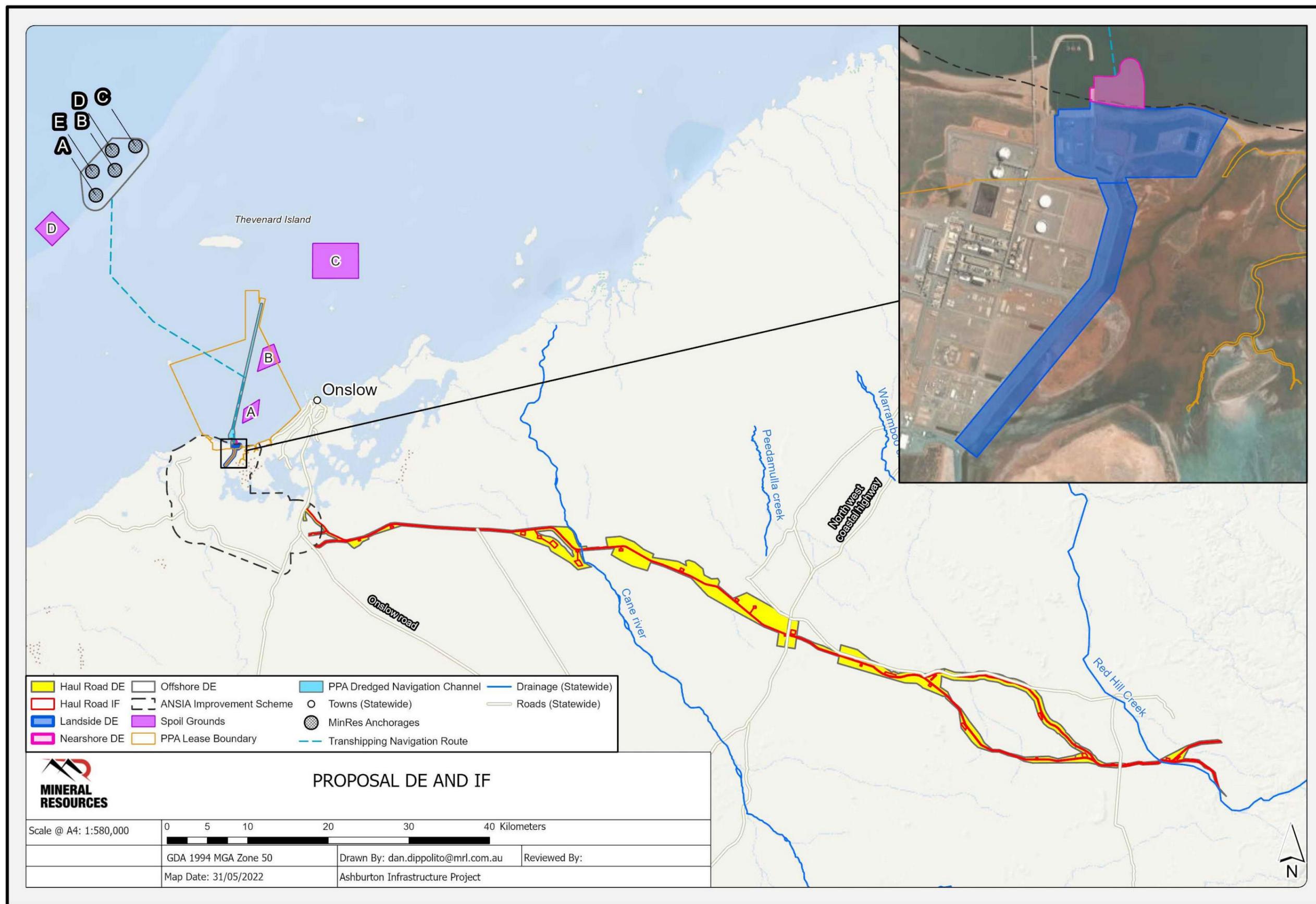


Figure ES-2: Proposal Development Envelope and Indicative Footprint

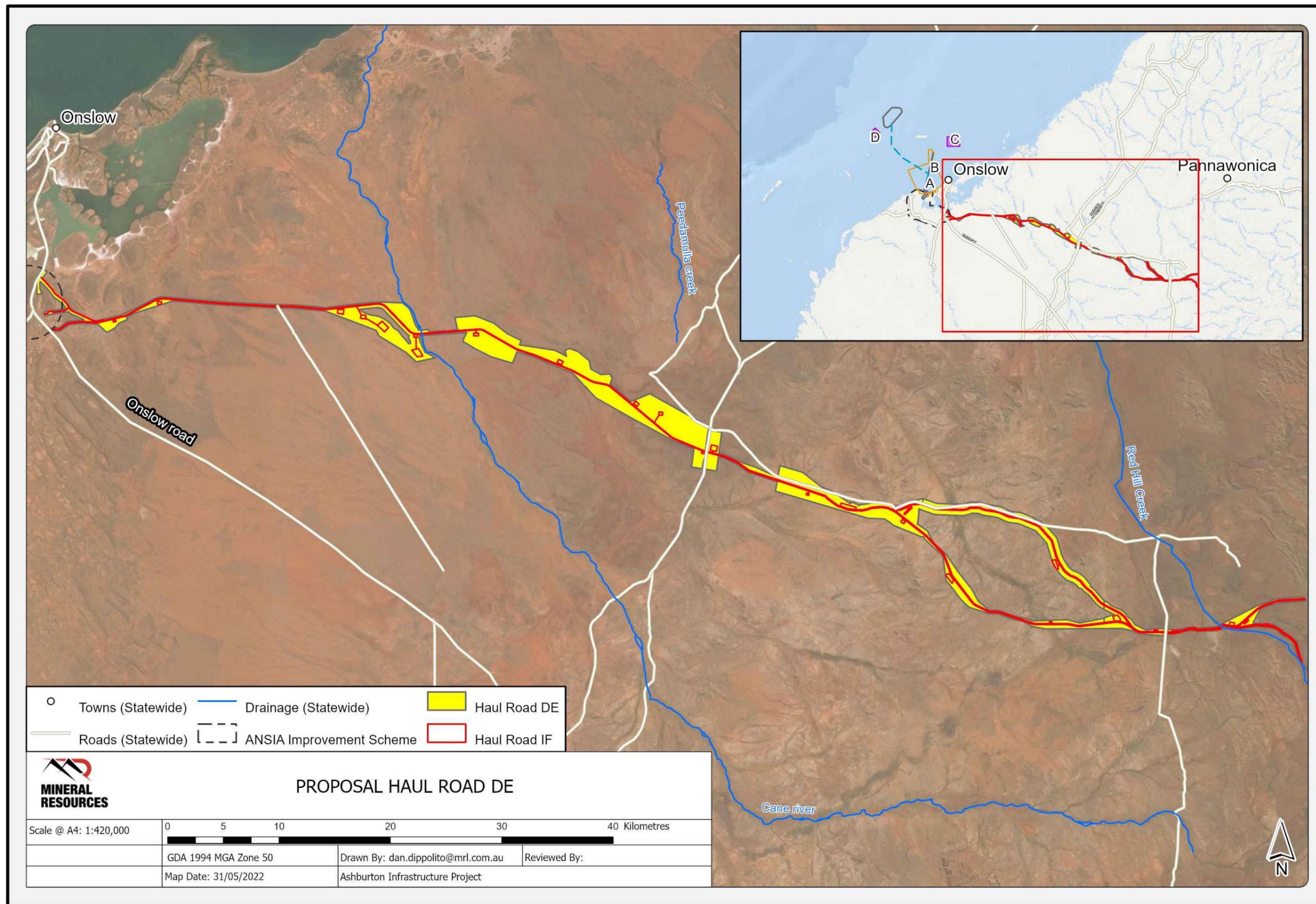
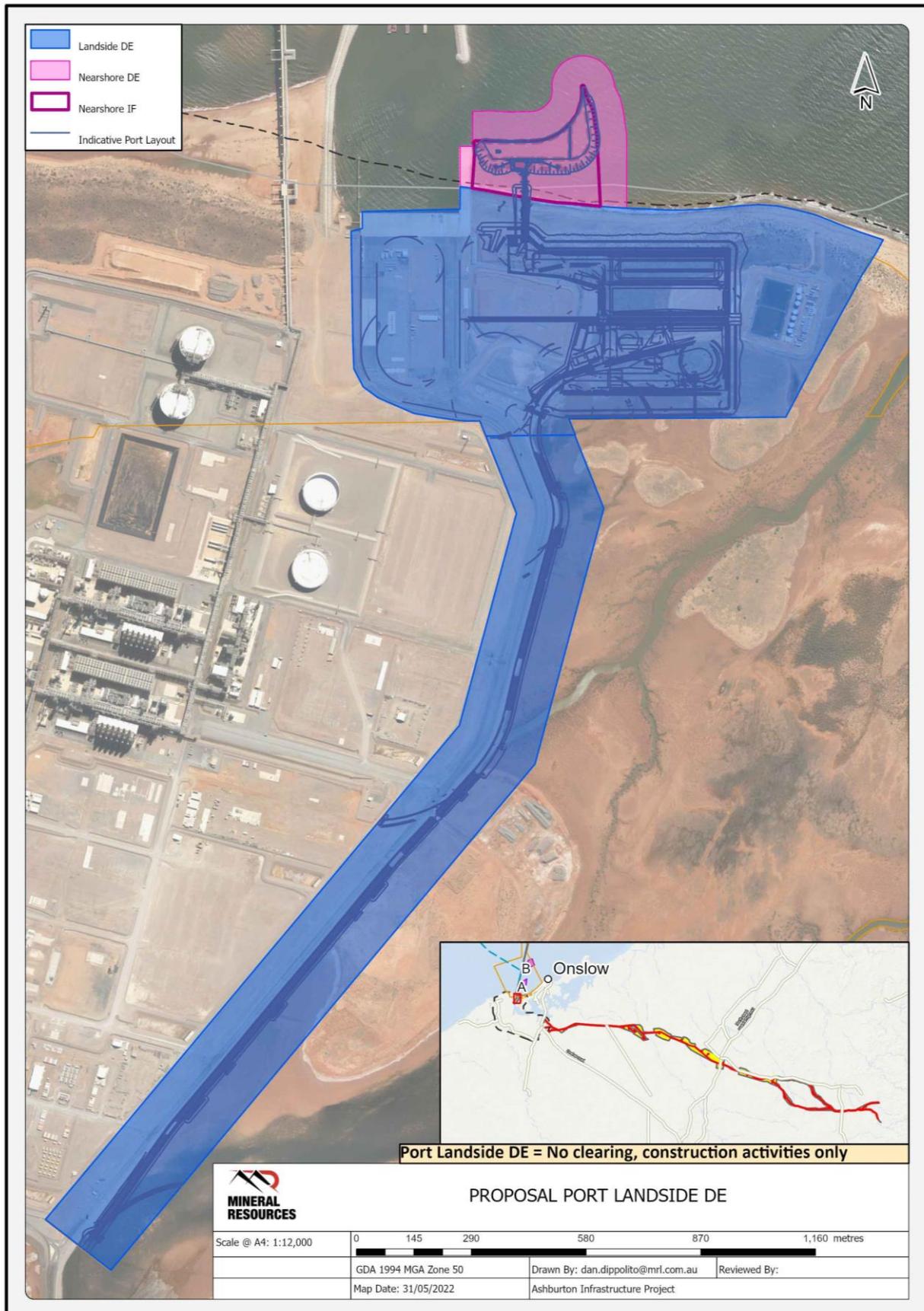


Figure ES-3: Haul Road Development Envelope and Indicative Footprint



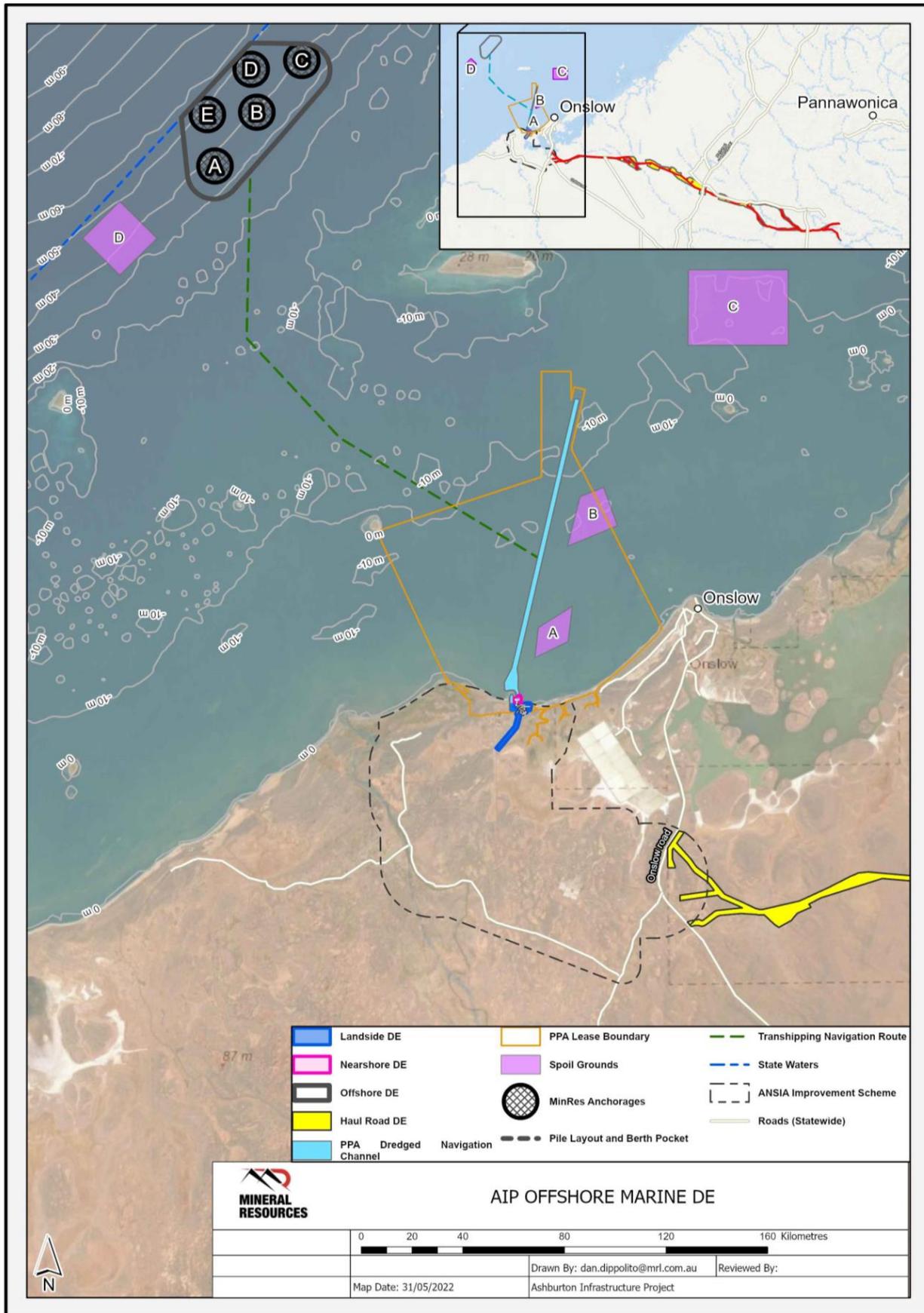
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Figure ES-4: Port Landside Development Envelope and Indicative Footprint



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Figure ES-5: Port Nearshore Development Envelope and Indicative Footprint



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Figure ES-6: Offshore Marine Development Envelope and TSV Navigation Route

Proposal Alternatives and Proposal justification

Need for the Proposal

As part of an overarching business and operational strategy the Proponent is undertaking planning to unlock stranded mineral assets in the West Pilbara region of WA. This involves mining ore deposits proximal to the Haul Road DE and the haulage of any mined product to the Port for export. The life of the Proposal is expected to be about 30 years which will contribute significantly to the economy over this period.

Given the long-term mining opportunities in the greater West Pilbara Iron Ore province, the Proponent envisions the access to the proposed haul road and port infrastructure may relieve environmental and economic constraints for other projects in the West Pilbara by avoiding duplication of infrastructure associated with individual mining projects.

The Proponent and APIM entered into a Commercial Agreement to progress the WPIOP under the RHIOJV. Given the original WPIOP project included for the development of a rail line to a proposed new port development, Anketell Port. The proposed AIP Haul Road and Port facilities may provide a more efficient and sounder, alternative for the delivery of WPIOP ore for export.

The life of the Proposal is expected to be about 30 years which will contribute significantly to the economy over this period. It is forecast that the \$3 billion development of the Proposal will create 2,100 direct and 6,300 indirect jobs during construction and 1,200 direct and 3,600 indirect jobs during operations. The Proposal is forecast for a capital spend of \$AU560M for the remainder of the 2021/2022 Financial Year. It is expected that per annum (for up to 30 years), the Proposal will contribute approximately \$AU190M in corporate taxes, \$AU150M in royalties and \$AU130M in payroll payments to the economy.

Alternatives to the Proposal

The Proponent has commissioned numerous comprehensive baseline studies and investigations to understand the environmental and social values of the Proposal area and surrounds. This work has informed the Proposal design to avoid or minimise potential impacts as far as practicable. The Proposal presented in this document is the result of an iterative design and review process that has optimised specific elements, balanced with a precautionary approach to avoid, mitigate and manage potential environmental impacts.

Alternatives considered for the Proposal include:

- Options for haulage method;
- Options for haulage and export locations;
- Options for transshipping routes and marine infrastructure;
- Options for power supply; and
- Options for ancillary infrastructure within the Haul Road DE.

If the Proposal does not progress the following have the potential to occur:

- Mineral deposits within the Western Pilbara remain stranded;
- Increased environmental impacts from individual Proposal haul roads to export locations; and
- Reduced royalties to the State of Western Australia.

Rationalisation of Development Envelopes

Evaluation of the Proposal was completed through iterative reviews of environmental, heritage, economic, constructability and engineering aspects and land access negotiations. As a result of findings of these baseline studies and investigations:

- The alignment of the referred haul road IF and DE differs greatly from the initial alignment. The original Haul Road DE was 25,930 ha and it has now been reduced 16,209 ha (by approx. 37%) to minimise and avoid impacts to MNES species;
- The location of the jetty and associated components is situated away from mangroves adjacent to existing port infrastructure, additionally the design of the piled jetty structures minimises impacts on longshore current patterns;
- The location of the desalination outfall and intake has been designed to avoiding cumulative impacts from dredging activities on marine environmental quality by locating the plant seawater intake and brine outlet pipelines for water supply within the jetty conveyor corridor to the ocean;
- The Proponent has approval from PPA to use an existing approved dredge material placement area (Spoil Ground C) adjacent to the Port for placement of spoil (as per DA087). Utilising the existing offshore disposal locations reduces native vegetation clearing and potential impacts to BCH;
- The Proposal will utilise the existing Port navigation channels reducing the amount of overall capital dredging required; and
- The final location of the five offshore transshipment anchorage points were selected to avoid benthic habitat, which was mapped within the anchorage investigation area as being limited to the 30 m depth contour, with the seabed beyond this depth being predominantly bare sand.

Summary of Potential Impacts, Proposed Mitigation and Outcomes

The Proponent has undertaken a comprehensive assessment of potential impacts to environmental factors, applying an iterative process as follows:

- Definition of the Proposal’s elements (physical, construction, operational and contribution to greenhouse gas emissions);
- Assessment in accordance with applicable EPA guidance;
- Peer review and advice from leading practitioners; and
- Application of mitigation hierarchy (avoid, minimise and rehabilitate) and consideration of outcomes (specifically around alterations of the conceptual footprint and design options).

Table ES-4 the following preliminary key and other environmental factors have been identified for the Proposal.

Table ES-4: Proposal Preliminary Key and Other Factors

Theme	Preliminary Key Factors	Other Factors
Sea	Marine Fauna Marine Environmental Quality Benthic Communities and Habitats	Coastal Processes
Land	Flora and Vegetation Terrestrial Fauna	[None identified]
Water	Inland Waters	[None identified]
Air	Greenhouse Gases	Air Quality
People	Social Surroundings	[None identified]

The remaining environmental factors are not relevant to the Proposal.

The impact assessment has been completed with a high degree of confidence based on comprehensive field and desktop-based studies. Modelling has been undertaken to understand the spatial extent of impacts from noise, light, brine, increased turbidity and dust originating from within the DEs. Key technical experts were also engaged to peer review surveys, modelling and investigations and impact assessments to demonstrate compliance with guidance and confirm a transparent scientific approach has been applied across all technical studies and impact assessments. A summary of potential impacts, mitigation and outcomes for each of the preliminary key environmental factors is included in **Table ES-5** to **Table ES-12**.

Table ES-5: Benthic Communities and Habitats

Key Environmental Factor – BCH	
EPA Objective	“To protect BCH so that biological diversity and ecological integrity are maintained”. (EPA 2016d).
Potential Impacts	<p>Direct Impacts:</p> <ul style="list-style-type: none"> • Direct removal/ disturbance of Bare Substrate BCH; • Introduction/translocation of Invasive Marine Species (IMS) from contaminated hulls and/or ballast waters of interstate and/or overseas vessels used during construction/operations which could impact benthic communities; and • Accidental fuel spillage to from construction vessels & vehicles with subsequent impacts to marine and intertidal BCH. Note the risk of a spill occurring is considered highly unlikely and the assessment of impact to MEQ as the primary receptor, including avoidance and mitigation, is discussed in Section 7.6.1.3. No further discussion in relation to impacts to BCH is discussed in this Section. <p>Indirect Impacts:</p> <ul style="list-style-type: none"> • Indirect impacts during construction may arise from disturbance to Bare Substrate BCH through increased suspended sediment and associated benthic light reduction within the predicted ZoMI; • No indirect irreversible or recoverable impacts are predicted to Coral, Seagrass, Filter Feeder or Macroalgae BCH. Further information regarding predicted dredging zones of impact is provided in Appendix J (O2 Metocean 2022); and • Additionally, the dredge material placement area (Spoil Ground C) is already impacted from dredging and is not likely to be further impacted as a result of the proposed disposal. No indirect impacts (irreversible or recoverable) to BCH beyond the dredge material placement area (Spoil Ground C) is predicted.
Mitigation Hierarchy	<p>Avoid:</p> <ul style="list-style-type: none"> • The port infrastructure has been designed within an area of bare substrate, resulting in no impacts to sensitive BCH within the Nearshore DE. • The ZoHI and ZoMI are entirely within an area of bare substrate, resulting in no impacts to sensitive BCH. • An existing dredge material placement area (Spoil Ground C) has been selected and is within and surrounded by an area of bare substrate, resulting in no impacts to sensitive BCH • The final location of the five offshore transshipment anchorage points were selected to avoid benthic habitat, which was mapped within the anchorage investigation area as being limited to the 30 m depth contour, with the seabed beyond this depth being predominantly bare sand. This results in a reduced potential impact to marine fauna, including listed species by avoiding impacts to benthic habitats. Initial design locations were moved to specifically avoid impacts to mapped benthic communities. • As the anchorage area is devoid of BCH and was specifically selected in consideration of the mitigation hierarchy, whereby impacts to BCH are avoided through site selection. • The anchorage zones (Offshore IF) within the proposed Offshore DE have been designated within an area of bare substrate, resulting in no impacts to sensitive BCH. • Brine diffuser and associated mixing zone has been positioned in an area of bare substrate, resulting in no impacts to sensitive BCH. <p>Minimise:</p> <ul style="list-style-type: none"> • Implementation of a Marine Construction Environmental Management Plan (MCEMP). • Implementation of a Dredging and Spoil Disposal Management Plan (DSDMP) which includes monitoring and mitigation measures to ensure that actual impacts are as predicted or less.
Residual Impacts & Assessment of Significance	<p>Proposal dredging and construction activities will result in combined direct removal / disturbance of up to 3 ha of bare substrate which includes:</p> <ul style="list-style-type: none"> • 0.2 ha within the Nearshore DE where proposed marine infrastructure (jetty and associated components) is being constructed (excludes direct impacts from dredging, refer below); and • 3.1 ha within the predicted dredging ZoHI (includes area of direct impacts from wharf construction). <p>Given that bare substrate does not represent regionally significant BCH or BCH of high functional ecological value, these impacts are not considered to be significant. Most of the dredging footprint will remain classified as bare substrate after the completion of dredging so has not been considered further in the BCH assessment. This, in conjunction with the avoidance and mitigation measures in place, it is not expected that the Proposal will result in any direct, indirect, or cumulative impacts to marine environmental quality.</p>
Proposed Environmental Outcomes	<p>If this Proposal is approved and implemented, it will result in a small loss of bare sediment and no loss of sensitive BCH (i.e., coral, seagrass, filter feeders, etc). Considered within this context, the predicted irreversible impact to BCH and cumulative loss from the Project is not considered to pose a significant risk to ecological integrity and biological diversity within the LAU or the broader Port environment.</p> <p>Following the proposed dredging the Proponent is confident that the environmental outcome ‘<i>No areas of sensitive BCH (i.e., coral, seagrass, filter feeders, etc) to be either directly or indirectly impacted from dredging, construction or operational activities</i>’ can be achieved.</p> <p>Based on no predicted direct or indirect loss of sensitive BCH it is considered that the Proposal will not contribute to loss of BCH such that biological diversity and ecological integrity are at risk at either a local or regional scale. Overall, the impacts to BCH are not considered to be significant and the EPA objective for BCH is considered to be met.</p>
Assessment of Offsets if Relevant	None

Table ES-6: Marine Environmental Quality

Key Environmental Factor – MEQ	
EPA Objective	“To maintain the quality of water, sediment and biota so that environmental values are protected.” (EPA 2016j).
Potential Impacts	<p>Direct Impacts:</p> <ul style="list-style-type: none"> • Release of contaminated sediments during dredging within the proposed dredge footprint and disposal at the existing Spoil Ground C; • Release of hypersaline brine to the marine environment resulting in altered physicochemical conditions (i.e., increased temperature and salinity) around the diffusers within the Nearshore DE; • Temporary, localised turbidity increase from dredging and disposal activities; and • Accidental fuel spillage to marine and intertidal environment from construction vessels & vehicles <p>Indirect Impacts:</p> <ul style="list-style-type: none"> • Accidental product spills to the marine environment, resulting from loading at the port infrastructure in the nearshore DE and at the transshipment location in the offshore DE; and • Accidental fuel spillage or pollution from vessels.
Mitigation Hierarchy	<p>Avoid:</p> <ul style="list-style-type: none"> • Dredge sediments to be disposed offshore in an existing and approved offshore dredge material disposal area (Spoil Ground C). • Sediments have been analysed against the DEWHA 2009 guidelines’ screening levels and are considered free from contaminants. • Brine diffuser and associated mixing zone has been positioned within the Nearshore IF, affixed to the jetty infrastructure and within a dredged berthing pocket so as to avoid further impacts to BCH or Marine Fauna. • Operate all vessels within the requirements of the existing PoA requirements as stipulated by Pilbara Ports Authority and directed by the Harbour Master. <p>Minimise:</p> <ul style="list-style-type: none"> • Implementation of the Dredge and Soil Disposal Management Plan (DSDMP). • Dredge plume modelling was completed to determine the zones of impact to ensure no unacceptable risk to MEQ (or other factors) would result from proposed activities. • Implementation of the Marine Construction Environmental Management Plan (MCEMP). • Brine discharge modelling was conducted to ensure appropriate species protection levels are met at LEP boundaries. The near-field modelling assessment indicates that the target dilutions required to meet the 90% and 99% SPLs, as applied to the moderate and high LEPs, respectively, are readily achieved within the 70 m mixing zone. The results indicate that satisfactory dilutions could readily be achieved within short distances of the Proposal infrastructure, with relatively simple diffuser designs. • Operate all plant in accordance with design specifications, typically brine quality prior to discharge and flow volumes/velocities for diffuser performance. • Cargo handling infrastructure designed to industry best practice to minimise spillage. • Development of specific procedures for transshipping operations within the proposed anchorage typically including: <ul style="list-style-type: none"> ○ Identification of sea state and wind loading parameters for offshore transshipping ○ Implement industry standards for hydrocarbon storage and management. ○ Facility and vessel cargo infrastructure maintenance and inspections. • Implement existing PPA PoA procedures typically including: <ul style="list-style-type: none"> ○ Inspect and maintain all refuelling equipment on a daily basis or at least prior to each and every use. ○ Implement existing PoA refuelling procedures. ○ Store all fuels, oils and lubricants on site to ensure that they do not pose a threat to the environment or the safety of staff and the public. ○ All vessel movements are subject to the Harbourmaster’s approval to ensure they are all planned, no incompatible operations co-occur, and that weather and tidal movements are factored into all operations. ○ All vessel movements subject to PoAs procedures, including qualified and experienced vessel operators. ○ All shipping movements are subject to PoAs scheduling and Pilotage requirements to ensure the highest level of planning, which includes all vessel movements, weather and tides. ○ Follow all reasonable directions given by the harbour master to ensure vessel collisions are avoided. • Oils Spill Contingency Management: <ul style="list-style-type: none"> ○ The Proponent is committed to updating and reviewing the Oil Spill Response and Tactical Response Plans to accommodate the increased levels of risk posed by additional vessel movements. ○ Operational staff shall be appropriately trained in oil spill response. ○ The Proponent is committed to working alongside the PoA to ensure oil spill response capabilities are met. ○ Ensure all operational vessels are compliant with the MARPOL.

Key Environmental Factor – MEQ	
Residual Impacts & Assessment of Significance	With avoidance and mitigation measures in place, it is not expected that the Proposal will result in any direct, indirect, or cumulative impacts to marine environmental quality.
Proposed Environmental Outcomes	<p>The Proponent’s assessment of impacts to MEQ included the following aspects:</p> <ul style="list-style-type: none"> • The established EQMF, EVs and EQOs across the Port. • Review of existing baseline water quality for the project area. • Consistency with EPA Technical Guidance - Protecting the Quality of Western Australia’s Marine Environment. <p>The Proponent considers that potential impacts to MEQ from the Proposal would be minor and temporary for the duration of marine construction activities (dredging and piling) is expected to be less than three months. The receiving environment has a degree of resilience to turbidity as the waters are naturally turbid. The dredge material is also likely to be clean due to the low levels of contaminants recorded in the sediment quality assessment.</p> <p>After the mitigation hierarchy has been applied, the Proponent has committed to protecting EVs and maintaining ecosystem integrity during operations as per the established Port of Ashburton LEPs and proposed LEP modifications (around nearshore infrastructure and diffuser) and considers there is a high level of confidence that the proposed water quality monitoring program and contingency management measures within the DSDMP, MCEMP and MOEMMP for the Proposal will achieve this.</p> <p>Based on no predicted long-term impacts to MEQ and the implementation of all mitigation measures to limit the impact of the Proposal on the environment. Overall, the impacts to MEQ are not considered to be significant and the EPA objective for MEQ is considered to be met.</p>
Assessment of Offsets if Relevant	None

Table ES-7: Marine Fauna

Key Environmental Factor – Marine Fauna	
EPA Objective	“To protect marine fauna so that biological diversity and ecological integrity are maintained.” (EPA 2016b).
Potential Impacts	<p>Direct Impacts:</p> <ul style="list-style-type: none"> • Injury from vessel strike; • Underwater noise from piling and dredging operations; • Light pollution; • Loss of marine fauna habitat due to direct removal or disturbance of benthic habitat from dredging; and • Entanglement/ plastic ingestion from marine debris <p>Indirect Impacts:</p> <ul style="list-style-type: none"> • Osmotic stress from brine discharge; and • Hydrocarbon spill causing marine fauna injury or fatalities and/ or impact on critical habitat; • Temporary, localised turbidity increase from dredging; • Introduction of marine pest species from project vessels
Mitigation Hierarchy	<p>Avoid:</p> <ul style="list-style-type: none"> • Marine construction activities will be undertaken outside of key ecological windows (i.e. southern migration for Humpback Whales with their calves and sawfish pupping season) for marine fauna species, as far as practicable. • Maximum vessel speed within all areas of the MOF is 10 knots and all vessels to adhere to standard set in the National Whale Watching Guidelines and Department of Biodiversity, Conservation and Attractions regulations to prevent injury to marine fauna from vessel strike. • Dredging resulting in benthic habitat removal and increased turbidity within the Nearshore DE is expected, however critical habitat does not exist within the Nearshore DE and is mostly comprised of both bare substrate with occasional areas of limestone pavement. Turbidity is only expected to be localised and temporary. • Dredge plume will only affect areas of bare substrate, hence no impact to sensitive benthic habitats. • Appropriate dilution of brine discharge based on ecotoxicity testing and brine modelling would result in a low risk to benthic habitat within the low ecological protection area that has been applied around the diffuser outfall. • Prevent the introduction of marine pests including compliance with PPA guidance and International Maritime Organisation International Convention for the Prevention of Pollution from Ships (MARPOL), as outlined in the Introduced Marine Pest Risk Assessment. <p>Minimise:</p> <ul style="list-style-type: none"> • Underwater noise from piling will be managed through use of dedicated marine fauna observers (MFOs), management zones informed by underwater noise modelling, soft-start and shut down procedures and will ensure that impacts from underwater noise will not cause disturbance and temporary or permanent injury to marine fauna. • Dredging operations crew will be trained in marine fauna observation, reporting, recording and mitigation measures to minimise impact to marine fauna from turbidity and vessel strike. • Vessel speeds will be aligned with those required by the Port, which will minimise the risk of vessel strike. • Construction and operational light spill and glow will be reduced through the implementation of best practice measures as outlined in the Artificial Light Impact Assessment and Management Plan, in order to minimise disruption to marine fauna (marine turtles and shorebirds). • Standardised waste and hydrocarbon management measures (as per existing PPA requirements) will be implemented during construction and operations to minimise the risk of unplanned spills and debris from entering the marine environment.
Residual Impacts & Assessment of Significance	<p>With avoidance and mitigation measures in place, the potential for harm or behavioural disturbance to marine fauna individuals remains. However, this would be of low significance without population-level consequences. The combined impact of the Proposal activities and the consequent environmental outcomes are not considered to pose any significant residual risks to the protection of marine fauna and therefore biological diversity and ecological integrity can be maintained.</p>
Proposed Environmental Outcomes	<p>Consideration of the potential for significant impacts is based on the nature and magnitude of potential impacts, taking into account the criteria as defined within the MNES significant impact guidelines (DoE, 2013). Modelling undertaken to understand the spatial and temporal extents of the dredge plume, brine outfall, lighting and underwater noise has provided high levels of confidence in undertaking the impact assessment. The dredge plume and brine outfall are small in scale and the only benthic communities and habitat category they will overlap with is bare substrate.</p> <p>No important habitats are restricted to these areas, or the DEs, and all habitat is widely represented throughout the region.</p> <p>The highest potential for impact to marine fauna is from construction piling underwater noise and operational lighting during sensitive ecological windows (i.e., noise during Humpback Whale mother and calf occurrence, or light spill / glow during turtle nesting or seabird / shorebird roosting). However, the implementation of appropriate management measures as outlined in Section 8.5, Marine Construction Environmental Management Plan (MCEMP),</p>

Key Environmental Factor – Marine Fauna	
Assessment of Offsets if Relevant	<p>Marine Operational Environmental Monitoring and Management Plan (MOEMMP), Dredging and Spoil Disposal Management Plan (DSDMP) and the Artificial Light Management Plan (ALMP) will prevent population-level consequences. Long term decreases in population size are unlikely for any marine fauna populations in the area due to the limited potential for impact.</p> <p>The following environmental outcomes for marine fauna are to be achieved by the Proposal:</p> <ul style="list-style-type: none"> • No impacts to important habitats (i.e., nesting, nursery, foraging or breeding areas), for any conservation significant, commercially or recreationally valued marine fauna species; • The number of individuals affected is expected to be low and not significant in terms of local populations; • No reduction in populations of species of local and regional importance; • Biological diversity and ecological integrity will be maintained; • No reduction in the biodiversity of marine fauna in the DEs or surrounds; and <p>Suitable habitat for all other identified threatened, and migratory MNES species will continue to be available in the DEs, local and regional areas.</p> <p><i>Based on the negligible potential impact on Marine Fauna habitat and the implementation of all mitigation measures to limit the impact of the Proposal on the environment, the EPA objective for Marine Fauna will be met.</i></p>
	None

Table ES-8: Flora and Vegetation

Key Environmental Factor – Flora and Vegetation	
EPA Objective	“To protect flora and vegetation so that biological diversity and ecological integrity are maintained.” (EPA 2020e).
Potential Impacts	<p>Direct Impacts:</p> <ul style="list-style-type: none"> Loss of native vegetation due to clearing; Loss of conservation significant vegetation communities due to clearing; and Loss of conservation significant flora due to clearing. <p>Indirect Impacts:</p> <ul style="list-style-type: none"> Fragmentation; Altered hydrological regimes; Introduction and/or spread of weed species; and Increased dust deposition.
Mitigation Hierarchy	<p>Avoid:</p> <ul style="list-style-type: none"> A Site Disturbance Permit (SSDP) procedure will be implemented for all land clearing activities to avoid impact on priority flora populations and ensure clearing within approval boundaries, to avoid any clearing occurring outside of the Haul Road DE. The Proponent has revised the Haul Road DE to avoid the Tanpool Land Systems PEC including a minimum buffer of 100 m from the Haul Road DE. The Proponent has reduced the Haul Road DE from 25,930 to 16,209 ha so impacts to conservation significant vegetation communities are avoided. The Proponent has redesigned the Haul Road DE to avoid high density populations of Priority flora species as much as possible. Observers and spotters will be used when working near sensitive sites, e.g., near Priority flora, or when clearing boundaries may not be readily visible (for example due to dense vegetation). The Proponent has reduced the Haul Road DE from 25,930 to 16,209 ha and will install bridges and culverts to avoid and/or minimise interactions with, and disturbance to, watercourses and riparian vegetation. The Proponent will implement strict hygiene procedures to prevent introduction of new or additional populations of weed species in the Haul Road DE. Vegetation clearing, grubbing and earthworks during high winds will be avoided where possible. The haul road will be sealed upon completion of construction. Construction of the haul road is expected to be completed within one year, during which time dust will be effectively managed using standard dust suppression techniques avoiding and/or minimising impacts to flora and vegetation. Engineering controls and water management structures (e.g. culverts, bridges and burrows) will be installed and maintained as part of the Proposal design to maintain hydrological regimes, capture and infiltrate rainfall, to avoid the degradation of water quality by sedimentation, erosion or chemical pollutants. The Proponent will implement the waste, hydrocarbon and chemical management measures to avoid contaminated stormwater and spills from entering the local environment. <p>Minimise:</p> <ul style="list-style-type: none"> Implementation of a Terrestrial Environmental Management Plan (TEMP) to minimise the duration, intensity and/or extent of flora and vegetation impacts during construction and operation. Vegetation clearing shall be kept to the minimum amount required, as far as practicable. Vegetation clearing at creek crossings will be minimised, as far as practicable. Any planned disturbance to watercourses shall be completed during dry, non-flow periods to minimise environmental impacts, wherever possible. The Proponent will effectively prevent and controls weeds through the implementation of weed management procedure. The Proponent will implement dust controls to effectively manage dust, through the use of dust suppression equipment will be utilised such as water carts, vehicle speeds on access tracks and around work sites reduced where necessary to minimise dust emissions the implementation of TEMP and a Contractor Dust Management Plan. <p>Rehabilitate:</p> <ul style="list-style-type: none"> Progressive rehabilitation of approximately 1,200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy.
Residual impacts & assessment of significance	The significant residual impacts, after the implementation of the mitigation hierarchy, is clearing of up to 544 ha of native vegetation in Good to Very Good condition in the Roebourne subregion, and 846 ha of native vegetation in Good to Excellent condition in the Hamersley subregion. As a result, environment offsets are proposed for the clearing of native vegetation.
Proposed environmental outcomes	<p>Key predicted environmental outcomes to flora and vegetation include:</p> <ul style="list-style-type: none"> No listed Threatened flora species, TECs or PECs are present within the Haul Road DE. Clearing of up to 1,564 ha of native vegetation comprising: <ul style="list-style-type: none"> Approximately 2.5 ha in Excellent condition;

Key Environmental Factor – Flora and Vegetation	
Assessment of Offsets if Relevant	<ul style="list-style-type: none"> ○ Approximately 1120.6 ha in Very Good condition; and ○ Approximately 398.1 ha in Good condition. <ul style="list-style-type: none"> • Clearing of Vegetation types considered to be potential GDVs will be limited to 10% of the mapped extent of GDVs within the Terrestrial Survey Area. • Impacts to Priority flora species are unlikely to be significant nor are they expected to result in a change to their conservation status. • Impacts to surface water regimes will be negligible, with appropriate implementation of avoidance and minimisation measures. • Spread of weeds and contamination are expected to be effectively managed within the Haul Road DE with the application of standard weed, dust and waste management measures as outlined in the TEMP. As a result, the Proposal is unlikely to significantly alter the condition of vegetation in the Haul Road DE. • The outcomes of air quality modelling completed are that it is not expected that construction or operational particulate emissions from the Port will significantly impact air quality (ETA 2022). The Proposal has been specifically designed to maximise the suppression and capture of dust emissions at the Port. Mitigation has been incorporated into the Proposal to minimise emissions by ensuring ore is stockpiled, conveyed and transferred in covered infrastructure at the Port. As such, the Proponent considers that dust emissions can be appropriately managed in accordance with management procedures and the EPA's objective for Air Quality can be met. <p><i>Based on the above the Proposal meets the EPA's objective for the flora and vegetation factor. The proposed loss of vegetation is unlikely to cause a loss of biological diversity at the local or regional scale, and the ecological integrity of the area surrounding the indicative footprint is expected to be maintained.</i></p> <p>The significant residual impacts for this Proposal, after the implementation of the mitigation hierarchy, is clearing of up to 846 ha of native vegetation in Good to Excellent condition in the Hamersley subregion. Contributions to the PEOF to offset the significant residual impact from the clearing of native vegetation considered in 'Good to Excellent' condition has been used as the standard offset approach by the EPA and proponents in the Pilbara since 2012.</p> <p>The Proponent proposes offsets in financial contributions to the PEOF. The actual offset amounts will be based on extents of actual clearing, which will be determined through an Impact Reconciliation Report (IRR) (Appendix HH). The intended construction timeframe is less than one year, so it is intended that the first and final offset amount will be calculated within three months of completion of construction. The approach to offsetting the significant residual impacts associated with the Proposal is considered to be consistent with the six principles outlined in the WA Environmental Offset Policy (Gov of WA 2011).</p>

Table ES-9: Terrestrial Fauna

Key Environmental Factor – Terrestrial Fauna	
EPA Objective	<p>“To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.” (EPA 2016g)</p>
Potential Impacts	<p>Direct Impacts:</p> <ul style="list-style-type: none"> • Loss of fauna habitat, including breeding, foraging and dispersal habitat due to clearing along the haul road; • Fragmentation of fauna habitats, limiting fauna access and movement along the haul road; and • Fauna mortality or injury. <p>Indirect Impacts:</p> <ul style="list-style-type: none"> • Species disturbance associated with increased dust, noise, vibration or light; and • A degradation of fauna habitats due to: <ul style="list-style-type: none"> ○ Introduction or spread of weeds; ○ An increase in feral predators (vertebrate fauna only); and ○ Altered fire regimes.
Mitigation Hierarchy	<p>Avoid:</p> <ul style="list-style-type: none"> • An SSDP Procedure will be used for all land clearing activities to ensure clearing within approval boundaries and avoids any clearing occurring outside of the Haul Road DE. • The Proponent has undertaken a redesign of the haul road to avoid direct impacts to 31.6 ha of Mesas and Breakaway habitat. Mesas and Breakaway habitat is known as Northern Quoll denning habitat, Ghost Bat and Pilbara Leaf-nosed Bat roosting habitat and shelter for Pilbara Olive Python. • The Proposal has reduced the Haul Road DE from 25,930 to 16,209 ha to avoid and/or minimise interactions with, and disturbance to, watercourses, riparian vegetation and flood plains which provides high value habitat to conservation significant fauna species. <p>Minimise:</p> <ul style="list-style-type: none"> • Implementation of a Terrestrial Environmental Management Plan (TEMP) to minimise the duration, intensity and/or extent of fauna impacts during construction an operation. • Vegetation clearing shall be kept to the minimum amount required, as far as practicable. • Vegetation clearing at creek crossings will be minimised as far as practicable and overpasses and culverts will be installed along the haul road to minimise impact to Drainage Line/River/Creek habitat as far as practical. • Clearing will commence from a disturbed vegetation edge to an undisturbed area (to encourage mobile fauna to relocate to adjacent areas naturally). • Vegetation clearing, grubbing and earthworks during high winds will be avoided where possible. The haul road will be sealed upon completion of construction, so dust will only be an issue during construction phase of the Proposal. Construction of the haul road is expected to be completed within one year, during which time dust will be effectively managed using standard dust suppression techniques avoiding and/or minimising impacts to flora and vegetation. • The Proponent will implement dust controls to effectively manage dust, through the use of dust suppression equipment will be utilised such as water carts, vehicle speeds on access tracks and around work sites reduced where necessary to minimise dust emissions the implementation of TEMP and a Contractor Dust Management Plan. • Install non-barbed wire fencing within areas that have low to high risk (i.e. east of NWCH) of interaction with Pilbara Leaf-nosed Bat and Ghost Bat. If barbed wire is deemed necessary in areas of low to high risk (i.e., east of NWCH) of interaction with Ghost Bats, it will be installed with suitable bat deflectors to minimise the risk of collision. • Where possible construction vehicle movements will occur during daylight, which will minimise interactions with nocturnal species (Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat). • Clearing works will be restricted to daylight hours within 1 km of Mesa and Breakaway habitats and east of Red Hill Creek. • The speed limit of the Haul Road will be limited to 80 km/hr at all times and the access road will be limited to 80 km/hr at night during operation • The speed limit of the Haul Road will be limited to 60 km within construction areas, except for within 1 km of Mesa and Breakaway habitat and east of Red Hill Creek which will have a speed limit of 40 km/hr during construction. • Fauna spotters will be engaged when working within 1 km of Mesa and Breakaway habitat and within Drainage Line/River/Creek (major). • Lighting will be directed inwards towards the haul road to minimise the light impact.

Key Environmental Factor – Terrestrial Fauna

- Recording of feral animal sightings during construction. If feral animal numbers increase (during construction), targeted control measures will be undertaken (including management of putrescible waste, removal of temporary water sources).
- Fire prevention measures (and control measures, should a fire break out) will be in place. This will increase the capacity for fire management in the wider area through fire-fighting equipment, trained personnel and fire access.

Rehabilitate:

- Progressive rehabilitation of approximately 1,200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy.

Residual Impacts & Assessment of Significance

The Proposal will result in the clearing of a maximum of 141 ha of foraging and dispersal habitat within 1 km of potential denning habitat, which is considered supporting habitat. This clearing is considered a **significant** residual impact.

Predicted outcomes for fauna habitat

- The Proposal will result in the clearing of up to **1,564** ha of terrestrial fauna habitat. This represents 6% of the area of fauna habitats within the Terrestrial Survey Area;
- The Proposal will result in the clearing of up to 141 ha of foraging and dispersal habitat considered supporting habitat for the Northern Quoll;
- The Proposal will result in the clearing maximum of 418 ha of high-value foraging and dispersal fauna habitat (Drainage Line/River/Creek (major and minor and Stony Hills and Slopes) within the Haul Road DE;
- No caves or permanent/semi-permanent pools were identified within the Haul Road DE or Terrestrial Survey Area;
- All of the fauna habitats recorded within the Haul Road DE are widely distributed throughout the Terrestrial Survey Area and region;
- No clearing of habitat critical to the survival of the Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon or Migratory waterbird species due to the application of the mitigation hierarchy (avoid, minimise and rehabilitate);
- Occasional injury and/or mortality of fauna individuals during clearing activities, construction and operation of the Proposal, with this risk being effectively mitigated through the use of fauna spotters, progressive clearing, non barbed wire fencing and speed limits; and
- The degradation of habitat from the spread of weeds, dust deposition and increased risk of fire will be effectively managed within the Haul Road DE by standard weed, dust and fire management measures.

Predicted outcomes for conservation significant fauna species as follows:

Value	Records of habitat/ species within Haul Road DE
Northern Quoll	<ul style="list-style-type: none"> The majority of Northern Quoll records occurred outside the Haul Road DE; The Proposal has been designed to avoid all Mesas and Breakaway habitats, providing Northern Quoll denning, foraging and dispersal habitat; The Proposal will result in the clearing of a maximum of 141 ha of foraging and dispersal habitat within 1 km of potential denning habitat, which is considered supporting habitat. This clearing is considered a significant residual impact; Offsets are proposed for the clearing of supporting habitat (Section 15); and Indirect impacts to Northern Quoll are expected to be negligible.
Pilbara Leaf-nosed Bat	<ul style="list-style-type: none"> Only one record of the Pilbara Leaf-nosed Bat is within the Haul Road DE. The Proposal has been designed to avoid all Mesas and Breakaway habitat, which provides high-value (potential roosting and foraging) habitat for Pilbara Leaf-nosed Bat; and The Proposal will result in the clearing of a maximum of 213 ha of supporting habitat Pilbara Leaf-nosed Bat habitat (0.2% of the available supporting habitat, based on a 125,000 ha foraging range). No critical habitat (diurnal or maternity roosts) occur within either the Haul Road DE or Terrestrial Survey Area; The risk of collision with fencing will be minimised through the installation of a non-barbed wire fence; No significant impacts to Pilbara Leaf-nosed Bat due to habitat clearing, fragmentation or direct mortality of individuals are expected; and Indirect impacts to Pilbara Leaf-nosed Bat are expected to be negligible.

Key Environmental Factor – Terrestrial Fauna

Value	Records of habitat/ species within Haul Road DE
Ghost Bat	<ul style="list-style-type: none"> No individual records of Ghost Bat within the Haul Road DE. The Ghost Bat was recorded at three locations outside the Haul Road DE, consistent with foraging individuals; The Proposal will result in the clearing of 213 ha of supporting habitat for the Ghost Bat (0.5% of the available supporting habitat, based on a 45,000 ha foraging range); No critical habitat, including diurnal or maternity roosts occur within either the Haul Road DE or Terrestrial Survey Area; No significant impacts to Ghost Bat due to habitat clearing, fragmentation or direct mortality of individuals are expected; and Indirect impacts to Ghost Bat are expected to be negligible.
Pilbara Olive Python	<ul style="list-style-type: none"> There are no records of Pilbara Olive Python within the Haul Road DE (the closest record 20 km south); The Proposal will not result in the clearing of any important foraging and dispersal habitat for the Pilbara Olive Python (i.e., Stony hills and slopes and Drainage link/River/Creek (major) habitat in proximity to Mesa and Breakaway habitat); There are no significant water pools within the Haul Road DE or Terrestrial Survey Area that may be critical habitats for the Pilbara Olive Python; No significant impacts to Pilbara Olive Python due to habitat clearing, fragmentation or direct mortality of individuals are expected; and Indirect impacts to Pilbara Olive Python are expected to be negligible.
Grey Falcon	<ul style="list-style-type: none"> There are no records of Grey Falcon within the Haul Road DE; The Grey Falcon may utilise all the fauna habitats within the Haul Road DE for foraging; The Proposal will result in clearing up to 268 ha of Drainage Line/River/Creek (major and minor) habitat, representing potential breeding habitat for the Grey Falcon (this equates to 8% of the suitable breeding habitat within the Terrestrial Survey Area); No significant impacts to Grey Falcon due to habitat clearing, fragmentation or direct mortality of individuals are expected; and Indirect impacts to Grey Falcon are expected to be negligible.
Western Pebble-mound Mouse	<ul style="list-style-type: none"> There are no records of Western Pebble-mound Mouse within the Haul Road DE; the closest record is 299 m away; The Proposal will result in clearing approximately 725 ha of suitable (Stony Plain habitat) for the Western Pebble-mound Mouse; This fauna habitat is not restricted and extends well beyond the Haul Road DE; Approximately 8,076 ha (92%) of Western Pebble-mound Mouse (Stony Plain) habitat will remain in the Terrestrial Survey Area; No significant impacts to Western Pebble-mound Mouse due to habitat clearing, fragmentation or direct mortality of individuals are expected; and Indirect impacts to Western Pebble-mound Mouse are expected to be negligible.
Long-tailed Dunnart	<ul style="list-style-type: none"> There is one record of the Long-tailed Dunnart at Red Hill Station within the Haul Road DE; The Proposal will result in the clearing of approximately 875 ha of suitable habitat (Stony Plain and Stony Hills and Slopes) for the Long-tailed Dunnart; These fauna habitats are not restricted and extend well beyond the Haul Road DE; Approximately 3,695 ha (81%) of suitable habitat (Stony Hills and Slopes and Stony Plain habitat) for the Long-tailed Dunnart will remain within the Terrestrial Survey Area; No significant impacts to Long-tailed Dunnart due to habitat clearing, fragmentation or direct mortality of individuals are expected; and Indirect impacts to Long-tailed Dunnart are expected to be negligible.
Short-tailed Mouse	<ul style="list-style-type: none"> There are no records of Short-tailed Mouse within the Haul Road DE; The Proposal will result in clearing up to 1,239 ha of suitable habitat (Claypans, Tidal Flats, Plains and Stony Plains) for the Short-tailed Mouse; This fauna habitat is not restricted and extends well beyond the Haul Road DE; Even with project flexibility, none of these habitat types are limited, and all extend outside of the Haul Road DE; No significant impacts to Short-tailed Mouse due to habitat clearing, fragmentation or direct mortality of individuals are expected; and Indirect impacts to Short-tailed Mouse are expected to be negligible.

Key Environmental Factor – Terrestrial Fauna	
Value	Records of habitat/ species within Haul Road DE
Peregrine Falcon	<ul style="list-style-type: none"> • 35 listed waterbirds are considered to possibly interact with the Proposal; • No important habitat for listed waterbirds occurs within the Proposal area, or within 10 km of the Proposal; • Suitable habitat for waterbirds will continue to be available in the Haul Road DE, Terrestrial Survey Area and region; • The utilisation of the Tidal Flat and Claypan habitats within the Haul Road DE is considered low and this is likely attributed to intermittent inundation and the widespread nature of these environments; and • No significant impacts to Migratory listed wetland/water birds due to habitat clearing, fragmentation or direct mortality of individuals are expected.
Migratory wetland/ waterbirds species	<ul style="list-style-type: none"> • No Migratory listed wetland/waterbirds were recorded in the Haul Road DE during the recent survey; • The Proposal will result in clearing up to 337 ha of high-value (foraging) habitat (Claypans, Tidal Flats and Drainage Line/River/Creek) for the Migratory listed wetland/water birds. Approximately 4,382 (93%) of suitable Migratory listed wetland/waterbirds habitat will remain in the Haul Road DE and throughout the Terrestrial Survey Area; and • No significant impacts to Migratory listed wetland/water birds due to habitat clearing, fragmentation or direct mortality of individuals are expected.
<p>Based on the above the Proposal meets the EPA's objective for the terrestrial fauna factor. The proposed loss of habitat is unlikely to cause a loss of biological diversity at the local or regional scale, and the ecological integrity of the area surrounding the Haul Road DE is expected to be maintained.</p>	
Assessment of Offsets if Relevant	<p>The Proposal will result in residual impacts for the Northern Quoll (Table 10-17) and offsets are proposed for the clearing of supporting habitat for this species.</p> <p>The Proponent proposes offsets in financial contributions to the PEOF. The actual offset amounts will be based on extents of actual clearing, which will be determined through an Impact Reconciliation Report (IRR) (Appendix DD and Appendix EE). The intended construction timeframe is less than one year, so it is intended that the first and final offset amount will be calculated within three months of completion of construction. The approach to offsetting the significant residual impacts associated with the Proposal is considered to be consistent with the six principles outlined in the WA Environmental Offset Policy (Gov of WA 2011).</p>

Table ES-10: Inland Waters

Key Environmental Factor – Inland Waters	
EPA Objective	“Maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.” (EPA 2020e).
Potential Impacts	<p>Direct Impacts:</p> <ul style="list-style-type: none"> Increased (upgradient) and/or decreased (downgradient) inundation (flooding) of natural and built environs as a result of new crossings, causeways, floodways and raised areas; and Reductions in the availability of groundwater for existing users or environmental values as a result of groundwater abstraction associated with construction of the haul road. <p>Indirect Impacts:</p> <ul style="list-style-type: none"> Increases in existing turbidity and sediment load of surface waters as a result of clearing and soil disturbance, including the construction of crossings and the placement and management of soil stockpiles; Increased risks to surface and/or groundwater quality as a result of disturbance of ASS; and Increased risks to surface and/or groundwater quality as a result of spills and leaks of hydrocarbons, wastes and other hazardous materials.
Mitigation Hierarchy	<p>Avoid:</p> <ul style="list-style-type: none"> Crossings, including bridges, culverts and floodways, will be design, constructed and maintained to ensure natural hydrological regimes are maintained for the majority of conditions, but particularly during low (base) and receding flows. The haul road will be fully sealed prior to operational use. This will greatly reduce erosion and sedimentation risks along the entire length of the road. Any planned disturbance to watercourses will be completed during dry, non-flow periods to minimise environmental impacts, where possible. Rock protection to be installed at waterway crossings where flow velocities are likely to exceed 2 m/s. Borrow areas within floodplains will be avoided where possible and where necessary, will only be excavated during dry conditions, and all disturbed areas will be stabilised prior to the commencement of the summer wet season. Temporary stockpiles will be preferentially located outside of flood risk areas. Only utilise and place hydrocarbon storage containers in accordance with WQPN 56 “Tanks for fuel and chemical storage near sensitive water resources” (DWER 2018). Include secondary containment. No storage or transfer of hydrocarbons (i.e., refuelling) within 100 m of any existing wellhead. Prior to excavation, an assessment of acid sulfate soil risk will be conducted in accordance with the DWER guideline (DER 2015b), including in areas where dewatering may be required – to be managed through the Mining Proposal for the haul road. <p>Minimise:</p> <ul style="list-style-type: none"> Installing and maintaining engineering controls and water management structures (e.g., culverts, bridges and burrows) as part of the Proposal design to maintain hydrological regimes, capture and infiltrate rainfall, minimise the degradation of water quality by sedimentation, erosion or chemical pollutants. Once the Haul Road is constructed, the Proponent will also monitor rainfall and water levels (including tidal) at selected locations within intertidal and claypan habitats adjacent to the Haul Road Where impacts to waterflows are detected, additional controls will be implemented to the extents provided for under relevant approvals. Regular inspection and upgrade/ repair to areas undergoing unacceptable erosion (e.g. where vegetation or infrastructure is at risk). Bores will be located at a distance greater than 400 m from existing licensed bores. All bores to be constructed and operated in accordance with RIWI Act permits and licences. Abstraction to be of relatively short duration (i.e. during construction), so water levels should quickly recover. The Proponent will ‘make good’ any loss or reduction in supply for pastoral bores. Regular inspection and upgrade/ repair to areas undergoing unacceptable erosion (e.g. where vegetation or infrastructure is at risk) Sedimentation controls and onsite sumps designed to contain most stormwater runoff on site, minimising offsite discharge. The Proponent’s standard spills response and clean-up procedures will apply. If present, an ASS Management Plan will be developed and implemented in accordance with the DWER guideline (DER 2015b). <p>Rehabilitate:</p> <ul style="list-style-type: none"> All crossing structures to be fully removed and the site rehabilitated unless alternative land use is agreed, as per approved MCP. Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas within the Haul Road DE (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I). Bores will be decommissioned as per WA Government guidelines unless A contaminated sites assessment will be conducted at closure and areas requiring remediation will be identified and addressed, as per approved MCP.

Key Environmental Factor – Inland Waters	
Residual Impacts & Assessment of Significance	With avoidance and mitigation measures in place, it is not expected that the Proposal will result in any direct, indirect, or cumulative impacts to inland waters.
Proposed Environmental Outcomes	<p>Using the EPA’s environmental factor guideline for Inland Waters (EPA 2018), the Proponent is confident that the EPA’s objective will be met, based on:</p> <ul style="list-style-type: none"> • The Proponent’s commitment to use established design and modelling processes to ensure crossings of waterways and sheet-flow areas do not impede important flows, particularly base flows, or significantly increase inundation periods for riparian and sheetflow areas or affect access to other infrastructure. • The temporary and low-volume groundwater requirements for haul road construction, as well as the sparseness of other groundwater users (noting groundwater use will require authorisation under the RIWI Act). • The low likelihood of contamination of surface or groundwater resources by significant soil erosion or from hydrocarbon spills/leaks. <p><i>The anticipated outcome of the Proposal is that hydrological regimes will be maintained, and water quality will not be affected - consistent with the EPA objective for Inland Waters.</i></p>
Assessment of Offsets if Relevant	None

Table ES-11: Greenhouse Gases

Key Environmental Factor – Greenhouse Gas Emissions	
EPA Objective	“To Reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change.” (EPA 2020j).
Potential Impacts	<p>Direct Impacts:</p> <ul style="list-style-type: none"> • Haul road construction: vegetation clearance and construction activities associated with the haul road development; and • Port construction and operations: fuel consumption from construction, Piped Natural Gas (PNG) electricity generation, transshipping vessels and stationary non-transport purposes, including temporary generators, lighting towers and pumps.
Mitigation Hierarchy	The Proponent, as an organisation has committed publicly to achieving net zero emissions across all of its operations by 2050. It has developed its <i>Roadmap to Net Zero Emissions</i> to “support the organisation’s transition to a low-carbon future” (MinRes 2021). The Proponent will strive to achieve its net zero target by displacing diesel fuel, renewable generation, electrification of equipment and transport, energy storage, and adopting future fuels. Abatement projects will prioritize current operational efficiencies and ‘net zero ready’ asset design to drive emissions reductions before carbon offset purchasing is considered
Residual Impacts & Assessment of Significance	<p>The Proposal adds to Western Australia’s contribution of GHG emissions, but this contribution will decrease over time to the point of Net Zero emissions by 2050 Climate Change - Mineral Resources. The Ashburton Infrastructure Project is construction of a Haul Road and Operation of a Transshipping Port to export 30 Mt (dry) iron ore with design flexibility for future operational expansion to 40 Mt (dry) expected after year 10, subject to availability of ore. As such, the direct impacts and GHG assessment has been based on 30Mt throughput.</p> <p>In 2019-2020, GHG Scope 1 emissions in Western Australia totalled approximately 68.3 million t CO₂-e (CER 2021). For comparison, the peak Scope 1 emissions for the Proposal would represent an increase of approximately 0.14% of the WA Scope 1 emissions for that period.</p>
Proposed Environmental Outcomes	<p>The Proposal will contribute to GHG emissions, primarily from the consumption of fuel (diesel and PNG), vegetation clearance and electricity generation, Haul Road and Port Construction (Year 1) Total GHG: 95,705 tCO₂-e/yr. The Proposal is predicted to contribute to peak annual emissions from Port Operations (from Year 2 emissions @ 30Mtpa) of 97,788 tCO₂-e/yr of Scope 1 emissions, and 54,602,377 tCO₂-e/yr** of Scope 3.</p> <p>Proposal design and planned operations and mitigation measures have been implemented to avoid and reduce GHG emissions wherever possible. The Proponent commits to continuously improving operations and subsequent emissions over the life of the Proposal. It is expected that the Proposal can be managed to meet the EPA’s objective for GHG emissions.</p>
Assessment of Offsets (if Relevant)	None

* Reported Scope 1 emissions for years 11-30 are conservative based on estimates 2021 estimates - the Proponent will be reducing the CO₂e during operations in line with its “Roadmap to Net Zero Emissions [Climate Change - Mineral Resources](#)” **

** The GHG inventory for port operations includes the predicted emissions for the first 10 years (up to 30 Mtpa) and the next 20 (up to 40 Mtpa). Note that these emissions are conservative and do not include additional future emissions reduction and offset measures to be taken by the Proponent to achieve its target of net zero greenhouse gas emissions by 2050.

Table ES-12: Social Surroundings

Key Environmental Factor – Social Surroundings	
EPA Objective	“To protect social surroundings from significant harm.” (EPA 2020e).
Potential Impacts	<p>Direct Impacts:</p> <ul style="list-style-type: none"> Disturbance of sites of cultural heritage significance; and Development of road and other infrastructure which may result in impacts on visual amenity. <p>Indirect Impacts:</p> <ul style="list-style-type: none"> Indirect disturbance of places of cultural significance, plants and animals with cultural associations due to dust and noise; Impacts from haul road on pastoralists – noise and inhibition of staff and livestock movement; Impacts to places of amenity values due to dust, noise and odour; and Impacts from port infrastructure and use on commercial and recreational fishing.
Mitigation Hierarchy	<p>Avoid:</p> <ul style="list-style-type: none"> Proposal redesigned to avoid the Cane River Lore Ground, including an appropriate buffer, in consultation with Traditional Owners, to avoid any indirect disturbance to areas of cultural heritage significance. Except for one lodged site (ID: 28200), no Aboriginal heritage sites have been identified to date – if any sites are identified within the Haul Road DE options will be assessed for amending the alignment to avoid the site – very significant sites will be avoided regardless. The Proposal has been designed to avoid areas of regular public traffic to avoid impacts to visual amenity values and for public safety. Transshipment area was chosen to avoid areas of higher biological activity (e.g. reefs), therefore avoiding higher productivity fishing areas and avoiding impacts from port infrastructure and use on commercial and recreational fishing. <p>Minimise:</p> <ul style="list-style-type: none"> A Social Cultural Heritage Management Plan (SCHMP) is being developed with each relevant Traditional Owner group and implement best-practice management for Aboriginal heritage, including the close involvement of Traditional Owners in management and monitoring. Thalanyji Monitors will be present during first disturbance ground clearing activities within Landside DE in accordance with Cultural Heritage Management Plan (CHMP) prepared by the PPA - the Proponent is preparing a CHMP for works within the PPA footprint that aligns with the PPA CHMP. Ensure relevant Aboriginal heritage material is appropriately salvaged and stored prior to disturbance, in line with Traditional Owner wishes and statutory approvals. Minimise clearing and access restrictions within areas used for cultural purposes or have cultural significance (e.g. at watercourse crossings) to avoid and minimise, disturbance of places of cultural significance. Ensure sediment controls in place during construction at waterway crossings upstream of any waterholes of cultural significance. All infrastructure is designed to be as compact and/or lowest height profile as practicable to avoid and minimise visual amenity. Dust suppression measures will be implemented where dust is visible to minimise levels at all times to avoid and minimise, disturbance of places of cultural significance, plants and animals with cultural associations due to dust and noise. Noise levels from construction and operation are predicted to comply with the Noise Regulations however the Proponent will implement noise standard controls. Underpasses will be installed under the haul road to facilitate light vehicle traffic and stock movement in locations to be agreed with the station leaseholders to minimise indirect impacts from haul road on pastoralists – noise and inhibition of staff and livestock movement. Workforce will not be permitted to utilise port or associated facilities for fishing and fishing will not be permitted within port exclusion zones, for safety reasons to minimise indirect impacts from port infrastructure and use on commercial and recreational fishing. <p>Rehabilitate:</p> <ul style="list-style-type: none"> All disturbance areas will be rehabilitated through revegetation and topsoil respread, including progressive rehabilitation of construction areas not required for operational phases; Progressive rehabilitation through topsoil respreading will be undertaken as areas become available and this will minimise the extent of cleared areas; and Port infrastructure will be removed and rehabilitated upon project completion or as agreed with the PPA.
Residual Impacts & Assessment of Significance	<p>No sites of Aboriginal or European cultural heritage significance currently identified within any parts of the DE, including both terrestrial and marine areas, with the exception of the single lodged site (Site ID 28200: Toolunga Creek Heritage Site 4), approximately 800 m south of the proposed NWCH crossing.</p> <p>Forthcoming heritage surveys will confirm if any Aboriginal heritage sites do occur outside the areas already covered by prior surveys. The Proponent will manage any sites of Aboriginal heritage significance that cannot be avoided in accordance with the AH Act.</p> <p>The Proponent’s proposed port infrastructure will not be visibly conspicuous given its scale and proximity to the neighbouring and much larger Wheatstone facility. The haul road crossing at the NWCH will be an underpass and only briefly visible from vehicles travelling at the speed limit, at the crossing point. All other sensitive locations with potential to be affected by visual changes to the landscape are too far from the Proposal to be significantly impacted.</p>

Key Environmental Factor – Social Surroundings	
Key Environmental Factor – Social Surroundings	<p>No significant impacts on any places of cultural significance or plants and animals with cultural associations are expected from the Proposal. Consultation to date has not identified any such place within any of the DEs; however, consultation will remain ongoing to ensure the Proponent is aware of any concerns Traditional Owners may have in this regard. Dust and noise would be expected to peak during construction, with any temporary effect ameliorated by standard dust suppression and noise management measures such as use of water carts and noise baffling equipment on machinery and plant.</p> <p>Two pastoral stations will be traversed by the Haul Road DE, Peedamulla and Red Hill but not expected to be significantly affected by noise. The haul road will be fenced on either side for its entire length, which will impede stock and vehicle movement for station operations. Therefore, the Proponent will install underpasses beneath the haul road at appropriate locations and of sufficient dimensions as agreed with pastoral leaseholders.</p> <p>Dust emissions may occur during construction; however, these emissions will be temporary and the small number of sensitive receptors near the Proposal are not expected to be affected. Dust emissions will be managed using industry-standard dust control measures. Dust emissions from the haul road during operation are expected to be negligible as it will be sealed, and the trucks covered. Modelling of noise emissions from construction activities for the haul road and port indicates noise levels will remain below assigned levels at all locations. Assigned noise levels are in accordance with the Environmental Protection (Noise) Regulations 1997, which for highly sensitive premises. Port and construction and operational noise levels at Onslow are predicted to be well under assigned levels.</p> <p>No commercially important marine fauna is restricted to the Nearshore or Offshore DEs. Given the relative scale of the Proposal, including extent of infrastructure and comparatively small workforce, the Proponent anticipates only negligible additional impacts with respect to recreational fishing impacts, and these will be managed through workforce restrictions.</p> <p>No significant cumulative impact to Social Surroundings is anticipated</p>
Proposed Environmental Outcomes	<p>Based on the assessment of potential impacts and proposed mitigation measures to protect environmental values associated with Social Surroundings, the Proponent considers that the EPA objective for this factor can be met. The predicted outcomes for Social Surroundings are summarised below:</p> <ul style="list-style-type: none"> • No significant impact to any Aboriginal heritage site or place of cultural heritage importance. • No impact to any European heritage site. • No significant impact to visual amenity. • No significant impact to sensitive receptors, including places of cultural significance, plants and animals with cultural associations or to residents and pastoralists, from noise, dust or odour. • No significant impact to commercial and recreational fishing. <p>Given no significant residual impacts are predicted for this factor, no environmental offsets are proposed, and the Proponent considers the Proposal can be managed to meet the EPA’s objective for social surrounding.</p>
Assessment of Offsets (if Relevant)	None

Other Environmental Factors

The following environmental factors relevant to the Proposal have been identified:

- Coastal Processes (**Section 14.1**); and
- Air Quality (**Section 14.2**).

Due to the predicted low level of impacts, application of industry standard controls and other regulatory mechanisms, these factors are not expected to be required to be assessed in detail by the EPA.

Holistic Impact Assessment

Marine

The Proponent recognises the high degree of connectivity and interrelatedness between marine fauna, benthic habitat, coastal processes and marine environmental quality. Understanding the environmental processes and their interactions is critical to assessing the significance of potential impacts from the Proposal on the marine environment surrounding the Proposal and its associated habitat and flora and fauna communities.

The Proposal has been designed to avoid high-value and sensitive environmental receptors primarily through utilising the existing port location and expanding facilities in an area that is already subject to disturbance and has negligible benthic habitat and therefore low productivity. **Figure ES-4** shows how the infrastructure of the Port impacts the environmental factors

The combined effects on the marine environment as a whole are no greater than the effects on individual factors (Marine Fauna, MEQ, BCH and Coastal Processes). Furthermore, any potential impacts to these factors have been effectively mitigated through the development of a comprehensive set of monitoring and management plans to be implemented during construction (**Appendix C**), dredging (**Appendix E**) and operations (**Appendix D**) of the Proposal.

Terrestrial

Important environmental values for different factors in the Haul Road DE tend to co-occur. That is, the most important fauna habitats are associated with rocky habitats (mesas) and drainage lines. These areas support higher biodiversity and are also important for social surroundings and the maintenance of hydrological regimes. Therefore, the avoidance of high-value habitat (Mesas and Breakaway) and minimising impact to major watercourses has also minimised the potential for significant combined environmental effects that might occur if the Proposal disturbed large areas of these landscape features.

Terrestrial Fauna, Inland Waters and Social Surroundings. No clearing for this Proposal will occur in the Landside DE and therefore the Proposal will avoid additional impacts to biodiversity and inland waters. **Figure ES 5** shows how the haul road crossing at the Cane River affects environmental factors as this major watercourse holds significant value for multiple terrestrial factors: Flora and Vegetation,

The combined effects on the terrestrial environment as a whole are no greater than the effects on individual factors (Flora and Vegetation, Terrestrial Fauna, Inland Waters and Social Surroundings). These effects have been minimised by applying the mitigation hierarchy (avoid, minimise and rehabilitate) to each factor as described in **Section 9, 10, 11** and **13**.



Figure ES-7: Holistic Impact Assessment: Port Infrastructure

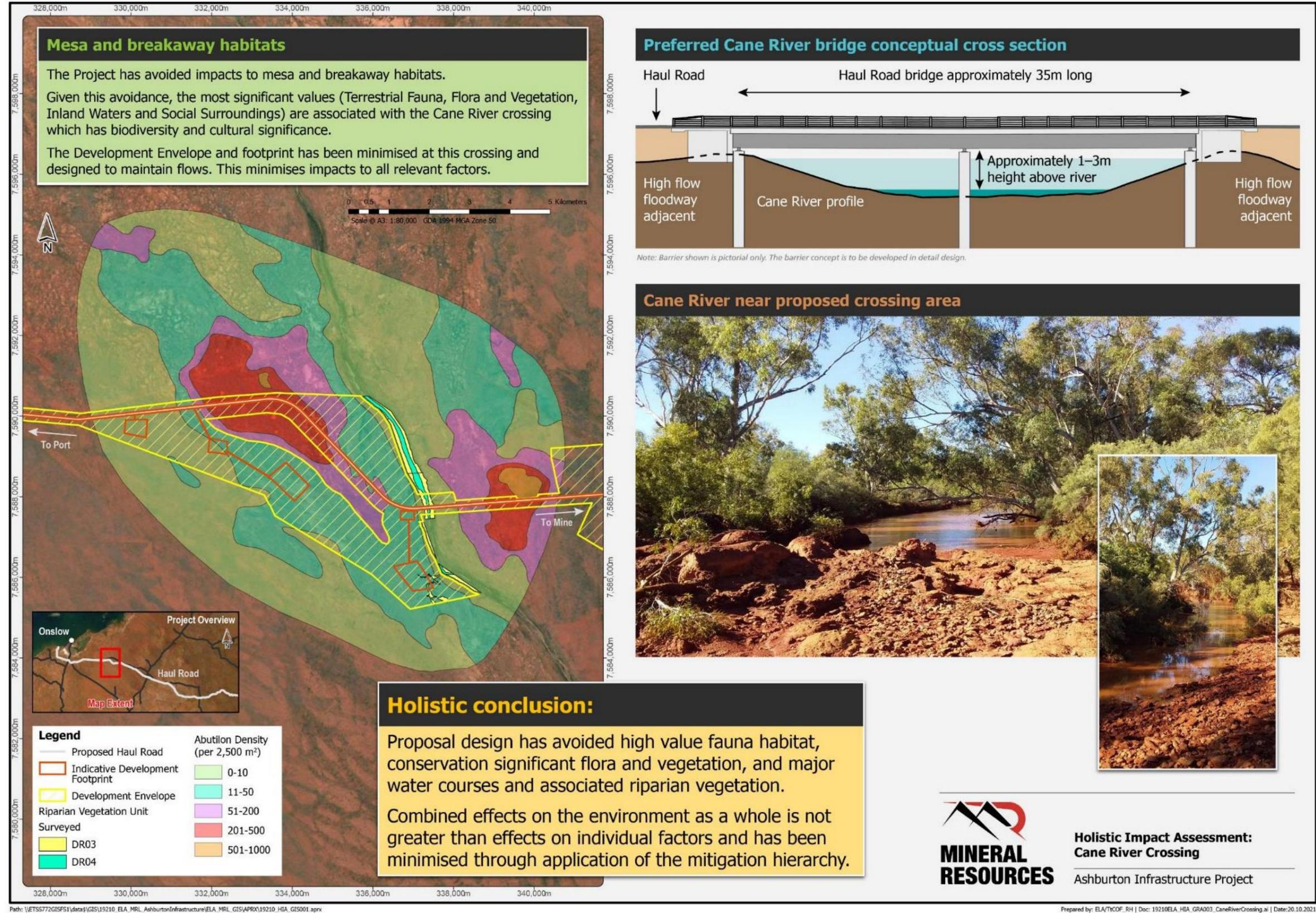


Figure ES-8: Holistic Impact Assessment: Cane River Crossing

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ABBREVIATIONS

AEP	Annual Exceedance Probabilities
AH Act	<i>Aboriginal Heritage Act 1972</i>
AIP	Ashburton Infrastructure Project
ALMP	Artificial Light Management Plan
ANGP	Ashburton North Gas Pipeline
ANSIA	Ashburton North Strategic Industrial Area
ANZG	Australian and New Zealand Governments Guidelines
APIM	API Management Pty Ltd
ARU	Autonomous recording units
ASRIS	Atlas of Australian Acid Sulfate Soils
ASS	Acid Sulfate Soil
ATB	Articulated tug and barge
BAM Act 2007	<i>Biosecurity and Agriculture Management Act 2007</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
BCH	Benthic community habitat
BIA	Biologically Important Area
Biosecurity Act	<i>Biosecurity Act 2015</i>
BMP	Best Management Practices
BTAC	Buurabalayji Thalanyji Aboriginal Corporation
CEMP	Construction Environmental Management Plan
CER	Clean Energy Regulator
CHMP	Cultural Heritage Management Plan
CP	Conservation Park
CPI	Consumer price index
DAWE	Australian Department of Agriculture, Water and the Environment
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DE	Development Envelope
DISER	Department of Industry, Science, Energy and Resources
DMIRS	Department of Mines, Industry Regulation and Safety
DoE	Department of Environment
DoT	Department of Transport
DPLH	Department of Planning, Lands and Heritage

DSDMP	Dredging and Spoil Disposal Management Plan
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DSO	Direct Shipping Ore
DWER	Department of Water and Environmental Regulation
DWER-EPAS	Department of Water and Environmental Regulation EPA Services
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management System
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPA	Western Australian Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPP	Eastern Planning Precinct
EQMF	Environmental Quality Management Framework
EQO	Environmental Quality Objectives
ERMP	Environmental Review and Management Programme
EVs	Environmental Values
FEMP	Framework Environmental Management Plan
GDV	Groundwater dependent vegetation
GHG	Greenhouse gas
GL	Gigalitre
GLpa	Gigalitre per annum
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
IF	Indicative Footprint
IMMA	Important Marine Mammal Area
IMPs	Introduced Marine Pests
IRR	Impact Reconciliation Report
JTSI	Department of Jobs, Tourism, Science and Innovation
km	Kilometre
kt	Kilotonne
LAUs	Local Assessment Units
LEP	Level of Ecological Protection
LEPA	Low Ecological Protection Area

LNG	Liquefied Natural Gas
LWMS	Local Water Management Strategy
m	Metre
MARPOL	International Convention for the Prevention of Pollution from ships
MCEMP	Marine Construction Environmental Management Plan
MCP	Mine Closure Plan
MEPA	Moderate Ecological Protection Area
MEQ	Marine Environmental Quality
MFO	Marine fauna observer
MNES	Matters of National Environmental Significance
MOF	Materials Offloading Facility
MP	Mining Proposal
MinRes	Mineral Resources Limited
MRWA	Main Roads WA
MS	Ministerial Statement
Mtpa	Million tonnes per annum
NEPM	National Environmental Protection Measure
NEPC	National Environmental Protection Council
NGER Act	<i>National Greenhouse and Energy Reporting Act 2007</i>
NPI	National Pollutant Inventory
NTU	Nephelometric Turbidity Units
NWCH	North West Coastal Highway
O&G TSE	Oil and Grease, Total Solvent Extractable
OCEMP	Marine Operational Environmental Management Plan
OGV	Capesize Ocean Going Vessel
PBC	Prescribed Body Corporate
PEC	Priority Ecological Community
PEOF	Pilbara Environmental Offsets Fund
PER	Public Environmental Review
PM	Particulate matter
PNG	Piped Natural Gas
PPA	Pilbara Ports Authority
PSU	Practical salinity units
PTS	Permanent threshold shift

RISM	Residual impact significance model
RIWI Act	<i>Rights in Water and Irrigation Act 1914</i>
RRK	Robe River Kuruma Aboriginal Corporation
RSD	Referral Supporting Document
s38	Section 38
SCHMP	Social and Cultural Heritage Management Plan
SOPEP	Shipboard Oil Pollution Emergency Plan
SPL	Species Protection Limit
SRE	Short-range endemic
SRI	Significant Residual Impact
SSDP	Site Surface Disturbance Permit
SWASP	State-Wide Array Surveillance Program
t	Tonne
TEMP	Terrestrial Environmental Management Plan
tCO2-e	Tonnes of Carbon Dioxide Equivalents
TEC	Threatened Ecological Community
tph	throughput per hour
TSP	Total Suspended Particle
TSS	Total suspended solids
TSV	Transshipping Vessel
TTS	Temporary Threshold Shift
WA	Western Australia
WAPC	Western Australian Planning Commission
WET	Whole Effluent Toxicity
WMT	Wheatstone Marine Terminal
WoNS	Weed of National Significance
WPIOP	West Pilbara Iron Ore Project
WRF	Weather Research and Forecasting
WWTP	Wastewater Treatment Plant
yr	Year
ZoHI	Zone of High Influence
ZoMI	Zone of Moderate Influence

1. INTRODUCTION

1.1 Purpose and Scope

Onslow Iron Pty Ltd (ACN 612 668 201, herein the Proponent), a wholly owned subsidiary of Mineral Resources Limited (MinRes) (ACN 118 549 910), is undertaking planning for the Ashburton Infrastructure Project (AIP, herein referred to as the Proposal) to service iron ore mining and export developments in the West Pilbara region of Western Australia (WA) (**Figure 1-1**).

This Proposal is being referred under Section 38 of the *Environmental Protection Act 1986* (EP Act) as it has the potential to significantly affect key environmental factors, as defined by the WA Environmental Protection Authority (EPA). The purpose of this Referral Supporting Document (RSD – Version 1) is to present sufficient information on the Proposal and the effects of the Proposal on the environment to allow assessment of the Proposal under Part IV of the (EP Act).

This RSD (Version 1) presents detailed information on each of the environmental factors nominated as ‘key’ environmental factors that the proposal's implementation could significantly impact. The RSD considers all phases of Proposal implementation, including construction, commissioning, operation and closure. Cumulative impacts with other projects, and holistic impacts of how key environmental factors interact are also addressed.

The Potential impacts to key environmental factors are described in detail and assessed using relevant studies specific to the Proposal. This RSD (Version 1) summarises and describes the environmental studies conducted for the Proposal as relevant to the Environmental Impact Assessment (EIA), and copies of the technical reports used in preparing the RSD are provided as appendices.

This RSD (Version 1) was prepared in accordance with the ‘*Instructions for the referral of a Proposal to the Environmental Protection Authority under Section 38 of the Environmental Protection Act 1986*’ (EPA 2021a) and Instructions on how to prepare an Environmental Review Document (EPA 2021b). Whereas RSD Version 0 was prepared in accordance with equivalent draft instructions released by the EPA for consultation in May 2021 following amendments to the EP Act passed by the WA Parliament in November 2020, draft instructions were adopted as final and published on 29 October 2021 (three days after referral of the Proposal), therefore this document has been updated in accordance with the finalised instructions.

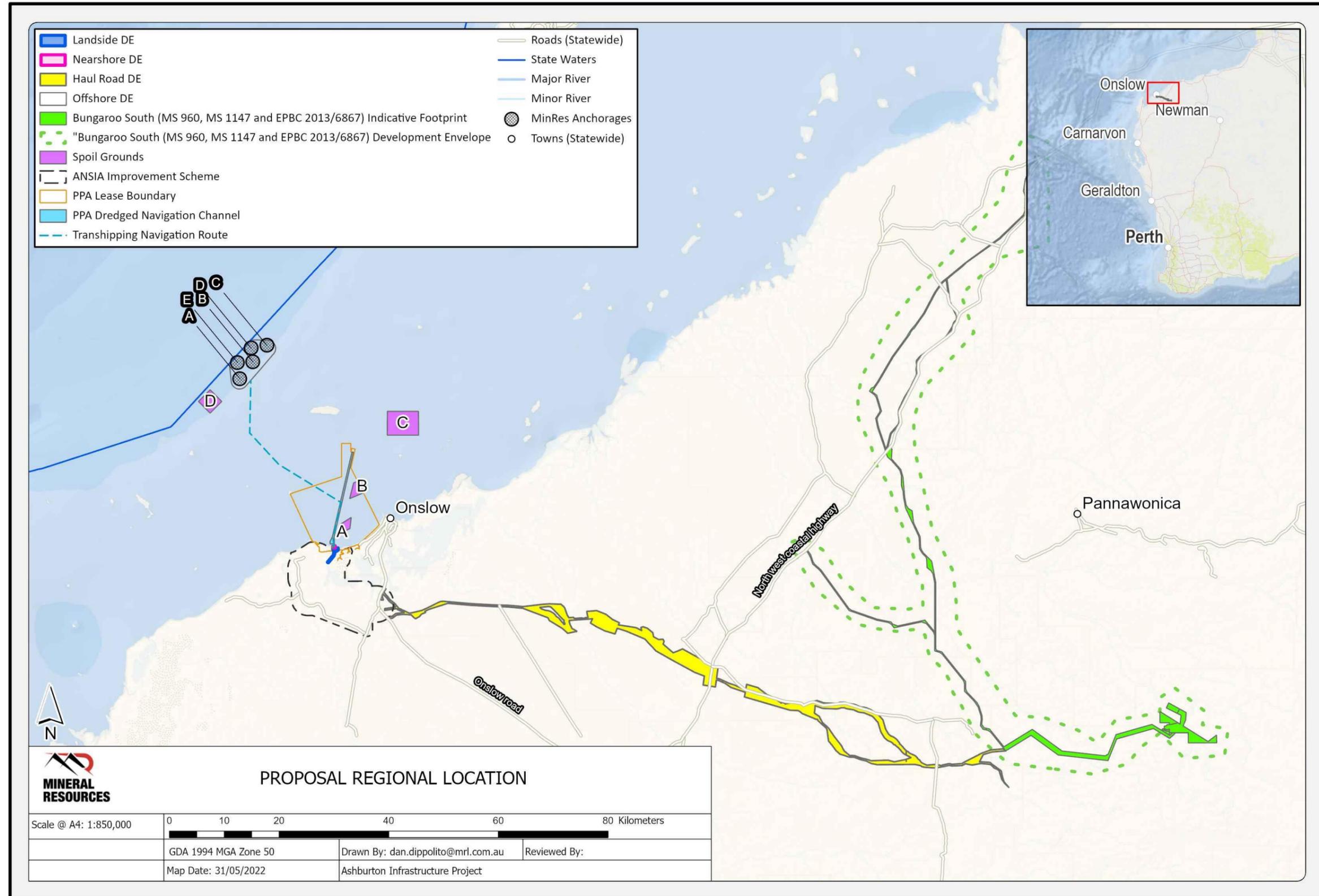
1.2 Proponent Details

The Proponent for this Proposal is Onslow Iron Pty Ltd (ACN 612 668 201), a wholly owned subsidiary of Mineral Resources Limited (ACN 118 549 910). The Proponent is a Perth-based leading mining services provider, organised along three core pillars: mining services, commodities, and innovation and infrastructure. Commodities are focussed on the iron ore and hard-rock lithium sectors in WA.

The Proponent operations include mine sites in the Pilbara, Goldfield and Yilgarn regions and shipping product through Utah Point, Esperance and Kwinana. Within the Pilbara region, the Proponent operates Iron Valley and Wodgina mines and also have a presence at other mining operations through CSI Mining Services, a subsidiary business of the Proponent. The Proponent has acquired the Buckland Project herein referred to as Bungaroo South) (Ministerial Statement [MS] 960 and MS1147), located about 45 km southwest from Pannawonica.

All correspondence regarding this Proposal should be forwarded to the key contact:

Proponent: Onslow Iron Pty Ltd
Address: 20 Walters Drive, Osborne Park WA 6017
Postal Address: 20 Walters Drive, Osborne Park WA 6017
Corporate contact: Les Purves, General Manager - Environment, Approvals and Land Access
Phone: +61 8 9329 3407
Email: les.purves@mrl.com.au



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Figure 1-1: Proposal Regional Location

2. PROPOSAL

2.1 Proposal Content

2.1.1 General Description

The Proponent is undertaking planning for Proposal to service ore mining and export developments in the West Pilbara region of WA (**Figure 1-1**). A Proposal Content Document for the Proposal has been prepared and is provided in **Addendum 1**.

As part of an overarching business and operational strategy, the Proponent is undertaking planning to unlock stranded mineral assets in the West Pilbara region. The Proposal will support the Proponent's approved mine, Bungaroo South, (MS 960 and MS 1147), other future ore developments it owns and facilitate export opportunities for third party stranded ore from the West Pilbara.

The Proposal includes a fully sealed private haul road, commencing at the boundary of the approved Bungaroo South (MS 960 and MS 1147) haul road and will continue approximately 125 km west to the Onslow Road (**Figure 2-2**). At the Pilbara Port Authority (PPA) Port of Ashburton (Port), landside and marine facilities are proposed to be developed, to export ore (**Figure 2-3**, **Figure 2-3**, **Figure 2-4** and **Figure 2-5**).

In addition, approval for the following linear infrastructure to connect with the approved West Pilbara Iron Ore Project Stage 1 Mine Areas (WPIOP) (authorised via MS 1027) is being sought due to overlapping tenure with part of the Ashburton Haul Road corridor:

- WPIOP Gas Pipeline – a 7km southern diversion of the gas pipeline corridor from the currently approved WPIOP Gas Pipeline (MS 1027 and EPBC 2009-4076) to allow connection with the existing Goldfields Gas Transmission Pipeline and the Central Processing Facility within the WPIOP; and
- WPIOP Haul Road Link – a 7.8 km fully sealed haul road to link to Ashburton Haul Road with the approved WPIOP (MS 1027).

The Proposal will initially support the export of approximately 30 million tonnes of iron per annum (Mtpa) through the Port. Landside and marine export facilities including a dedicated nearshore berth facility and offshore anchorages will support the export of iron over a 10-year period as a Direct Shipping Ore (DSO), with future plans to support the export of 40 Mtpa over a 30-year period from future mine developments. Because of the different components of the Proposal, the Proposal Development Envelope (DE) comprises four separate DEs (**Figure 2-1**), the Haul Road DE (**Figure 2-2**), Landside DE (**Figure 2-3**), Nearshore DE (**Figure 2-4**) and Offshore DE (**Figure 2-5**). **Section 2.1.4** provides a detailed descriptions of each of the DEs and proposed construction and operations activities within each DE as part of the Proposal. Note, the Landside DE forms part of MS 1131 held by PPA and is referenced within this proposal for the purpose of describing the location of the proposed port operations

Export facilities will include a dedicated nearshore berth facility and offshore anchorages. Transshipping Vessels (TSVs) that will travel along PPAs shipping channel, out to deep water (up to 20 - 57 m depth), to five proposed dedicated anchorage points (**Figure 2-5**). Ore will be loaded from TSVs onto Ocean Going Vessels (OGVs) at a maximum of two of the five anchorage points at any one time. Five anchorage points have been included within the Proposal to allow for operational flexibility to factor in for adverse weathers conditions, operational issues, maintenance requirements and ship scheduling.

Given the long-term mining opportunities in the greater West Pilbara region, the Proponent envisions that access to Proposal infrastructure may relieve environmental and economic constraints for other projects in the West Pilbara. As such, the Proposal presents an immediate opportunity to minimise and consolidate currently approved, and reasonably foreseeable future environmental impacts. It is noted that the viability of the Proposal is not dependent on use by these future projects.

An overview of the key Proposal elements is provided in **Table 2-1** with a detailed description provided below.

Table 2-1: General Description of the Proposal

Proposal Title	Ashburton Infrastructure Project (AIP)
Proponent Name	Onslow Iron Pty Ltd (ACN 612 668 201, herein the Proponent), a wholly owned subsidiary of Mineral Resources Limited (MinRes) (ACN 118 549 910).
Short Description	<p>The Proposal is to develop a fully sealed private haul road, approximately 125 km in length, starting from about 45 km southwest of Pannawonica to access the Port of Ashburton (Figure 1-1). Within the Port, landside and marine facilities will be developed to support export of up to 40 million tonnes of ore per annum (Mtpa) over a minimum 30-year period (Figure 2-1).</p> <p>This Proposal includes:</p> <ul style="list-style-type: none"> • Development of a fully sealed private Haul Road; • Gas pipeline and ancillary haul road infrastructure; • Operation of storage and bulk handling of ore at the Port of Ashburton (the Port); • Dredging a dedicated berthing pocket adjacent to the existing Ashburton Cargo Wharf (ACW) and offshore disposal of dredge spoil to existing spoil disposal areas; • Development and operation of a modular jetty wharf and ship loader; • Use of five offshore anchorage areas for transshipment of ore to Ocean Going Vessels: and • Ancillary landside infrastructure (seawater desalination plant, power station, bulk storage of fuel wastewater treatment plan (WWTP) etc). <p>The Proposal will be implemented within a 20,821 ha Development Envelope (DE) (Figure 2-1), including 16,327 ha for land-based elements (Figure 2-2) and 4,494 ha for marine-based elements (Figure 2-3, Figure 2-4 and Figure 2-5).</p> <p>The Proposal is located within an area of existing pastoral, mining and industrial land use. The Proposal's DE transects two pastoral stations, mining tenure and the operational Port of Ashburton.</p>

2.1.2 Nomenclature

Key nomenclature used throughout this document is summarised below:

- The Proposal: a fully sealed private haul road from the boundary of the approved Bungaroo South (MS 1027) haul road (approximately 45 km south of Pannawonica) continuing 125 km west towards to the Port and associated export facilities at the Port.
- AIP: The Proposal.
- Development Envelope (DE) (**Figure 2-1**): refers to the land package that the Proposal sits upon, this includes four specific areas (**Table 2-2**, **Figure 2-2**, **Figure 2-3**, **Figure 2-4**, and **Figure 2-5**):
 - **Haul Road DE (Figure 2-2)**: The package of land that the proposed Ashburton Haul Road (haul road) sits within, which includes a fully sealed private haul road from the boundary of the approved Bungaroo South (MS 960) haul road (approximately 45 km southwest of Pannawonica) continuing 125 km west to Onslow Road.
 - **Port Landside DE (Landside DE, Figure 2-3)**: The Landside DE forms part of MS 1131 held by PPA and is referenced within this proposal for the purpose of describing the location of the proposed port operations. The package of land that the proposed above ground Port Landside Facilities sits within, which will include storage and bulk handling of ore, a Seawater Desalination Plant, a power station, bulk storage of fuel, administration building, and a wastewater treatment plant (WWTP).

- Port Nearshore DE (**Nearshore DE, Figure 2-4**): The package of land that the Nearshore Port Marine Facilities sits within, which includes a dedicated berthing pocket, a modular jetty wharf and ship loader at the Port adjacent to the Landside DE. The jetty and wharf structure includes provision for seawater intake and outfall pipelines from the Seawater Desalination Plant . All Nearshore Port Marine Facilities will be constructed in Port Waters managed by the PPA, located within water depths of up to 8 m.
- Port Offshore DE (**Offshore DE, Figure 2-5**): The package of land that the Offshore Port Marine Facilities sits within, which includes an offshore transshipment area in State Waters for five offshore anchorages, 10 km from Thevenard Island and 35km from the coast. Located within water depths of 20 m to 57 m.
- The Haul Road Indicative Footprint (IF) (**Figure 2-2**) refers to the likely location of infrastructure within the Haul DE which totals 1,564 hectares (ha). The area of the Haul Road IF is a maximum extent, but there is some flexibility in the location of the footprint.
- The Nearshore IF, refers to the likely location of the dredge footprint within the Nearshore DE (**Figure 2-4**). This extends approximately 30,0000 m² (5 ha), within which a temporary causeway (for construction purposes), berth pocket, modular jetty wharf and ship loader will be installed.
- The Offshore IF, refers to the five designated anchorage areas within the Offshore DE where OGVs will moor and anchor for loading of ore from TSVs (**Figure 2-5**).

Table 2-2: Development Envelopes and Indicative Footprints

Location	Development Envelope (DE)	Indicative Footprint (IF)
Haul Road DE	16, 209 ha	1,564 ha
Landside DE	118 ha*	N/A**
Nearshore DE	11 ha	5 ha
Offshore DE	4,483 ha	0 ha

**This Landside DE forms part of MS 1131 held by PPA and is referenced within this proposal for the purpose of describing the location of the proposed port operations*

***There is no Landside IF as the entire Landside DE is subject to PPA development approvals.*

2.1.3 Proposal Elements

The Proposal will be implemented within a DE of 20,821 ha (**Figure 2-1**), including 16,327 ha for land-based elements, Haul Road DE (**Figure 2-2**) and Landside DE (**Figure 2-3**) and 4,494 ha for marine-based elements, Nearshore DE (**Figure 2-4**) and Offshore DE (**Figure 2-5**).

Table 2-3, and **Addendum 1** outline the extent of Proposal elements that have the potential to significantly affect the environment.

Table 2-3: Proposal Elements with Potential to Significantly Affect Environment General Description of Proposal

Proposal Element		
Physical Elements		
Haul Road elements: <ul style="list-style-type: none"> Sealed Haul Road AIP Gas Pipeline Consumer gas pipeline 	Haul Road Figure 2-2	Clearing of no more than 1,564 ha of native vegetation within the 16,209 ha Haul Road DE.
<ul style="list-style-type: none"> Landside elements: Materials Handling Systems - Ore Loading and Supply, Fuel Tanker Loading Product (Ore) Storage 	Landside DE Figure 2-3	30 Mtpa ore product for 30 years, with design and material handling capacity up to 40 Mtpa.
Nearshore elements: <ul style="list-style-type: none"> Berth Pocket Nearshore Infrastructure including Temporary Causeway and Jetty (excluding Dredging) 	Nearshore DE Figure 2-4	TSV berth pocket with a target declared depth of up to 8 m. Direct disturbance of up to 3 ha of Bare Substrate BCH within the Nearshore DE.
Offshore elements: <ul style="list-style-type: none"> Anchorage Points Dredge Material Disposal 	Offshore DE Figure 2-5	Anchorages will be located approximately 35 km offshore. Direct disturbance of up to 1,347 ha of Bare Substrate BCH from OGVs anchoring in the designated area within the Offshore DE. Dredge material disposal within the existing PPA Spoil Grounds. No additional disturbance.
Construction Elements		
Bulk Earthworks	Haul Road DE Figure 2-2	Borrow works with crushing and screening, concrete-batching. Culverts, Drains and Levees will be installed and constructed to maintain flows. The Haul Road will be sealed with bitumen.
Temporary Causeway	Nearshore DE Figure 2-4	Construction of the dedicated nearshore berth facility will be undertaken from a temporary impermeable causeway that will be removed after construction and commissioning of the jetty is completed.
Dredging & Dredge Material Placement	Nearshore DE Figure 2-4 Spoil Ground C Figure 2-5	Removal/disturbance of up to 3 ha of Bare Substrate BCH.

Proposal Element		
		Capital dredging of up to 165,000m ³ with dredge material disposal into existing Spoil Ground C.
Piling for Jetty / Wharf Construction	Nearshore DE Figure 2-4	Installation of approximately 71 piles for jetty/wharf construction. Direct disturbance of up to 0.2 ha of Bare Substrate BCH.
Water supply - Dust Suppression	Haul Road DE Figure 2-2	Water supply from haul road borefield (up to 2 GL/annum during construction.
Operational Elements		
Materials Handling and Stockpiling	Landside DE Figure 2-3	Storage of up to 280,000 tonnes of ore product.
Power Generation	Landside DE Figure 2-3	Power generation capacity of up to 14 MW. A 1 MW (peak) roof top solar power system.
Bulk Material Loading	Landside DE Figure 2-3 Nearshore DE Figure 2-4	Operational throughput capacity of up to 100 kt/d of ore.
Dust Collection and Suppression Systems	Landside DE Figure 2-3	Water for operational dust suppression may be sourced from a third party operator to support 2GL/annum.
Seawater Intake	Landside DE Figure 2-3 Nearshore DE Figure 2-4	Seawater intake of up to 2 GL/annum for desalination and dust suppression.
Brine Outfall	Nearshore DE Figure 2-4	Discharge of up to 2 GL/annum of hypersaline brine. Discharge to ensure water quality meets the High Ecological Protection Level at the boundary of the Low Environmental Protection Area (LEPA).
Transshipment Vessels	Landside DE Figure 2-3 Nearshore DE Figure 2-4 Offshore DE Figure 2-5	Transport of product via TSVs and powered by tugboats on a 24-hours, seven days a week basis. The TSVs will operate at a maximum speed of nine knots.

Greenhouse Gas Emissions

Construction

Scope 1	Haul Road and Port Construction (Year 1) Total GHG: 95,705 tCO ₂ -e/yr
Scope 2	None
Scope 3	None

Operation

Scope 1	Port Operations (From Year 2 emissions @ 30Mtpa) - Annual baseline GHG: 97,788 tCO ₂ - e/yr*
Scope 2	None
Scope 3	Port Operations (From Year 2 emissions @ 30Mtpa): 54,602,377 tCO ₂ -e/yr**

Rehabilitation

Topsoil will be collected in windrows and stored for rehabilitation of temporary construction areas.

Progressive rehabilitation of temporary disturbance areas along the Haul Road DE will be undertaken (such as borrow pits and temporary construction areas).

Progressive rehabilitation through topsoil respreading will be undertaken as areas become available and this will minimise the extent of cleared areas.

Commissioning

The Port Landside facilities:

- Will progressively undergo Functional Testing and No Load Commissioning; and
- Load Commissioning will be completed in two stages, In-Loading System followed by Out-loading System.

Seawater Desalination Plant: Water sourced from either ocean, bore or potable supply. Discharged to ocean via diffuser.

Decommissioning

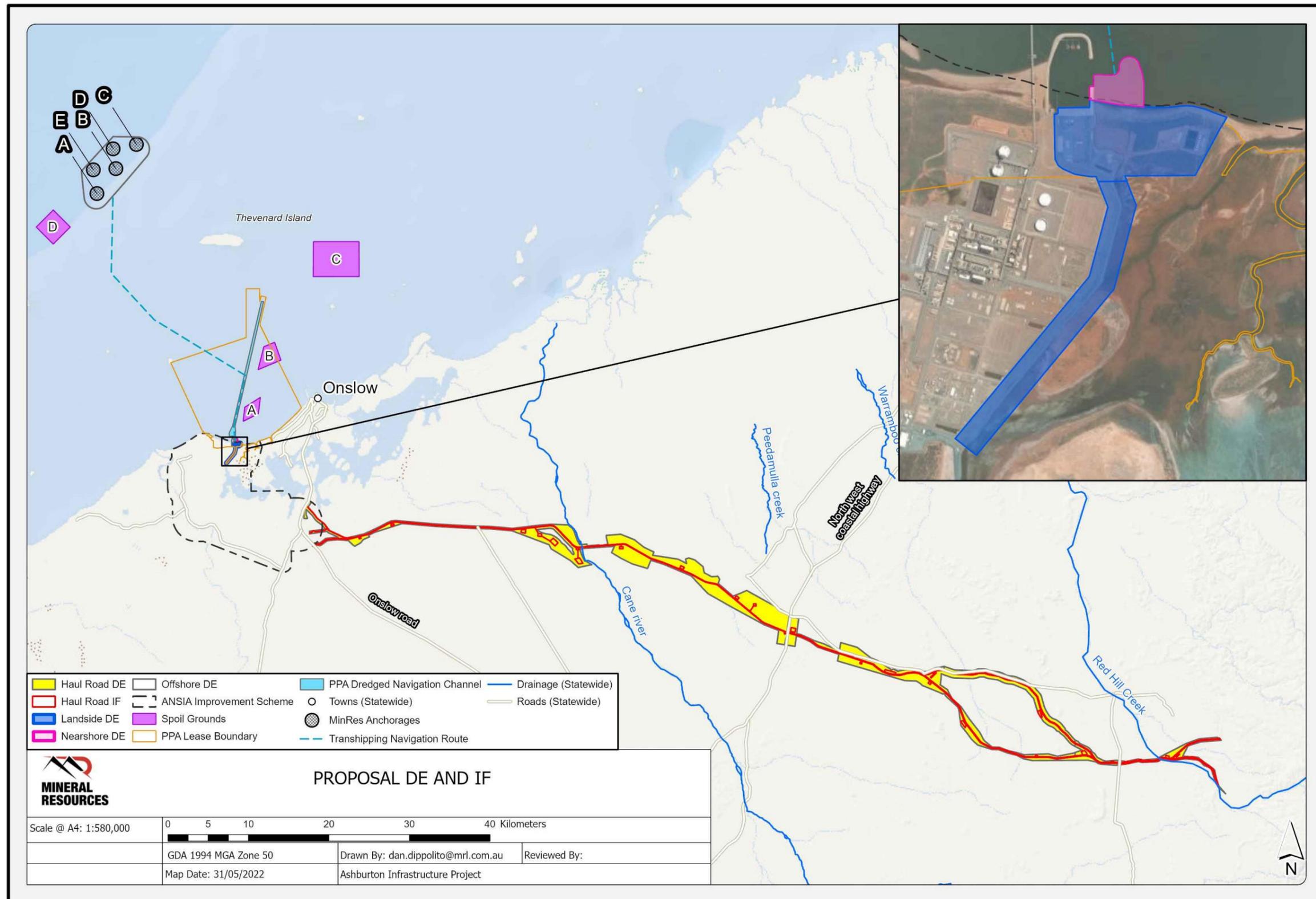
End of project life closure strategies include either facilities being handed over to the relevant State or local government authority or decommissioned. Final outcomes will be developed through further consultation with key stakeholders and be undertaken as part of the regular review of closure commitments.

Other Elements which Affect Extent of Effects on Environment

Proposal time	Minimum Project Life	30 years.
Construction phase	Haul road, and Port Nearshore facilities	Approximately 18 months (including early works and construction from multiple approval areas).
Commissioning phase (including commissioning and ramp-up)	Port landside facilities	Approximately 12 months.
Operational phase	Operating days	Up to 365 operational days per year over a minimum of 30-years

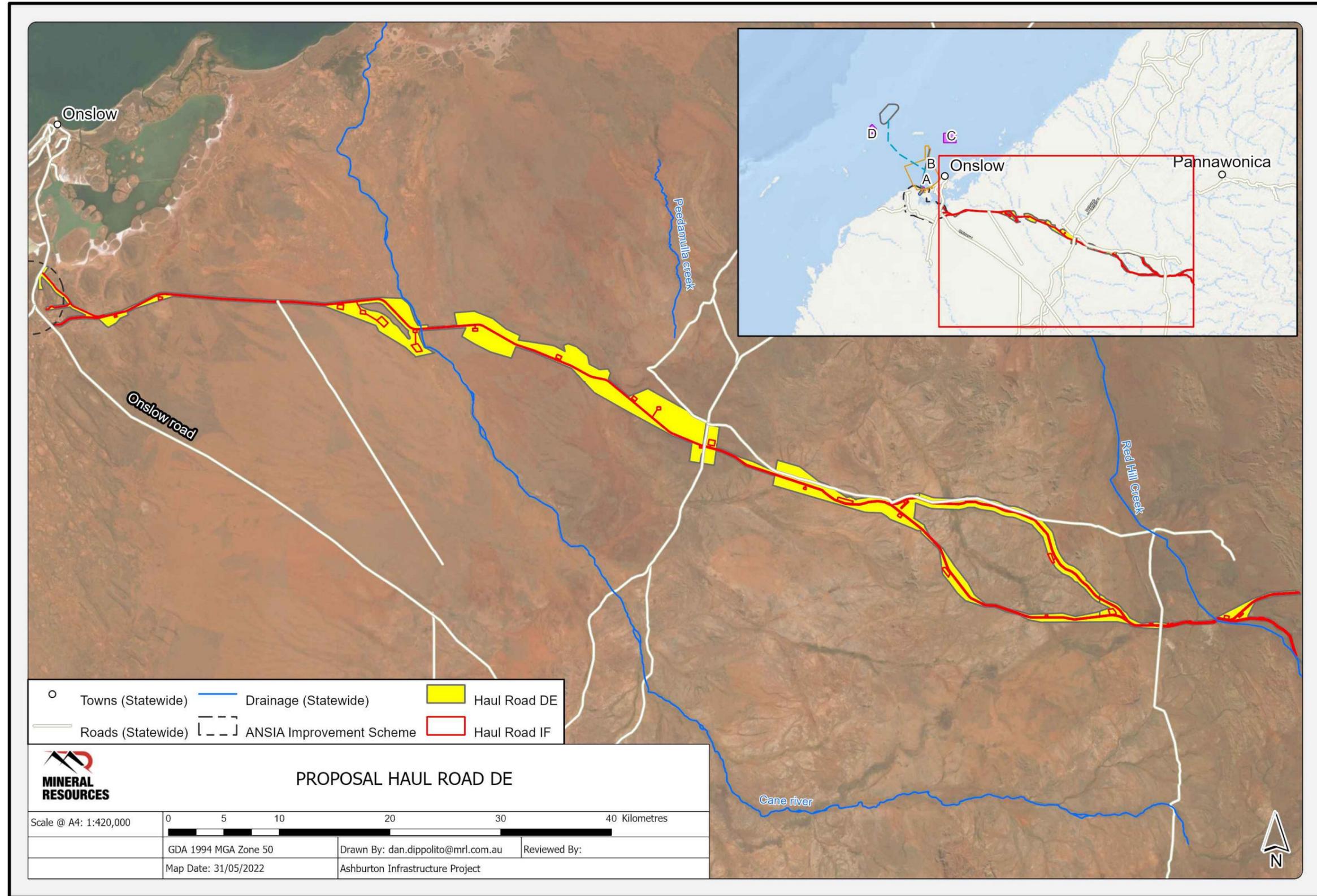
Reported Scope 1 emissions for years 11-30 are conservative based on estimates 2021 estimates - the Proponent will be reducing the CO₂e during operations in line with its "Roadmap to Net Zero Emissions [Climate Change - Mineral Resources](#) "

** The GHG inventory for port operations includes the predicted emissions for the first 10 years (up to 30 Mtpa) and the next 20 (up to 40 Mtpa). Note that these emissions are conservative and do not include additional future emissions reduction and offset measures to be taken by the Proponent to achieve its target of net zero greenhouse gas emissions by 2050.



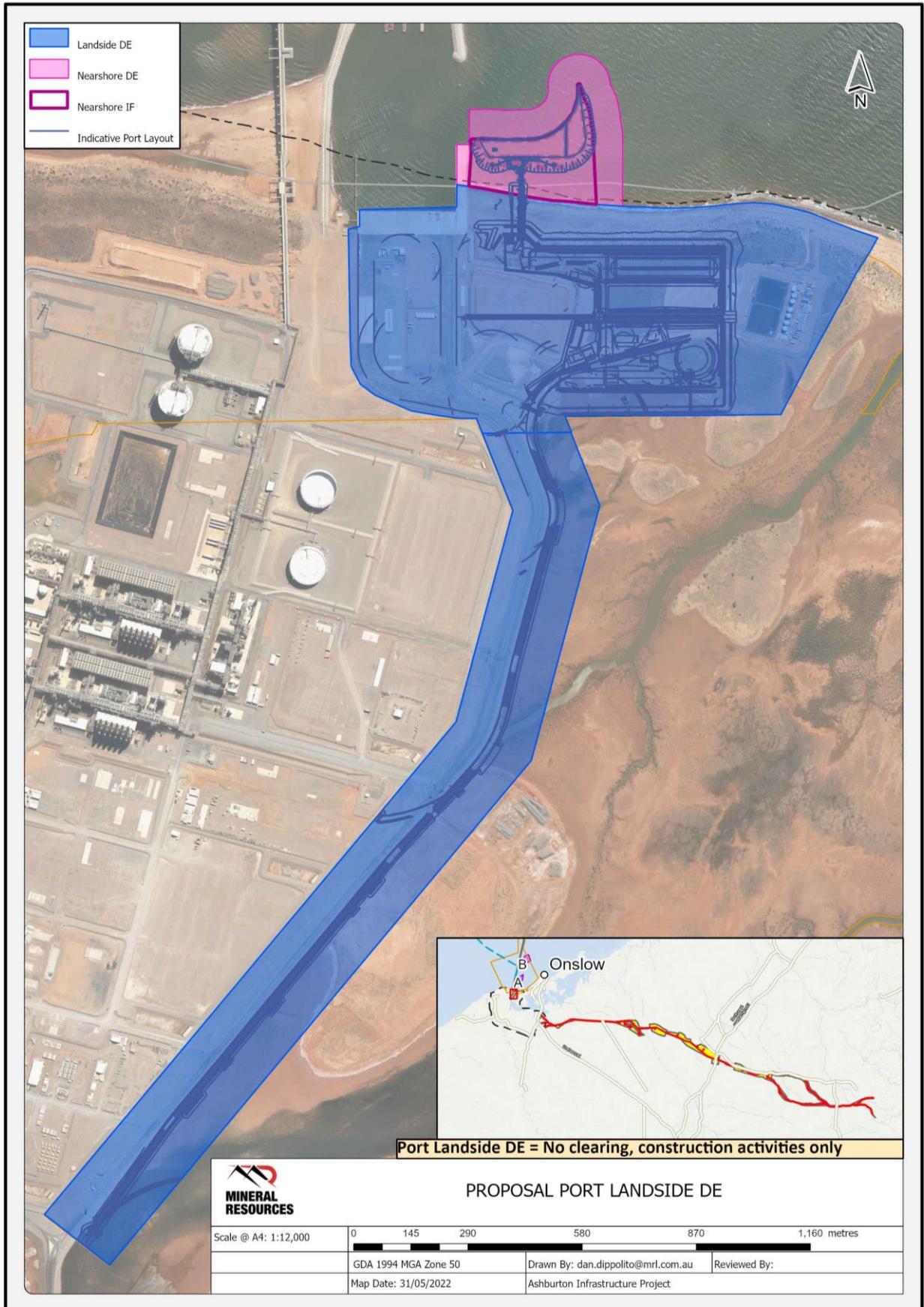
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Figure 2-1: Proposal Development Envelope and Indicative Footprint



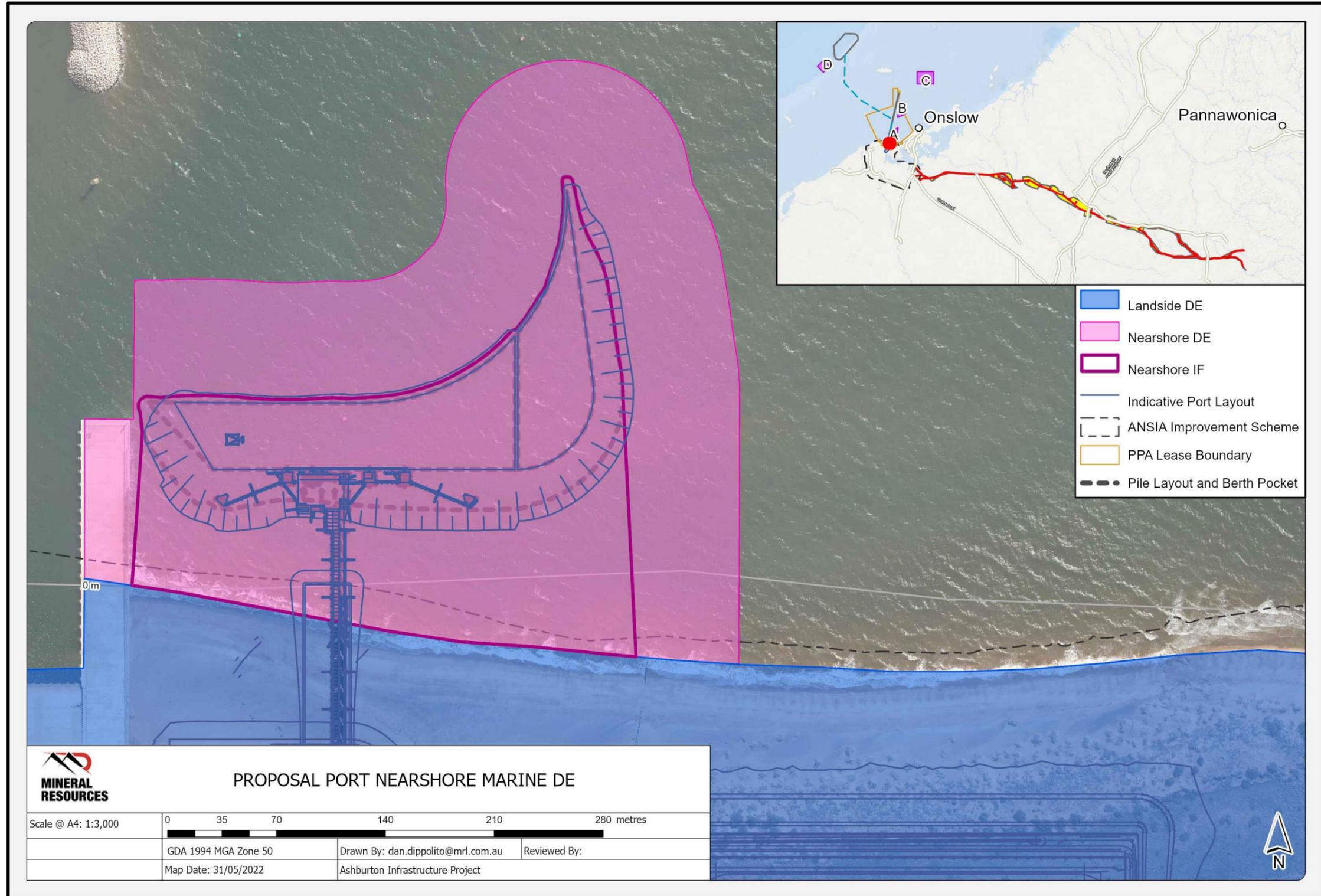
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Figure 2-2: Haul Road Development Envelope and Indicative Footprint



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Figure 2-3: Port Landside Development Envelope



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Figure 2-4: Port Nearshore Development Envelope and Indicative Footprint

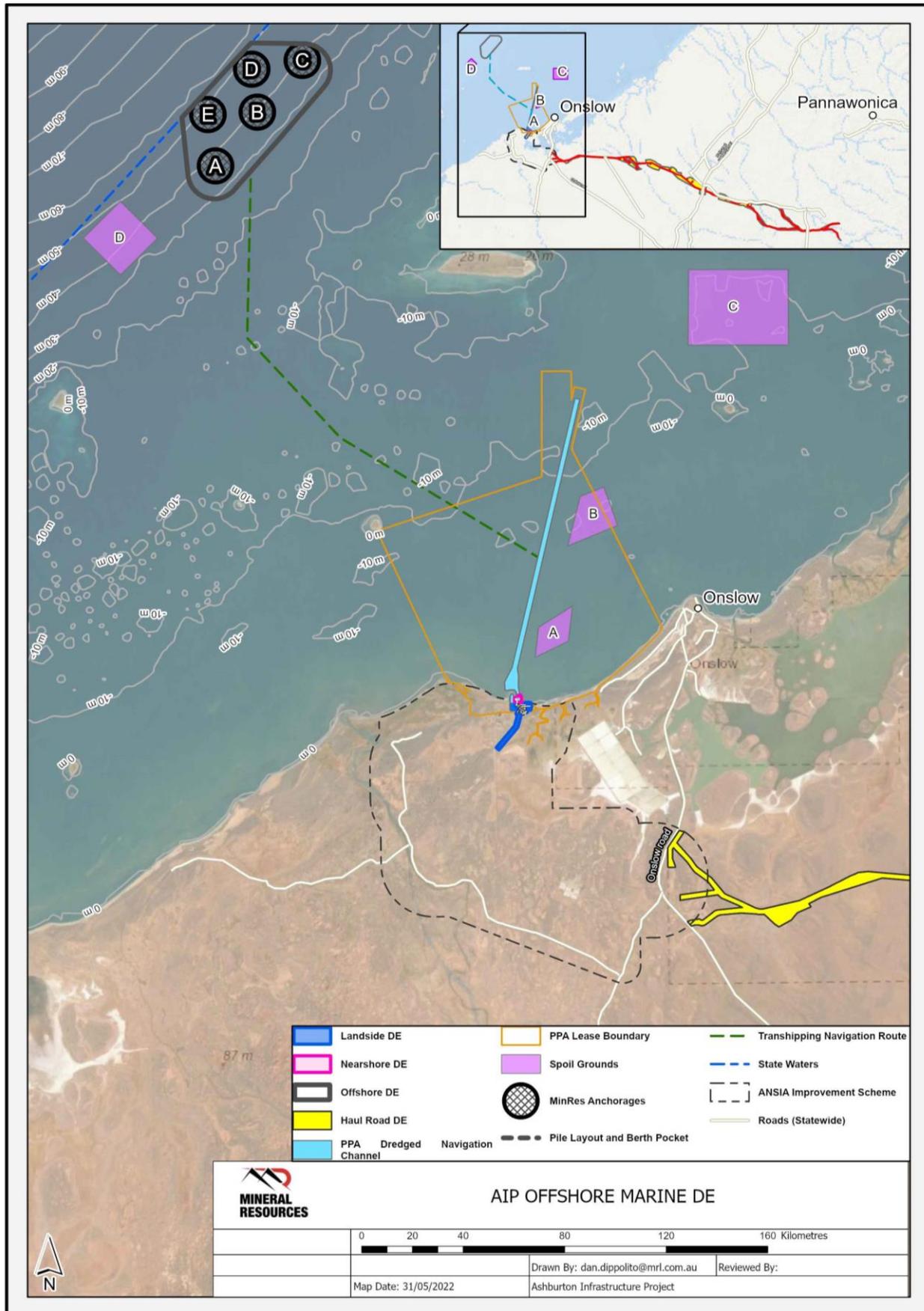


Figure 2-5: Offshore Marine Development Envelope and TSV Navigation Route

2.1.4 Detailed Description of Proposal Elements

2.1.4.1 Haul Road Development Envelope

Haul Road

The fully sealed private haul road will begin at the boundary of the approved Bungaroo South mine haul road and continue for approximately 125 km westward towards Onslow and the Port (**Figure 2-2**).

The road surface will be bitumen sealed along the entire length within a corridor including batters and drainage. A construction corridor will be cleared allowing for construction activities, topsoil stockpiles, LV access road and services corridors. The operational haul road corridor allows for two lanes, hard shoulders and table drains each side, plus lay bays of 3.6 km length at every 15 km and services corridors.

Grade separation is required where the haul road crosses Onslow Road and the North West Coastal Highway (NWCH). Following a review of options, a haul road underpass using a precast concrete arch system will be installed at NWCH allowing the haul road to pass under the existing highway. Main Roads Western Australia (MRWA) will be modifying the Onslow Road intersection with a similar design to allow grade separated access to trucks using their multiuser haul road in this area.

The haul road will include the installation of waterway crossings, including a bridge across the Cane River and a combination of culverts and floodways at other crossings, which has the potential to impede flows and/or increase soil erosion. Culverts will be installed in areas of sheetflow to maintain drainage patterns to downstream receptors.

Fill material for the haul road embankment will be sourced from either cuttings or localised borrow pits. Borrow pits are required along the length of the haul road for fill material primarily for construction of the road. The locations of borrow pits have been selected considering tenure constraints, and environmental values of the area (i.e., selection based on 'lowest environmental significance' criteria). Progressive rehabilitation of temporary disturbance areas will be undertaken post construction including borrow pit. Construction materials unable to be sourced along the route (e.g. rock armour) will be sourced from local quarries.

Groundwater is considered to be the primary source of supply for the construction and maintenance of the haul road and up to 2 GL/a will be sourced from bores within the Haul Road DE. Groundwater will be sourced from a series of deep aquifers with water levels >30 m below ground surface along the length of the haul road, at various intervals to support a number of construction fronts. A continuous groundwater supply is required for construction activities, however, as there will be a number of different construction fronts, operating over different periods of time, the groundwater abstraction for construction activities will be variable over the life of the construction period. The Proponent will install turkey's nests at intervals of approximately every 10 km, each with a capacity of between 1 ML to 1.5 ML. As such the Proponent requires a series of bores with sufficient yield to recharge each turkey's nest within a 24 hr period.

Once constructed, the haul road will be utilised for the transport of ore from the Proponent's approved, Bungaroo South mine and future Proponent and third-party mines, within the West Pilbara. Third party users may include the West Pilbara Iron Ore Project and other third party stranded ore from the West Pilbara. The Proponent intends to run a fleet of custom-built Kenworth Road trains (with covered trailers) with a 335-tonne gross combined mass along the haul road. The same heavy vehicles are currently in use at the Proponent's Yilgarn Operations at Koolyanobbing. Each truck configuration consists of a prime mover and three covered quad axle trailers.

Additional Infrastructure within Haul Road

A temporary 200-person construction accommodation camp will be situated near the NWCH on L08/205 (owned by MinRes subsidiary) with direct access to the haul road and will accommodate up to 200 personnel. This camp will be typical of mining industry 'fly camps' and include (for example):

- Accommodation units;
- Laundry, kitchen/dining/barbeque areas, ablutions;
- Offices, medical, communications, recreation area;

- Water and WWTP;
- Fuel storage and generators; and
- Parking area.

Due to overlapping tenure, the opportunity to consolidate development footprints of the WPIOP Stage 1 Mine Areas (MS 1027) and the Proposals linear infrastructure is being progressed. A 15 km buried gas pipeline connecting the existing Goldfields Gas Transmission Pipeline to the approved WPIOP (MS 1027) will be constructed parallel to the haul road, within the Haul Road DE, for 7 km before diverging south within a standalone corridor. A fully sealed haul road link will run parallel to the remaining 7.8 km of the gas pipeline. Above ground assets will include an inlet station and delivery station typically built on a concrete pad. The end-to-end communication path with access points for various services including 4G coverage and digital mobile radio will be installed for the haul road.

2.1.4.2 Port Landside Development Envelope

The Port was originally established by Chevron Australia Pty Ltd (Chevron) for the Wheatstone Liquefied Natural Gas Project (Wheatstone) and is located adjacent to the Ashburton North Strategic Industrial Area (ANSIA) and is managed by the PPA. In 2020, a change in the nominated proponent from Chevron to PPA was approved for the shipping channel, Ashburton Cargo Wharf (ACW), and access road at the Port under MS 1131. **Figure 2-6** illustrates the existing facilities at the Port.

The PPA is proposing to develop an area of land at the Port referred to as the Eastern Planning Precinct (EPP). The EPP development area footprint (43.44 ha) is under the control and management of the PPA under the *WA Port Authorities Act 1999*. The EPP will be developed through clearing, filling and construction of an outer revetment rock wall. The filling of the site will provide a development-ready hardstand area at an elevation suitable for the Port infrastructure proposed as part of this proposal. EPA approved a request a change to a proposal for MS 1131 under Section 45C of the EP Act to undertake these works on 2 February 2022.

The Port Landside components of the Proposal will be located within the EPP of the Port Landside planning area and the Haul Road will be constructed through the ANSIA Services Corridor. In March 2021, the Proponent submitted a Development Application (DA) for the Proposal Landside and Marine facilities to the PPA as the authority to approve the development of port works and facilities in the Port and the Proponent's DA087, was approved on the 7 September 2021. The DA included the construction and operation of the following components for the export of ore over from the Port (**Figure 2-6**):

- Services Corridor – including a haul road and services.
- Eastern Planning Precinct – including truck unloading, in-loading and out-loading conveyor systems, storage shed, and non-process infrastructure; and
- Port Waters – including an approach jetty, TSVs loading wharf, and berth pocket.

No clearing within the Port or ANSIA Services Corridor will be conducted as part of this Proposal. The site preparation will be undertaken as part of approvals by PPA and only operation of the following facilities within the Port are part of the Proposal:

- Seawater Desalination Plant (RO Plant);
- Power station;
- Materials handling: ore storage sheds and bulk handling facilities;
- Bulk storage of fuel;
- A WWTP; and
- Administration building and other ancillary facilities including workshop (heavy vehicle servicing), warehouse and laboratory.

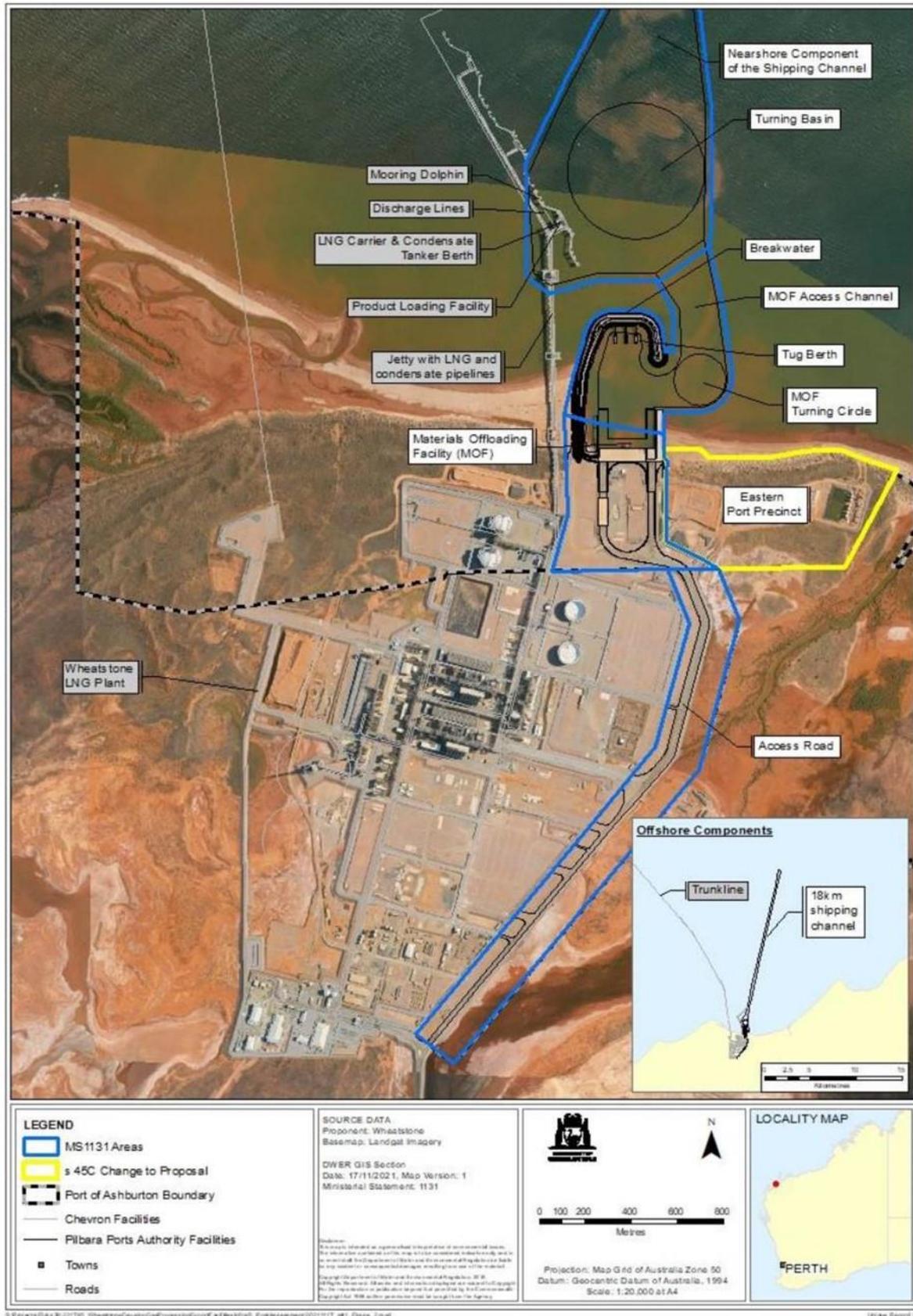


Figure 2-6: Shipping Channel, ACW, Access Road and Eastern Port Precinct (MS 1131, EPA 2022)

The Proposal's port operations will utilise the existing Wheatstone Marine Terminal (WMT) and ACW and navigation channels. The design and operation of the proposed port facilities will maintain unimpeded access to the WMT for existing Chevron operations, noting that the ACW is multi-user and will be only used occasionally for the Proposal (**Figure 2-6** and **Figure 2-7**).

The layout of the ore handling, storage and shiploading facilities for the Proposal has been designed to optimise traffic management and utilisation of space whilst maximising potential product storage area (**Figure 2-7**)

Seawater Desalination and Wastewater Treatment Plant

Relatively minor amounts of water will be required in the product handling and storage facility area for dust suppression, utilities, firefighting and potable water supply. These water requirements, expected at 2 GL/a, will be sourced via desalinated raw seawater that has been treated to the appropriate specification, with the brine returned to the ocean. Seawater intake and brine outlet pipelines for the seawater desalination plant will be situated within the jetty conveyor corridor. The seawater desalination plant will include a permanent seawater intake and a diffuser for the outfall. Plant design and capacity are yet to be confirmed, with model predictions based on two discharge rate scenarios: 0.28 GL/a (9 L/s) and 2 GL/a (65 L/s) with outfall salinity of 70 Practical Salinity Units (PSU), and a temperature increase of one degree above ambient sea temperature.

A small amount of sewage will be produced and treated on site with periodic removal of solid waste from site required. The liquid effluent will be co-disposed with the brine on the basis that it is treated to a Class A standard. Some of the treated liquid effluent will be used for on-site irrigation of landscaped gardens.

Power Station

Operations within the Port Landside DE are proposed to be supplied with power via an on-site gas fired power station that will connect to the Australia Gas Infrastructure Group (AGIG) gas lateral that connects proximal to the DE, at the Consumer gas pipeline. A peak power requirement of 4-5 MW is expected for the Port.

The installed power generation capacity will be 14 MW (7 x 2 MW containerised gensets), allowing for spinning reserve and sparing requirements. The power station hub will be fully self-contained within a fenced area and include a transformer and MCC.

Additional to gas sources, a 1 MW solar power installation on top of the product storage shed is proposed. Alternate power supply options including renewables will be ongoing throughout Proposal development.

Bulk Loading and Unloading Facility Operations

Road trains will enter the product handling and storage facility. This facility includes a truck unloading loop and fully enclosed product storage shed. The truck unloading shed will include a single materially enclosed steel structure with four vehicle lanes in a drive-in/drive-out unloading arrangement (**Figure 2-8**). Multiple tipping stations enable trucks to side tip ore product into a fully automated materials handling system.

A series of feeders and conveyors will transfer material into a large storage facility capable of holding up to 280,000 tonnes of ore prior to shipping (**Figure 2-9**). The materials handling system will be covered, and the storage shed fully enclosed with appropriate dust management and monitoring systems.

Materials Handling: Ore Storage Sheds and Bulk Handling Facilities Operations

The in-loading conveyor from the road train unloading area will transfer product onto a stockpile tripper conveyor at the top of the storage shed (**Figure 2-9**). The tripper conveyor extends the full length of the storage shed, discharging ore from the tripper cart across the length of the stockpile.

Ore product will be reclaimed from the stockpile using a bi-directional travelling bucketwheel reclaimer which is bridge mounted and spans the entire stockpile width. Ore product reclaimed by the reclaimer discharges from the bucketwheel onto a reclaim conveyor which transfers material onto an out-loading conveyor. The out-loading conveyor extends the full length of the shed, transferring product to the TSVs via conveyors across the jetty facility.

Bulk Fuel Storage

Bulk fuel storage will be required during construction, environmental commissioning, and operation. Diesel fuel storage consists of three 220 KL self-bunded storage tanks. This facility provides fuel for Light Vehicles, Mobile Equipment (including Front End Loaders) and TSVs. The fuel storage facility will include fuel bowsers for refuelling vehicles and a pumping system to deliver fuel to the TSVs whilst moored at the wharf.

Administration Building and other Ancillary Facilities including a Workshop Warehouse and Laboratory

A number of buildings will be required to support the Proposal including, but not limited to (**Figure 2-7**):

- Offices;
- Crib and training area;
- Maintenance workshop;
- Warehouse;
- Laboratory; and
- Control room.



Figure 2-7: Proposed Port Landside Facilities with Nearshore DE in the Background



Figure 2-8: Proposed Port Landside Bulk Loading and Unloading facilities



Figure 2-9: Proposed Port Landside Materials Handling Shed and Reclaimer facilities

2.1.4.3 Nearshore Port Marine Development Envelope

Marine Nearshore infrastructure includes a dedicated berthing pocket, an approach jetty and ship loading platform and will be constructed in Port Waters managed by the PPA east of the existing ACW (**Figure 2-10 and Figure 2-11**). The jetty is designed as a modular fixed-point loading wharf, with roadway access and lifting areas for up to 130 tonne cranes.

The location of the jetty has been selected to enable transshipment barges to sail into port under ballast draft (3.5 m maximum draft) without any tidal constraints and moor at the berth. For loading the barges, a berth pocket and basin will be dredged to facilitate loading during all tides.

A temporary causeway (rock structure) is required for the construction of the approach jetty for approximately six months and will be removed once jetty construction has been completed. Construction from a temporary causeway versus overhand construction will reduce the number of piles required, also reducing the duration of proposed piling. This will reduce potential impacts to sensitive marine fauna. Piling for the temporary causeway will involve the installation of 1,000 mm drive piles.

The new berth and jetty will require a dredging programme and offshore disposal of spoil at the existing Spoil Ground C (**Figure 2-7**). Capital dredging will remove approx. 130,000 m³ (that will swell to a disposal volume of approximately 165,000 m³) to modify the existing access channel for the ACW to allow safe access and berthing of TSVs at the nearshore wharf facility is required. Capital dredging will be undertaken to achieve a depth of m below mean sea level, with the proposed dredge footprint extending approximately 5 ha. The location of the jetty has been selected to enable transshipment barges to sail into port under ballast draft (3. m maximum draft) without any tidal constraints and moor at the berth. For loading the barges, a berth pocket and basin will be dredged to facilitate loading during all tides. Dredging operations will occur for approximately 90 days, to be scheduled for December 2022 pending approvals.

Seawater intake and brine outlet pipelines for the Desalination Plant will be situated within the jetty conveyor corridor. The Desalination Plant will include a permanent seawater intake and a diffuser for the outfall. Plant design and capacity are yet to be confirmed, with model predictions based on two discharge rate scenarios: 0.28 GL/a (9 L/s) and 2 GL/a (65 L/s) with outfall salinity of 70 PSU, and a temperature increase of one degree above ambient sea temperature. A Low Ecological Protection Area (LEPA) has been designated surrounding the brine outfall diffuser (**Figure 2-22**).

The Nearshore Port Marine facilities include:

- Berth pocket;
- Dredge material will be deposited within Spoil Ground C;
- Temporary impermeable causeway;
- Approach Jetty and Loading Platform;
- Ship loader installed on wharf for loading ore via conveyors into TSV's;
- Seawater intake pipeline; and
- Brine outlet pipeline.



Figure 2-10: Proposed Berth Pocket and Jetty in the Foreground, Port Landside Facilities in the Background



Figure 2-11: Proposed Port Nearshore Ship Loading Facilities with Jetty

Berth Pocket Dredging

The TSV berth pocket, manoeuvring area, and batters will be dredged to suitable depths to accommodate the berthing and manoeuvring of the TSV's. The dredge pocket and manoeuvring area will be dredged to depths of - 8.0m Chart Datum and -7.0m Chart Datum as per **Figure 2-14** and **Figure 2-15**.

Capital dredging of the TSV berth pocket will have a dredge footprint of approximately 5 ha. Approximately 130,000 m³ of dredge material will be removed and disposed. The dredged material will swell to a disposal volume of approximately 165,000 m³. The dredged material will be disposed of at existing Spoil Ground C. The berth pocket will be subject to annual bathymetric surveys. Dredge material impacts will be monitoring and maintained through an annual survey to monitor siltation and inform maintenance dredging. Maintenance dredging, if required will be undertaken by the PPA as part of their normal maintenance dredging programmes.

Dredging works are forecast to require up to 90 days. Dredging operations will be performed 24hrs per day, 7 days a week and a Backhoe Dredge (**Figure 2-12**) will be used to complete the works.



Figure 2-12: Side view of Backhoe Dredge

Disposal Methodology

Dredge material is to be placed into a Side Hopper Barge moored alongside the pontoon of the Backhoe Dredge (**Figure 2-13**). The Backhoe Dredge will excavate the material from the dredging area by means of its bucket and place the dredged material into the Side Hopper Barge alongside. A tugboat will be positioned either in front, behind or on the side of the Side Hopper Barge upon completion of the loading operations. The Side Hopper Barge will cast off from the Backhoe Dredge pontoon and the tug will tow or push the Side Hopper Barge to the dredge material placement area (DMPA) approximately 26.5 km (or 14.5 nautical miles) from the Berth pocket.

The dredge spoil will be transported to the existing offshore DMPA, Spoil Ground C, (**Figure 2-5**) and placed in accordance with the Sea Dumping Permit and Dredge and Spoil Disposal Management Plan (DSDMP).



Figure 2-13: Backhoe Dredge Loading a Side Hopper Barge

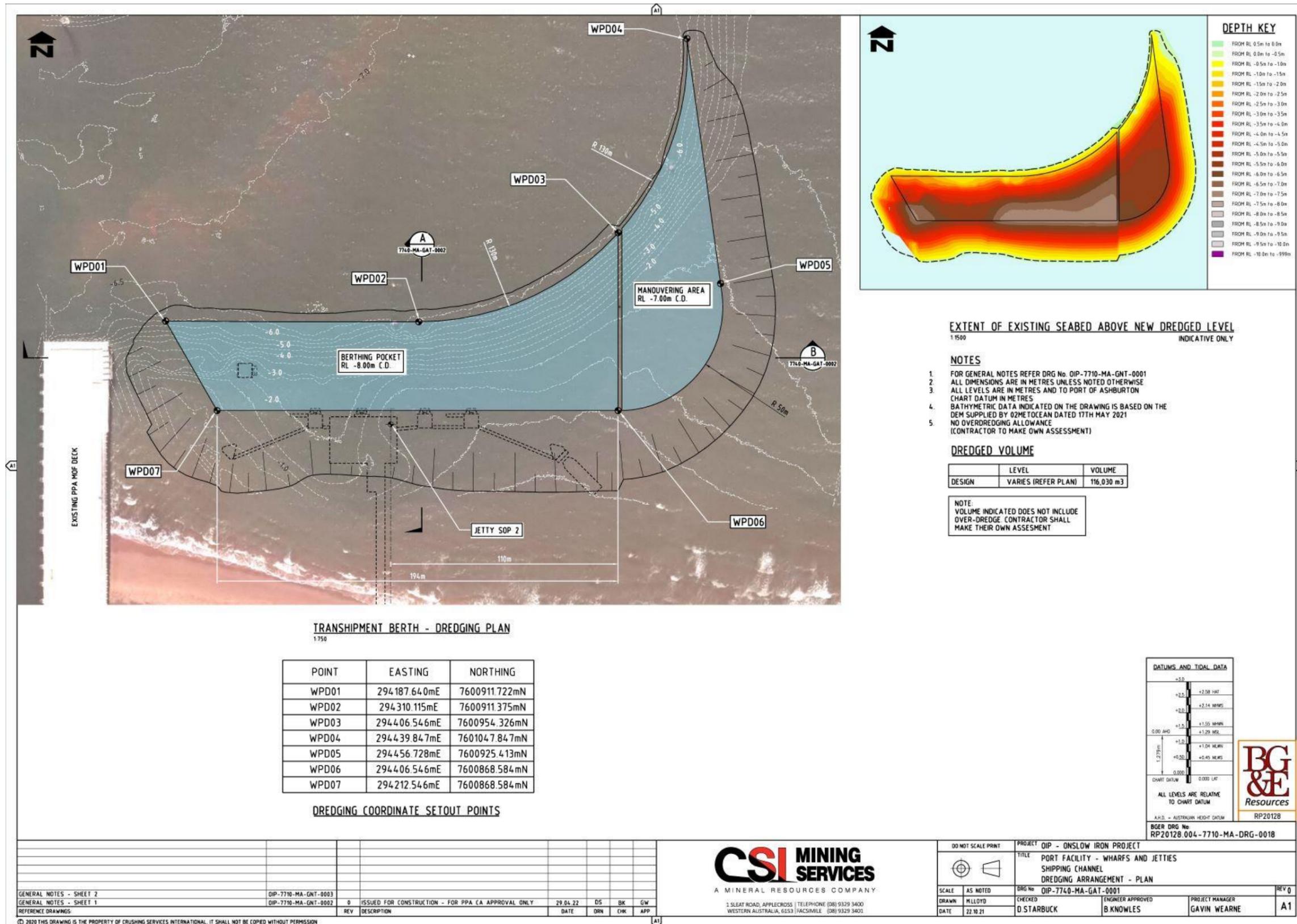


Figure 2-14: Berth Pocket Dredging Plan

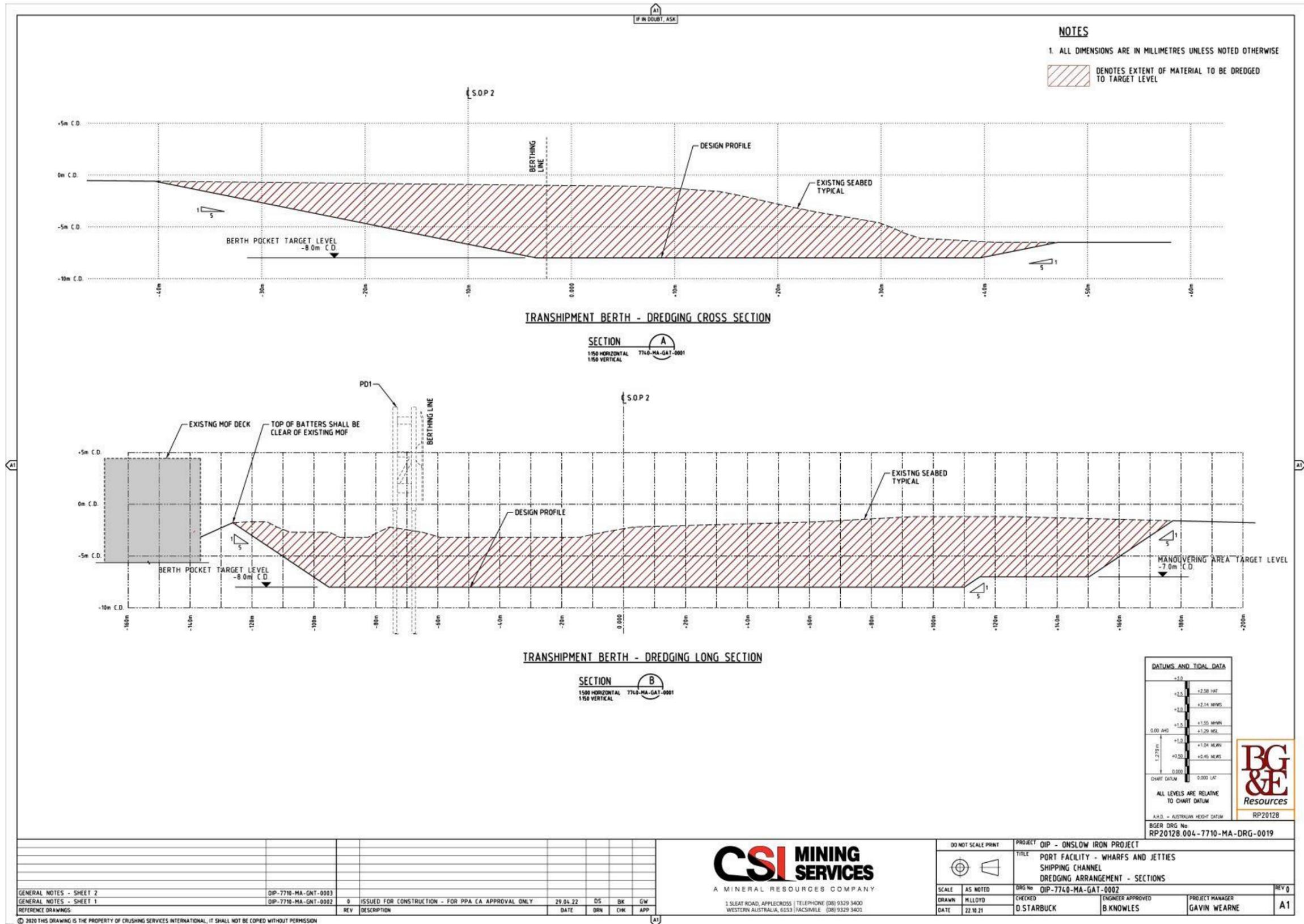


Figure 2-15: Dredge Pocket Cross Section

Temporary Causeway

A temporary causeway will be used to construct the approach jetty and loading platform with an expected life of six to twelve months. This is required for the installation of piles between B1 and B6 (**Figure 2-16**). In addition, the temporary causeway will be used to lift in the jetty and conveyor modules. Construction from a temporary causeway versus overhead construction reduces the number of piles required and the duration of piling works. The temporary causeway will be removed once jetty construction has been completed.

This will reduce potential impacts to the marine environment. In addition, the water depth between B1 and B6 restrict access for marine plant to high tide and would prevent the roadway modules being lifted as a single lift via heavy lift crane.

The remaining piles and jetty modules will be installed from floating plant and a vibratory piling will be used to start the piling and hammering to complete the process. Piling is estimated at 100 days with hammering occurring during day light hours only.

Planned construction activities for the jetty including temporary causeway are as follows:

- Push out Causeway;
- Mobilise craneage;
- Start preparing onshore abutment;
- Install Headstocks (full penetration butt welds);
- Lift in Roadway Support Beams;
- Push out Causeway;
- Mobilise craneage;
- Start preparing onshore abutment;
- Begin Installation of Precast Roadway Planks;
- Continue delivery of piles, headstocks and support steel work from causeway;
- Deliver conveyor trestles and trusses to work front from causeway;
- Begin installation from seaward end backwards; and
- Finalise major construction, remove causeway material, reinstate dune adjacent to abutment, finalise rock armour.

Approach Jetty and Loading Platform

The location of the jetty has been selected to enable transshipment barges to sail into port under ballast draft (3.5 m maximum draft) without any tidal constraints and moor at the berth. The approach jetty and loading platform consist of the following components (**Figure 2-16**):

- The approach jetty and ramp provide access from the landside to the TSV loading wharf;
- The TSV loading wharf provides the structure for loading ore onto ship; and
- Dolphins and catwalks independent of the wharf structure to support all the vessel loads from mooring and berthing.

Construction of the jetty and loading platform will be performed from the temporary causeway and floating plant. This will reduce tidal constraints and allow the jetty modules to be lifted via a single heavy lift.

The major steps for the onshore (temporary causeway) and offshore works are the same. However, the onshore works will not require the use of floating marine plant. Equipment and materials will be delivered to the causeway

via truck. Equipment and materials for the offshore work will either be loaded onto marine plant at the ACW or lifted directly into place via heavy lift ships that will transport the items directly to site.

Piling for the jetty and loading platform will involve various tubular steel piles driven in (hammered) using a hydraulic impact hammer for the construction of the wharf, approach jetty, and dolphins and may include:

- 14 piles for approach jetty installed from temporary causeway;
- 23 piles for approach jetty and loading platform installed from floating plant;
- 34 piles for dolphins and catwalks;
- 24 piles for the wharf; and
- 14 piles for the approach jetty.

Vibratory piling will be used to start the piling and hammering to complete the process. Piling is estimated at 100 days. Offshore piling will be restricted to day light hours to reduce the risk of interaction with marine fauna.

The dolphins will be pre-fabricated offsite and transported directly to site. Floating plant will lift the jackets directly on to the piles before they are grouted into place. Catwalks and stairs connecting the dolphins and loading platform will then be installed.

Ship Loader Conveyor to Load TSVs

A wharf and ship loader are proposed at the Port to load TSVs. TSVs will be loaded via covered conveyor(s) carrying ore originating from the product storage shed transfer product to a ship loader. The base case design is a linear travelling ship loader along the existing wharf. The ship loader will feed product ore into the TSVs top hatches.

Seawater intake and brine discharge pipelines

Minor amounts of water will be required in the product handling and storage facility area for dust suppression, utilities, firefighting and potable water supply. These water requirements, expected at 2 GL/a, will be sourced via desalinated raw seawater that has been treated to the appropriate specification, with the brine returned to the ocean. Seawater intake and brine outlet pipelines for the Seawater Desalination Plant will be situated within the jetty conveyor corridor. The Seawater Desalination Plant will include a permanent seawater intake and a diffuser for the outfall. Seawater Desalination Plant design and capacity are yet to be confirmed, with model predictions based on two discharge rate scenarios: 0.28 GL/a (9 L/s) and 2 GL/a (65 L/s) with outfall salinity of 70 PSU, and a temperature increase of one degree above ambient sea temperature.

Wastewater Treatment Plant

A small amount of sewage will be produced and treated on site with periodic removal of solid waste from site required. The liquid effluent will be co-disposed with the brine on the basis that it is treated to a Class A standard. Some of the treated liquid effluent will be used for on-site irrigation of landscaped gardens.

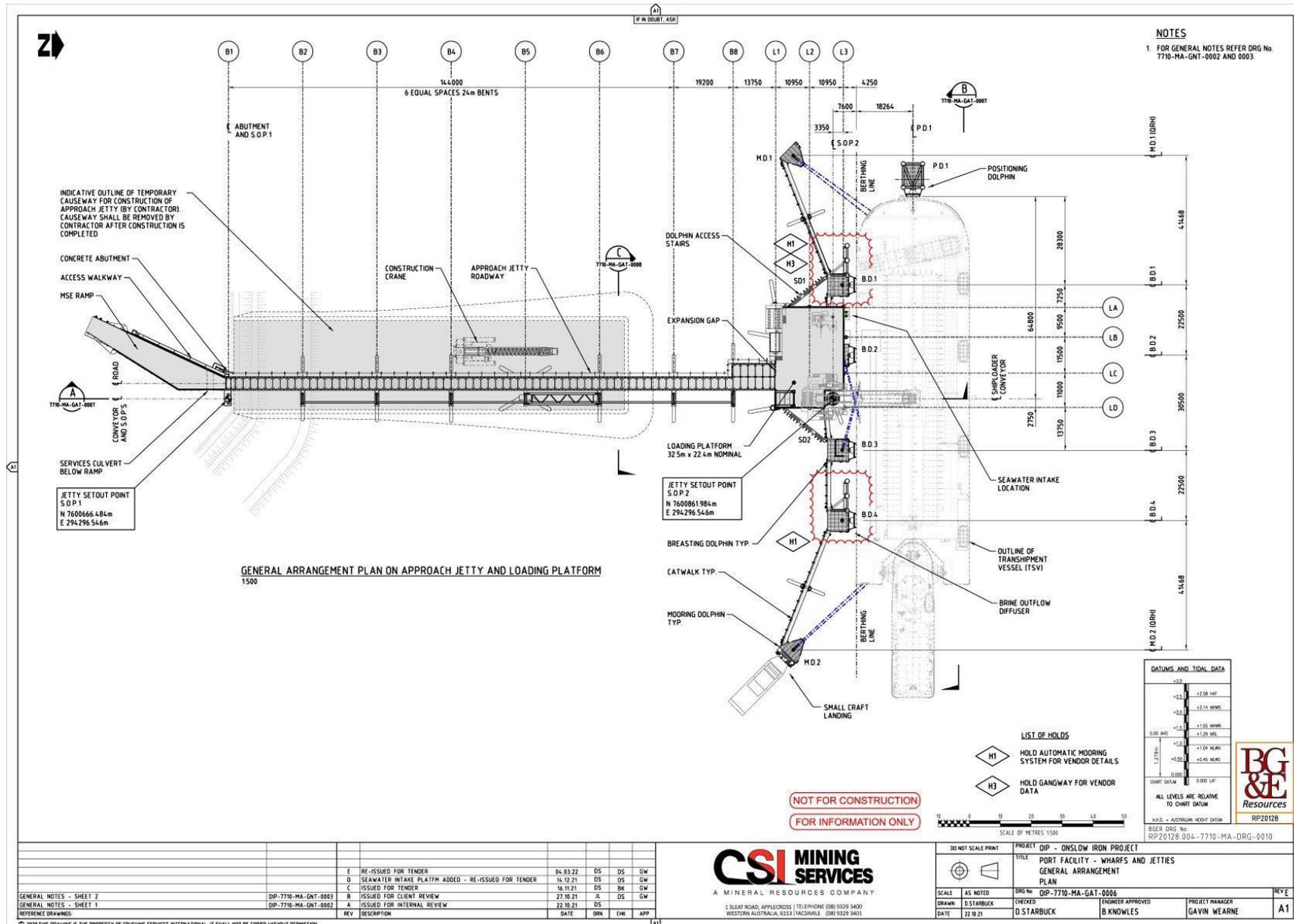


Figure 2-16: Temporary Causeway Plan

2.1.4.4 Offshore Port Marine Development Envelope

The Offshore Port Marine DE includes a navigation route from the PPA Port Boundaries utilising the existing shipping channel through marine waters, to the TSVs to OGVs anchorage area (**Figure 2-6**). A transshipment load-out area will include five dedicated offshore anchorages to accommodate Capesize OGVs. The anchorage points will be located north of the Port and approximately 12.5 km to the west/north-west of Thevenard Island, in water depths between 20-57 m.

- Activities within the Offshore DE include:
- Anchorage points;
- Offloading of TSVs;
- Loading of OGVs; and
- Shipping channel.

Transshipping Vessels

The TSVs is an articulated tug and barge (ATB) arrangement. For the planned export of 30 Mtpa, five 20,000 t capacity TSVs will be required. The TSVs will be self-propelled through a tug in a notch (ATB) with bow thrusters fitted forward to ensure a high level of manoeuvrability of the vessels. The Proponent has completed a full navigation simulation exercise using the recognised marine consultant HR Wallingford to confirm safe and efficient operation with the planned design. The TSVs are self-unloading (6,000 tph) with required material handling equipment incorporated into the design and operation.

The TSVs will use the main channel until there is sufficient water depth to move into open water. The TSVs will then pass through operational marine areas within the Port of Onslow, through State waters to anchorage point locations. The TSVs will then pass through operational marine areas within the Port of Onslow, through State waters to anchorage point locations (**Figure 2-5**).

Loaded TSVs will come alongside and moor to the anchored bulk carrier for unloading, subject to suitable metocean operating conditions. Transshipment operations will operate on all tides and priority will be given to Wheatstone shipping operations when utilising the existing main navigation channel.

Vessels will operate on a 24 hour basis, with five TSVs constantly. Seasonal changes will not alter the frequency of TSVs operations. The TSVs will run at a maximum speed of nine knots. A maximum of five offshore anchorage points will be available.

Ocean Going Vessels

The OGVs will be approximately 180,000 to 200,000 tonnes DWT with an approximate arrival draft of 9 m and fully loaded draft of 18 m. The TSVs will tie up to the OGVs using lines from the TSVs (**Figure 2-5**). Mooring of the TSVs alongside the OGVs is a critical issue and a full dynamic mooring analysis has been undertaken to ensure safe and effective mooring alongside the berth and the OGVs. Davit launched Yokohama fenders will be deployed on the load-out side of the TSVs to facilitate safe mooring alongside the OGVs in the open sea.

There will be approximately 12 mooring winches on the TSVs with a centralised control system. The operation will be 24 hours per day, 7 days per week subject to metocean conditions. The transshipping operation will also include a pilot/crew launch to transfer personnel safely and efficiently between the shore and the OGVs and TSVs.

Anchorage Points

A total of five anchorages will be located approximately 35 km offshore (**Figure 2-5**). The Anchorage points are identified on a chart but otherwise there will not be any construction activity associated with them. Loaded TSVs will transit from the berth to the OGVs at the anchorage points, utilising the existing WMT navigation channel until there is sufficient depth to leave the channel. OGVs will anchor in a designated anchorage and will be controlled by the Port Authority Vessel Traffic System.

2.1.4.5 Indicative Timeline

Subject to approval, construction of the Proposal is anticipated to commence in December 2022. An indicative Proposal implementation schedule for construction is outlined in **Table 2-4**.

The Proponent expects to commence haulage and export in Q4 2023, with an operational life of Proposal until 2052. The Proposal will not be a staged development.

Subject to approval, construction of the Proposal is anticipated to commence in December 2022.

Table 2-4: Proposal Construction Timeline

Construction Timeline		
Proposal Time	Minimum Project Life	30 years
Construction Phase	Haul Road, and Port Nearshore facilities	Approximately 18 months (including early works and construction from multiple approval areas)
Commissioning Phase (including commissioning and ramp-up)	Port Landside facilities	Approximately 12 months
	Port Nearshore facilities	Approximately 12 months
Operational Phase	Operating days	Up to 365 operational days per year over a minimum of 30 years.

2.1.5 Proposal Exclusions

Elements that are specifically excluded from the proposal, due to existing approvals include:

- Land clearing within the Port Landside DE (PPA's MS 1131);
- 15 km section of the haul road located within Main Roads WA area from the Ashburton Port Access Road to Onslow Road and 3 km section from Onslow Road to Warrida Road intersection and overpasses: and turning lanes.
- 3 km section of haul road along Ashburton Port Access Road within PPA Port boundaries (PPA's MS 1131).
- Permanent accommodation village in Onslow (not in the DE). Planning is underway and, if required, will be undertaken on freehold lots with appropriate zoning under local Town Planning Scheme No 7; and
- Heavy vehicle maintenance facility- Onslow Camp Dunes Project (Yarri Leases) G8/80, L8/114, M8/488, M8/496).

The areas excluded from the Proposal are displayed on **Figure 2-17**.

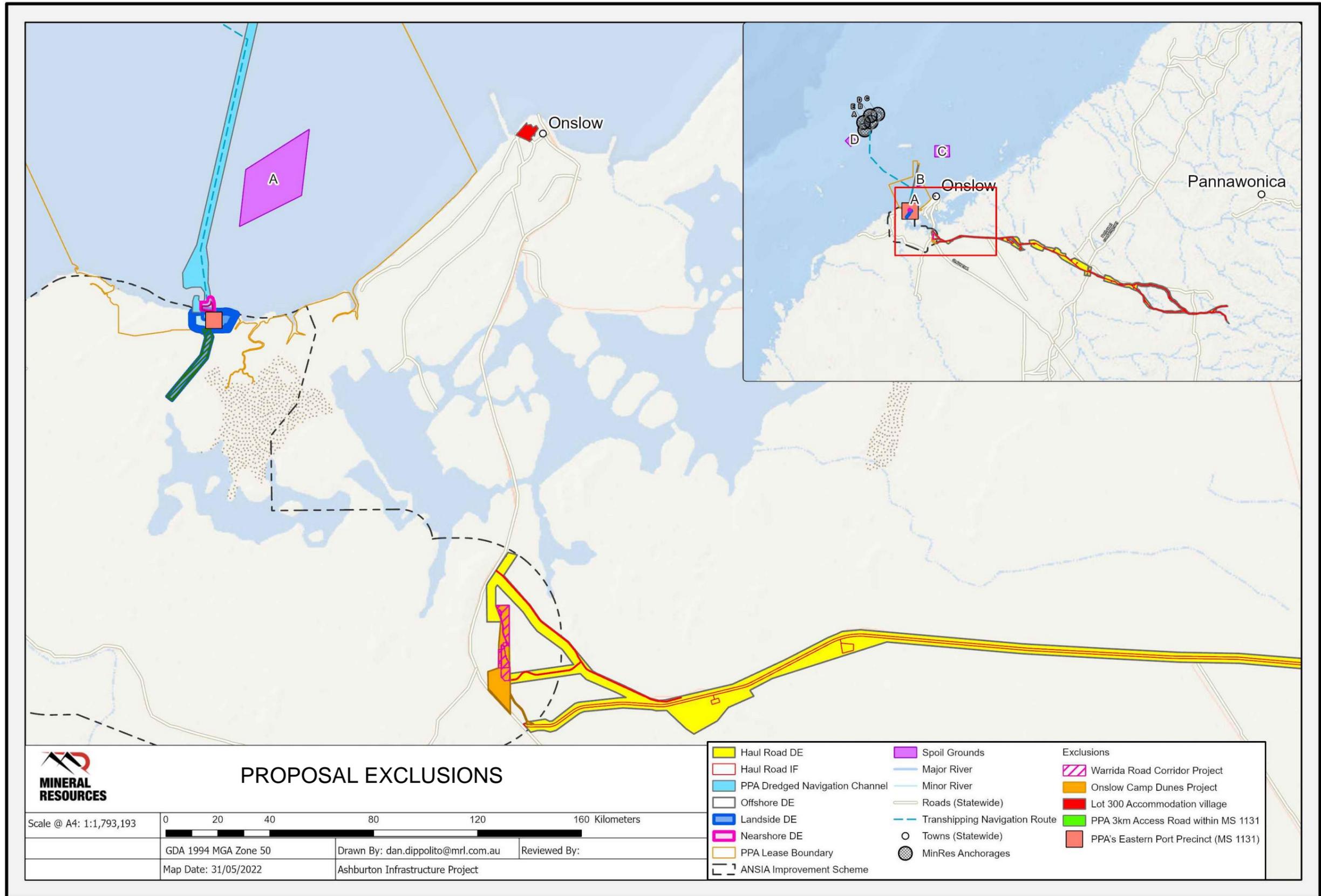


Figure 2-17: Exclusions from the Proposal

2.1.6 Environmental Management Approach

The Proponent's operations are governed by an Environmental Management System (EMS), developed in line with principles of ISO 14001:2015 – *Environmental Management Systems* standard. Environmental management is embedded in the Proponent's culture and is fundamental to the Company's success. The Proponent has progressively developed its EMS to ensure that environmental impacts are minimised across its operations.

At its core, the Proponent EMS is a system of practices and procedures relating to:

- The identification of aspects and impacts related to the Proponent's mining operations;
- The implementation of management measures to avoid or minimise impacts on the environment and communities in which we operate; and
- The evaluation of environmental performance and review of the system to facilitate continual improvement and sustainable mining practises.

Implementation of the EMS ensures the Proponent:

- Maintains a consistent and sustainable approach to environmental management across all of its operations;
- Fulfils the legal obligations and other commitments relevant its operational activities; and
- Minimises adverse environmental impacts, prevents pollution and reduces waste from its activities.

The Proponent's EMS comprises overarching Environment, Community and Heritage Policies supported by company-wide and site-specific standards, procedures and plans (**Appendix A**). Key elements addressed in the EMS include; risk identification and management; roles and responsibilities; training; non-compliance and corrective action management; inspection and auditing; reporting; record keeping; and continual improvement. The EMS provides operational controls to effectively manage aspects and impacts specifically relating to the Proponent's activities, including but not limited to; native vegetation clearing; surface and groundwater use; flora; fauna; waste; heritage; land rehabilitation; and chemical management.

2.1.6.1 Environmental Management Plans

A suite of specific Environmental Management Plan (EMPs) have been developed, which are directed by either outcome based or objectives-based provisions that clearly define environmental objectives and outcomes, and are supported by management targets/criteria, management actions/contingencies, monitoring, adaptive management, and reporting protocols. Where relevant, these EMPs have been prepared in accordance with or considered the 'Instructions on how to prepare *Environmental Protection Act 1986* Part IV Environmental Management Plans' (EPA 2020c) and are summarised in **Table 2-5**.

Where required, the supporting EMPs present clearly defined environmental outcomes or objectives (or both):

- Outcomes-based management provision (performance based) focus on monitoring and evaluating specific measurable outcomes and are typically driven by trigger and threshold criteria; and
- Objective-based management provisions (management actions/targets), that aim to avoid and minimise impacts through the implementation of management actions, where specific trigger or threshold criteria may not be appropriate for the circumstances.

2.1.6.2 Conceptual Mine Closure Plan

A Proposal Closure Strategy (PCS) (**Appendix I**) has been prepared to support the RSD to fulfil requirements for a conceptual plan that outlines the decommissioning and closure of facilities strategies for the Proposal. The Proponent is currently developing a Mine Closure Plan (MCP) which aligns with the Department of Mines, Industry Regulation and Safety (DMIRS) MCP Guidance (DMIRS 2020) (the guidelines) to be submitted with the Mining Proposal for the Proposal.

2.1.6.3 Offsets

Where a high or significant residual risk of impact remains after applying the mitigation hierarchy and implementing management plans, and where rehabilitation cannot be achieved, offsets will be applied (**Section 15**).

Table 2-5: Management Plans Prepared for the Proposal

Factor/Phase	Management Plan	Purpose
Whole of Proposal Environment	Framework Environmental Management Plan (FEMP) (Appendix B)	The FEMP has been developed to present a robust environmental management framework that guides and informs the Proposal's full suite of environmental management plans. The FEMP details the Proposal's overarching environmental management framework aimed to mitigate potential impacts during both construction and operational phases.
Marine Fauna/ Construction	Marine Construction Environmental Management Plan (MCEMP) (Appendix C)	The MCEMP has been prepared to detail how underwater noise, collision with vessels, hydrocarbon spills, invasive marine species and marine debris will be managed by the Proponent during construction of the marine components of the Proposal. The MCEMP provides the overall environmental management framework and specific management measures to address relevant environmental factors and mitigate potential impacts of the marine construction activities.
	Underwater Noise Management Protocol (UNMP) (Appendix G)	The UNMP will manage underwater noise associated with piling works. The UNMP has been informed by underwater noise modelling performed by Talis Consultants (2022). The UNMP outlines protocols to inform piling contractors, the obligatory requirements of Pre-Start, Soft-Start, Shut Down procedures and low visibility condition protocols. These procedures are to be carried out with guidance from the Marine Fauna Observer (MFO) based on dedicated observation and exclusion (shut down) zones.
Marine Fauna, MEQ and BCH / Dredging and Dredge Material Disposal	Dredging and Spoil Disposal Management Plan (DSDMP) (Appendix E)	The DSDMP has been prepared to detail how environmental impacts will be managed during the dredging phase.
Marine Fauna, MEQ and BCH / Construction and Operations	Artificial Light Management Plan (ALMP) (Appendix F)	The ALMP describes how light spill and glow from will be managed, with a focus on protecting turtles, shorebirds and seabirds. The plan includes monitoring of hatchling orientation on Ashburton Island (closest Island to the onshore/nearshore facilities) and Thevenard and Bessieres Islands (due to critical marine turtle habitat, multi-species use, and proximity to the Offshore Anchorage DE and TSV navigation route). The Plan includes measures to be adopted in the event monitoring shows disorientation attributable to the Proposal.
	Marine Operational Environmental Management Plan (OCEMP) (Appendix D)	The purpose of this MOEMMP is to establish a framework to ensure that the implementation of the Proposal does not compromise the Environmental Factors, Values (EVs) and Environmental Factors Quality Objectives (EQOs) and also

Factor/Phase	Management Plan	Purpose
		describes management measures to minimise the risk of vessel strike during vessel operations.
Flora and Vegetation / Terrestrial Fauna /Inland Waters / Air Quality Construction and Operations	Terrestrial Environmental Management Plan (TEMP) (Appendix H).	The TEMP has been prepared to detail the mitigation and management measures the Proponent proposes to implement to reduce direct and indirect impacts to surrounding flora, vegetation and fauna. The management objectives for the plan relate to specific management objectives on each environmental factor.

2.2 Proposal Alternatives and Proposal Justification

2.2.1 Need for the Proposal

As part of an overarching business and operational strategy the Proponent is undertaking planning to unlock stranded mineral assets in the West Pilbara region of WA. This involves mining ore deposits proximal to the Haul Road DE and the haulage of any mined product to the Port for export. Mining is focussed initially on the approved Bungaroo South mine (MS 960 and MS 1147), located approximately 45 km south of Pannawonica, of which the Proposal will enable export from.

The Proponent has acquired the Bungaroo South project. Implementation of this project is authorised via MS 960, MS 1147, EPBC 2013-6867, and all subsequent approvals have been received under the *Mining Act 1978* and *Environmental Protection Regulations 1987*. The Bungaroo South approval involves an 8 Mtpa mine, processing facilities and supporting infrastructure. A 176 km haul road from the mine site to the customer delivery point near Cape Preston also formed part of the Proposal. However, the Proponent has undertaken detailed review of the approved Proposal and considers the opportunity to develop new infrastructure and use the of existing and proposed new facilities at the Port will provide a more efficient and safe method of delivery of Bungaroo South ore to the Port for export.

The Proponent also holds tenure related to the Kumina ore deposit located about 289 km from Onslow and is completing separate feasibility, definition and environmental studies for development of this resource. This stand-alone project will be the subject of a separate referral under the EP Act and is introduced to provide context of potential opportunities this Proposal presents to unlock further stranded iron ore mines in the region.

The Proponent and APIM entered into a Commercial Agreement to progress the WPIOP under the RHIOJV. Given the original WPIOP project included for the development of a rail line to a proposed new port development, Anketell Port. The proposed AIP Haul Road and Port facilities will provide a more efficient and less environmentally impactful, alternative for the delivery of WPIOP ore for export.

In addition, approval for the following linear infrastructure to connect with the approved WPIOP Stage 1 Mine Areas (authorised via MS 1027) is being sought due to overlapping tenure with part of the Ashburton Haul Road corridor:

- WPIOP Gas Pipeline – a 7 km southern diversion of the gas pipeline corridor from the currently approved WPIOP Gas Pipeline (MS 1027 and EPBC 2009-4076) to allow connection with the existing Goldfields Gas Transmission Pipeline and the Central Processing Facility within the WPIOP; and
- WPIOP Haul Road Link – a 7.8 km fully sealed haul road to link to Ashburton Haul Road with the approved WPIOP (MS 1027).

Given the long-term mining opportunities in the greater West Pilbara region, the Proponent envisions the access to the proposed haul road and port infrastructure may relieve environmental and economic constraints for other projects in the West Pilbara. The Proposal is expected to support the export of up to 40 Mtpa over a 30-year period.

The development of this Proposal provides a direct benefit through employment and opportunities for local businesses that will be supported by the Proponent as a direct result of the Proposal. The Proponent has a number of strategies that are already being implemented to support the local community and region including an indigenous employment strategy and local procurement policies, and a community development and grants programs.

The Proponent has commenced engagement with key decision-making authorities regarding the Proposal and the Proponent's broader strategy and has received in-principal support for this from the WA Government. The life of the Proposal is expected to be about 30 years which will contribute significantly to the economy over this period. It is forecast that the \$3 billion development of the Proposal will create 2,100 direct and 6,300 indirect jobs during construction and 1,200 direct and 3,600 indirect jobs during operations. The Proposal is forecast for a capital spend of \$AU560M for the remainder of the 2021/2022 Financial Year. It is expected that per annum (for up to 30 years), the Proposal will contribute approximately \$AU190M in corporate taxes, \$AU150M in royalties and \$AU130M in payroll payments to the economy.

It has been assumed that the haul road will be completely removed at the end of the post closure monitoring and maintenance period. It is likely however, that stakeholders may want the haul road left intact permanently. Further consultation with key stakeholders will be undertaken as part of the regular review of closure commitments under Mining Act approvals associated with the Proposal.

2.2.2 Alternatives to the Proposal

The Proponent has commissioned comprehensive baseline studies and investigations to understand the environmental and social values of the Proposal area and surrounds. This work has informed the Proposal design to avoid or minimise potential impacts as far as practicable. The Proposal presented in this document is the result of an iterative design and review process that has optimised specific elements, balanced with a precautionary approach to avoid, mitigate and manage potential environmental impacts.

Alternatives considered for the Proposal are summarised below.

2.2.2.1 Options for Haulage Method

Initial assessments of haulage options considered both rail and road solutions. Road was adopted as the preferred logistics solution for a number of important reasons including:

- Land access and tenure;
- Capital; expenditure vs operational expenditure trade off where the road haulage distance to port meant road was more efficient;
- Lack of available land within the Port area to allow rail unloading infrastructure within the port footprint / site layout;
- Speed to market;
- Improving road transport efficiencies, in particular increased payloads on private haul roads; and
- Environmental and heritage constraints.

Through the use of a Haul Road vs rail option evaluation, the Haul Road has greater ability to be re-aligned to avoid sensitive areas such as significant flora species, critical habitat and the Cane River Lore Grounds.

2.2.2.2 Options for Haulage and Export Locations

Transport of ore through other ports for export was considered, such as the use of the Cape Preston Export Facility proposed by Iron Ore Holdings Ltd at the time of approvals of the Bungaroo South mine (in 2013). However, as this Cape Preston Export Facility has not yet been constructed and requires greenfield development, export through an existing developed Port (i.e., the Port of Ashburton) was seen to be favourable, not only from a cost perspective, but results in better environmental outcomes. Using an existing Port rather than developing a Port in a new greenfield location, reduces the impacts on the environment, particularly in relation to the total area of disturbance of native vegetation and benthic communities and habitat required. In addition, use of an existing port provides an overall shorter construction duration reducing direct and indirect construction impacts on marine fauna.

2.2.2.3 Options for Transshipping Routes and Marine Infrastructure

The Proponent investigated two options to construct the approach jetty including overhand construction and construction from a temporary causeway. Using a temporary causeway for construction of the approach jetty has been determined as the better environmental outcome. This method will reduce the number of piles required for the jetty by almost half, and also reduces the duration of proposed piling and construction time.

Noise modelling results indicate that the highest potential for noise impact to marine receptors are from piling activities. Using the temporary causeway for construction of the approach jetty is therefore expected to minimise noise impacts to Green Sawfish (*Pristis zijsron*), Humpback Whales (*Sousa sahalensis*) and Flatback Turtle (*Natator depressus*) Green Turtle (*Chelonia mydas*) and Hawksbill Turtle (*Eretmochelys imbricate*).

Using the temporary causeway for construction of the approach jetty will minimise noise by reducing the number of piles and reducing piling duration. This results in a better environmental outcome in terms of reducing potential impacts.

2.2.2.4 *Options for Power Supply*

A number of power supply options were considered for the Proposal, including the following options: renewable power sources such as solar photovoltaics (PV) and wind turbines.

- Wind turbines were considered however, the Proposal is located in a Category D cyclone area. There are no known suppliers of wind turbines that would tolerate cyclonic wind speeds; and
- Solar photovoltaics (PV) were considered, however suitable areas around the Port have already been designated for other uses by PPA. PVs are under consideration by the Proponent as part of a broader renewables supply program for other port users. We are planning to have battery storage to support this energy strategy.

The final outcome was that power will be supplied to the Port via an onsite gas fired power station. The power station will be supplied with gas via connection to an existing consumer gas pipeline. This option was adopted as gas is more economical, requires no land clearing and has lower emissions providing an improved carbon footprint vs a diesel power station.

A 1 MW (peak) solar power installation on top of the product storage shed is planned which will reduce carbon dioxide emissions by approximately 750 tonnes per year.

The Proponent will continue to investigate additional renewable power supply options opportunities during the Proposals development.

2.2.2.5 *Options for Ancillary Infrastructure within the Haul Road*

A permanent camp for operational workforce was initially proposed within the Haul Road DE, however this has been removed from the referred DE as the Proponent investigates options to construct the accommodation camp within the Onslow township. Any accommodation will be sympathetic to the local town planning scheme zoning within TPS No.7. The direct impact from clearing native vegetation within the Haul Road DE has been avoided as a result of relocating the operational accommodation camp and replacing it with a smaller temporary construction camp adjacent to the North West Coastal Highway. This results in avoiding potential impacts and a reduction in clearing of native vegetation including potential habitats, and avoidance of disturbance of adjacent sensitive areas such as riparian vegetation within the DE.

2.2.2.6 *No Proposal*

If the Proposal does not progress the following have the potential to occur:

- Mineral deposits within the Western Pilbara remain stranded or increased environmental impacts from individual haul roads to other export locations
- Unrealised royalties: The WA Government would forego in the order of \$7 billion over the life of the Proposal
- Unrealised tax revenue: The Commonwealth Government would not receive tax revenue from company profits and employee wages;
- Unrealised employment and training: Opportunities (1200 direct operational jobs, 2,100 construction jobs, and 6300 other in-direct jobs) in the local and regional area for employment and training would be forfeited.
- Unrealised supply opportunities: Opportunities for local, regional and broader Western Australian businesses to supply goods and services would not be realised.
- Loss of direct investment through approximately \$3 billion of capital expenditure; and

- Lost opportunity for positive social benefits: The local and regional community benefits derived from the flow on effect of employment and business confidence generated by the Proposal would be unrealised.

In conclusion, not proceeding with the Proposal would result in a loss of social and economic benefits to the local, regional and State communities and Australia as a nation.

2.2.3 Rationalisation of Development Envelopes

2.2.3.1 Haul Road Development Envelope

Evaluation of the haul road alignment was completed through iterative reviews of environmental, economic, constructability and engineering aspects and land access negotiations. The primary rationale for the private haul road is to remove mine haul vehicles from public roads.

As a result of findings of the baseline studies and investigations, the alignment of the referred haul road footprint and DE differs greatly from the initial alignment. The original Haul Road DE was 25,930 ha and encompassed 31.6 ha of Mesas/Breakaways habitat type that is known denning and foraging habitat for Northern Quoll, potential roosting habitat for Ghost Bat, Pilbara Leaf-nosed Bat and potential shelter/denning habitat for Pilbara Olive Python. The Proponent has undertaken multiple redesigns of the haul road to reduce impacts to MNES species, reducing the size of the DE to 16,209 ha (by approx. 37%) and realigning the corridor to avoid all mesas/Breakaways habitat (**Figure 2-18**).

To provide flexibility in the haul road design, the Haul Road DE includes two possible routes for the haul road through Redhill Station. Geotechnical work will be undertaken on both routes to determine the location of the final haul road footprint. The impacts associated with either route have been assessed within this RSD. **Figure 2-18** compares the original Haul Road DE with the final DE to illustrate how the identified high value Mesas/Breakaways habitat type has now been avoided in the final design.

2.2.3.2 Nearshore Development Envelope

The location of the jetty and associated components is situated away from mangroves adjacent to existing port infrastructure, additionally the design of the piled jetty structures minimises impacts on longshore current patterns. This presents a more environmentally acceptable option as potential impacts on the EPA's Factors Coastal Processes are minimised.

The location of the desalination outfall and intake has been designed to avoiding cumulative impacts from dredging activities on marine environmental quality by locating the plant seawater intake and brine outlet pipelines for water supply within the jetty conveyor corridor to the ocean.

The Proponent has approval to use an existing dredge material placement area (Spoil Ground C) adjacent to the Port for placement of spoil (as per DA087). Utilising the existing offshore disposal locations was considered to present a more environmentally acceptable option, as potential impacts on the EPA's Factors Terrestrial Fauna and Flora and Vegetation (by reducing native vegetation clearing) and Benthic Community Habitat (BCH) (through avoiding the establishment of a new offshore spoil disposal location) is minimised, by utilising the existing Spoil Ground. Advice was sought and ongoing investigation into onshore disposal was not recommended.

2.2.3.3 Offshore Development Envelope

A pre-feasibility assessment was undertaken on the proposed port marine elements to understand potential environmental impacts of various transshipment options. The environmental footprint of the Proposal was minimised based on the recommendations of this assessment. The Proposal will utilise the Port navigation channels reducing the amount of overall capital dredging required.

The Proposal is located in relatively flat and shallow waters of the western Pilbara. The Offshore DE incorporates five dedicated offshore anchorages to accommodate Capesize OGVs. The navigation route that traverses water depths of eight to 40 m, between the Nearshore and Offshore DEs. There is a slight gradient from the coast to the 20 m contour, where there is a steeper slope from 20 to 50 m. Depths at the offshore anchorage areas range between 27 to 59 m.

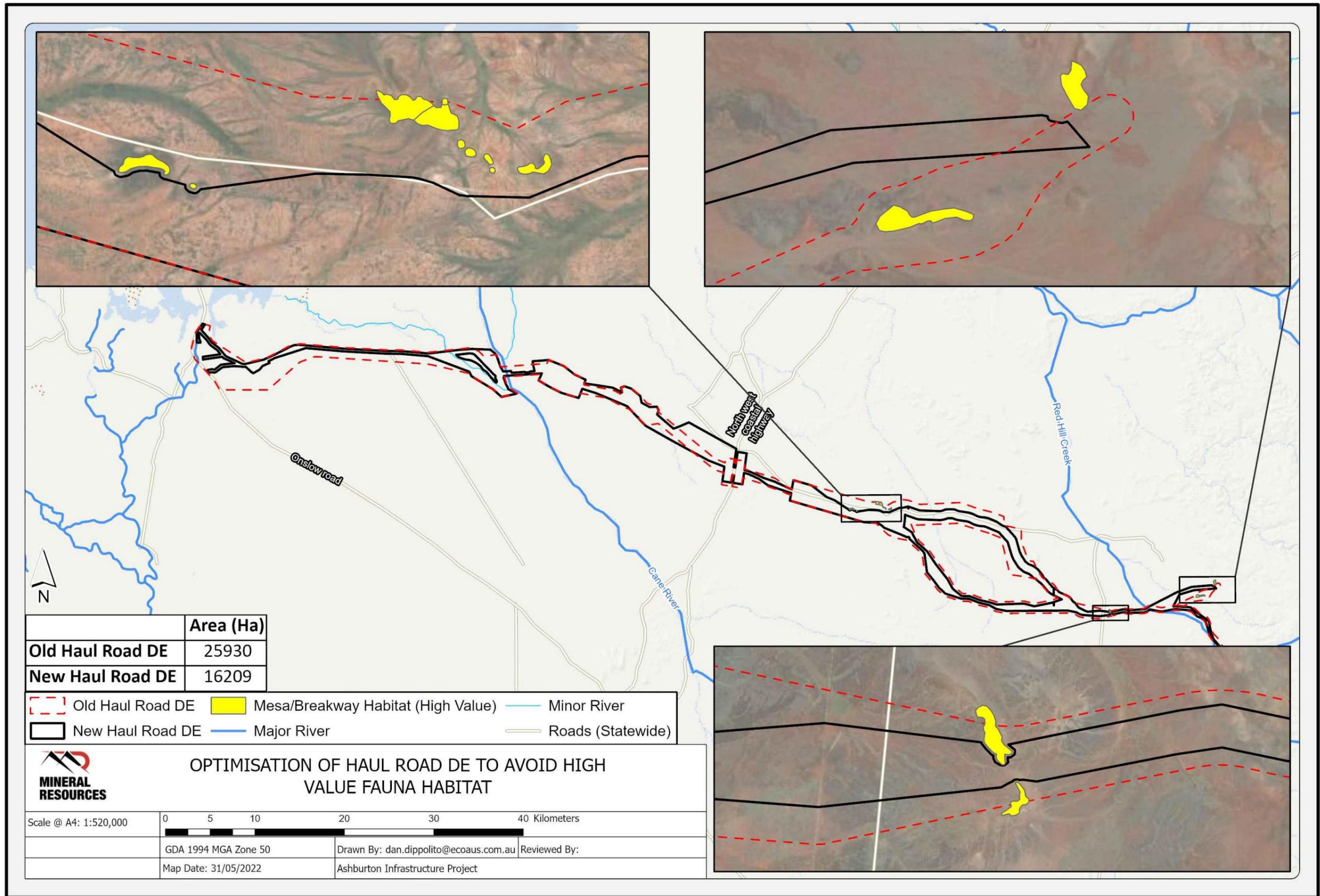
An iterative process was undertaken to determine the final location of the five offshore transshipment anchorage points. Initial locations (**Figure 2-19**) were investigated during the BCH survey and based on the outcomes of BCH survey results, alternative locations were identified. The final location of the five offshore transshipment anchorage points were selected to **avoid** benthic habitat, which was mapped within the anchorage investigation area as being limited to the 30 m depth contour, with the seabed beyond this depth being predominantly bare sand (**Figure 2-19**). This results in a reduced potential impact to marine fauna, including listed species by avoiding impacts to benthic habitats. Initial design locations were moved to specifically avoid impacts to mapped benthic communities.

As the anchorage area is devoid of BCH and was specifically selected in consideration of the mitigation hierarchy, whereby impacts to BCH are avoided through site selection, no further mitigation was considered warranted.

TSVs and OGVs will anchor by using a single anchor in 30-40m of depth. In most cases depending on weather a scope of 3:1 will be required meaning a total of 120 m of chain will be used. In most circumstances 30-40m of anchor chain will contact seabed around the anchoring point. The rest of the chain will be in the catenary to the vessel bow. The anchoring point will be the same for all anchorage operations and targeted by the ship's captain using GPS navigation.

The use of moorings was considered, however a large amount of permanently fitted infrastructure must be utilised for this size of vessel, involving large amounts of heavy chain, multiple anchor legs and clump weights. There is no advantage of this versus using a single anchor. In addition to this, OGVs are not normally fitted with bow working infrastructure and thus can make the operation of hanging off anchors hazardous and impractical.

For the above reasons we consider the using of existing anchorage methods between the 30-40m contours to be the lowest environmental impact and optimal for the project.



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Figure 2-18: Optimisation of Haul Road Development Envelope

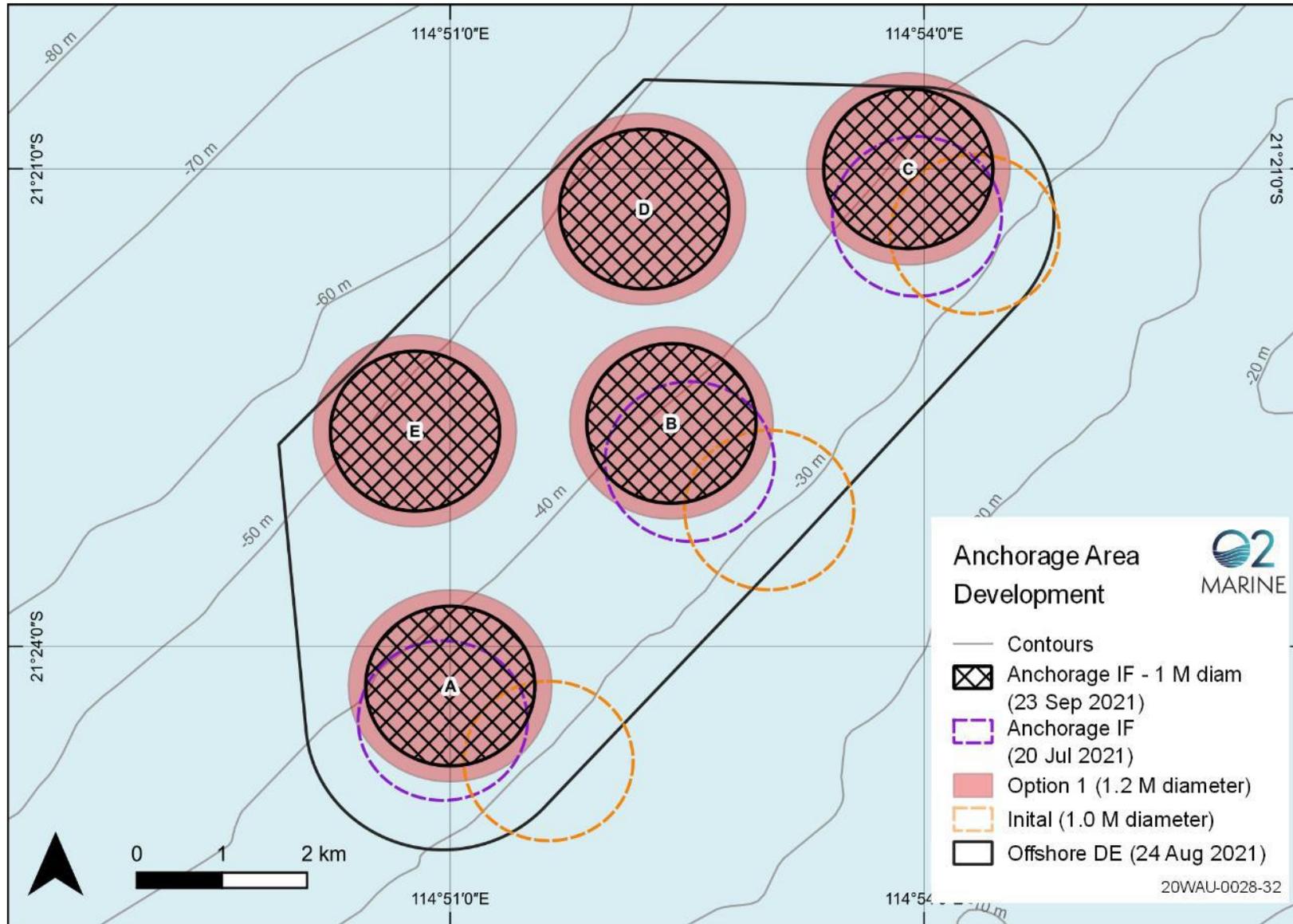


Figure 2-19: Anchorage Site Options

2.3 Local and Regional Context

2.3.1 Terrestrial Environment

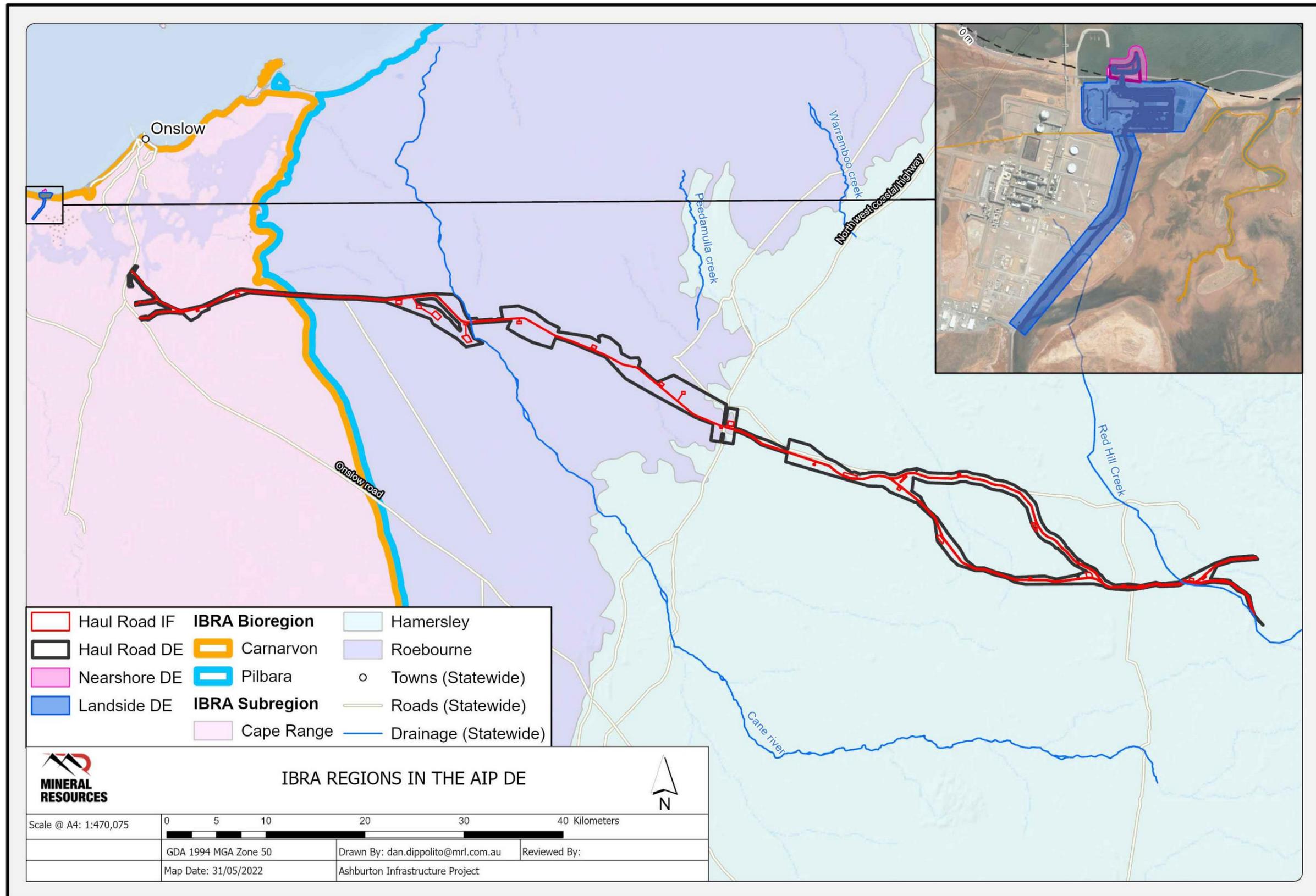
2.3.1.1 Bioregions

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. The *Interim Biogeographic Regionalisation for Australia* (IBRA) (Thackway & Cresswell 1995) Version 7 recognises 89 geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. The 89 bioregions are further defined into 419 sub-regions, which are more localised and homogenous geomorphological units within each bioregion.

The Proposal DE extends across the Carnarvon and Pilbara IBRA bioregions, and three subregions being Cape Range (CAR01) in the Carnarvon bioregion and Hamersley (PIL03) and Roebourne (PIL04) in the Pilbara Bioregion. These are further defined below in **Table 2-6** and displayed in **Figure 2-20**.

Table 2-6: IBRA Region and Subregions in the Haul Road Development Envelope

IBRA Region	Subregion	Description
Carnarvon	Cape Range (CAR01)	“The Carnarvon bioregion is composed of quaternary alluvial, aeolian and marine sediments overlying Cretaceous strata and comprises 8,374,700 ha. A mosaic of saline alluvial plains with samphire and saltbush low shrublands, Bowgada low woodland on sandy ridges and plains, Snakewood scrub on clay flats, and tree to shrub steppe over hummock grasslands on and between red sand dune fields. Limestone strata with <i>Acacia stuartii</i> or <i>A. bivenosa</i> shrubland outcrop in the north, where extensive tidal flats in sheltered embayments support mangal. Subregional area is 2,547,911 ha (Kendrick and Mau 2002).
	Hamersley (PIL03)	“PIL3 is the Southern section of the Pilbara Craton. Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and <i>Eucalyptus leucophloia</i> over <i>Triodia brizoides</i> on skeletal soils of the ranges. The climate is semi-desert tropical, average 300mm rainfall, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon. Drainage into either the Fortescue (to the north), the Ashburton to the south, or the Robe to the west. Subregional area is 6,215,092ha within an area of 17,806,000 ha (the Pilbara bioregion).” (Kendrick 2001).
Pilbara	Roebourne (PIL04)	“Quaternary alluvial and older colluvial coastal and subcoastal plains with a grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of <i>Acacia stellaticeps</i> or <i>A. pyrifolia</i> and <i>A. inaequilatera</i> . Uplands are dominated by <i>Triodia</i> hummock grasslands. Ephemeral drainage lines support <i>Eucalyptus victrix</i> or <i>Corymbia hamersleyana</i> woodlands. Samphire, <i>Sporobolus</i> and mangal occur on marine alluvial flats and river deltas. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite. Islands are either Quaternary sand accumulations, or composed of basalt or limestone, or combinations of any of these three. Climate is arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer. Cyclonic activity is significant, with several systems affecting the coast and hinterland annually. Subregional area is 2,008,983ha within an area of 17,806,000 ha (the Pilbara bioregion).” (Kendrick and Stanley 2001).



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Figure 2-20: IBRA Regions in the Proposal Development Envelopes

2.3.1.2 Land Systems

The Department of Primary Industries and Regional Development has mapped and described the land systems of WA rangelands, providing a comprehensive description of biophysical resources, including soil and vegetation condition. Fourteen land systems occur within the Proposal DE and are further detailed in **Table 2-7**.

Table 2-7: Land Systems Within the Proposal Development Envelopes

Land System	Description
Cane System	Alluvial plains and flood plains supporting snakewood shrublands, soft and hard spinifex grasslands and tussock grasslands.
Capricorn System	Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.
Dune System	Dune fields supporting soft spinifex and minor hard spinifex grasslands.
Giralia System	Sandy plains with linear dunes and broad sandy swales supporting hummock grasslands of hard and soft spinifex with scattered acacia shrubs.
Houndstooth System	Rough shale hills, stony plains and broad drainage floors supporting hard spinifex grasslands and sparse shrubs.
Nanutarra System	Low mesas and hills of sedimentary rocks supporting soft and hard spinifex shrubby grasslands.
Littoral System	Bare coastal mudflats (unvegetated), samphire flats, sandy islands, coastal dunes, and beaches, supporting samphire low shrublands, sparse acacia shrublands and mangrove forests
Onslow System	Undulating sandplains, dunes and level clay plains supporting soft spinifex grasslands and minor tussock grasslands
Peedamulla System	Gravelly plains supporting hard spinifex grasslands and minor snakewood shrublands.
Robe System	Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.
Sherlock System	Stony alluvial plains supporting snakewood shrublands with patchy tussock grasses and spinifex grasslands.
Stuart System	Gently undulating stony plains supporting hard and soft spinifex grasslands and snakewood shrublands.
Uaroo System	Broad sandy plains, pebbly plains and drainage tracts supporting hard and soft spinifex hummock grasslands with scattered acacia shrubs
Urandy System	Stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands.

2.3.1.3 Geology, Topography and Landforms

The Proposal is underlain by the Western Region soil-landscape region, which occupies almost half of WA (~48%) and extends from the Indian Ocean to the Sandy Desert and Central Southern Regions (Tille 2006). The geology of Western Region is complex and varied, but can be broadly described as undulating plateaux, with plains, ranges, hills and coastal plains on Pilbara and Yilgarn Cratons, Albany-Fraser and Capricorn Orogens and Perth and Carnarvon Basins. The Western Region is divided into ten provinces with the Proposal situated within the Exmouth and Ashburton Provinces (Tille 2006).

The Exmouth Province is situated in the western Pilbara, containing the towns of Coral Bay, Exmouth and Onslow. The Province predominantly consists of alluvial plains and sandplains with dunes and coastal flats, as well as some stony plains and ranges, over the sedimentary rocks of the Northern Carnarvon Basin (Tille 2006). The Proposal mostly occurs within the eastern portion of this Province, beyond the Exmouth Gulf, which is characterised by the Birdrong Sandstone and Cretaceous Windalia Radiolarite of the Peedamullah Shelf, overlain by Quaternary alluvium, aeolian sand and colluvium. The landform characteristics intersecting the Proposal consist of tidal mudflats associated with undulating dune fields and sandplains amongst clay plains (Tille 2006).

The Ashburton Province is situated in the north-western Gascoyne and southern Pilbara, and extent into the north-eastern Goldfields. The Province does not contain any towns, and instead contains numerous scattered station homesteads and small settlements (Tille 2006). The Province is broadly characterised by hills and ranges, including hardpan wash plains and stony plains, situated on the sedimentary basins and granitic rocks associated with the Capricorn Orogen. The Proposal mostly occurs within the north-western and central portions of this Province, which are associated with the Palaeoproterozoic sandstone, basalt, carbonate, conglomerate and shale of the Ashburton Basin. The landform characteristics intersecting the Proposal consist of a mosaic of stony plains and hilly terrain found on the sedimentary rocks of the Ashburton, Collier and Edmund Basins, as well on the gneiss, schist, quartz, and granite of the Gascoyne Complex. In areas downslope from hilly terrain, gently sloping plains and extensive flats are associated with red-brown hardpan (Tille 2006).

The overlying topography of the Proposal is variable, ranging from 0 m above sea level (asl) in the Landside DE (before the Hamersley Ranges) and reaching a maximum elevation of 180 m asl at the eastern most extent of the Haul Road DE in the rugged undulating terrain associated with the Hamersley Ranges.

2.3.1.4 Hydrology and hydrogeology

The Haul Road DE is located within the Pilbara Surface Water Area, a Surface Water Proclaimed Area under the *WA Rights in Water and Irrigation Act (RIWI Act)*. Over its approximate 125 km extent, the Haul Road DE traverses four regional catchments and intersects 20 watercourses, three permanent water sources with occasional significant flow. Watercourses within the Haul Road DE are typical of those in the Pilbara being ephemeral in nature and flow as a result of upstream rainfall events. The three significant watercourses are:

- Cane River;
- Peedamulla Creek; and
- Red Hill Creek.

These water courses are illustrated on **Figure 2-21**.

The Haul Road DE is located entirely within the Pilbara groundwater area, which is proclaimed under the RIWI Act. Along the Haul Road DE, groundwater resources are mainly alluvial, sedimentary or fractured rock aquifers.

The dominant regional land uses along the haul road alignments are currently mining and cattle grazing. Existing pastoral, mining and drinking water supply groundwater bores occur along the proposed haul road. Production bores within Priority 1 Drinking Water Supply areas under the *Country Areas Water Supply Act 1947*, such as the Cane River Water Reserve, have a 500 m wellhead protection zone established, to protect the source of water used for abstraction and potable supply. Pastoral bores have a 400 m wellhead exclusion zone established under the *Mining Act 1978*. The Haul Road DE is 7 km from the closest wellhead protection zone.

The Landside DE is located largely within the controlled drainage network of the ANSIA. Apart from along the access road, the Landside DE has been previously filled and protected to provide a stable, dry development area. Site drainage is controlled in accordance with the District Water Management Strategy (ENV Australia 2010) that has been approved by DWER (Taylor Burrell Burnett 2019), with strong emphases placed on ensuring chemical spills do not escape into the natural environment and that Best Management Practices (BMPs) are utilised (ARUP 2015).

The hydrogeology and groundwater of the Landside DE have been described previously as part of the proposed development of the Wheatstone Project and the ANSIA generally:

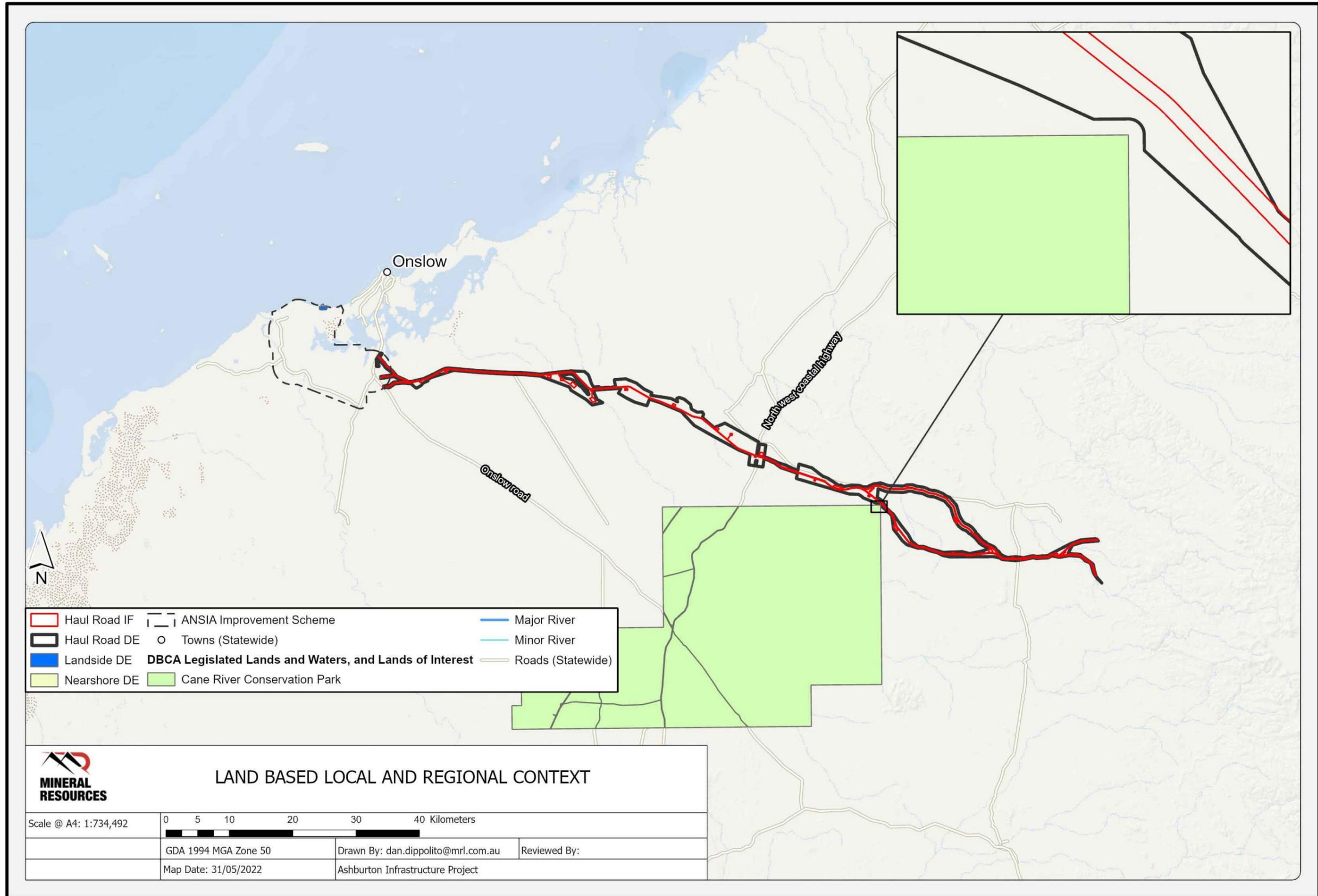
- ANSIA District Water Management Strategy (ENV Australia 2010); and
- Wheatstone Project Groundwater Studies (URS 2010a).

The studies indicate that the site is underlain by a shallow (~1 m) groundwater table that is strongly influenced by the nearby seawater. The groundwater is not suitable for potable or industrial use, being brackish to hypersaline, near-neutral to slightly alkaline, and with comparatively high dissolved metal concentrations; some which exceed the Australia and New Zealand Guidelines (ANZG) 2018 for Fresh and Marine Water Quality.

2.3.1.5 Key Ecological Features and Conservation Areas

The Proposal does not overlap any recognised Conservation Areas or any Environmentally Sensitive Areas. The nearest conservation areas are (Department of Biodiversity Conservation and Attractions, 2019b ,Figure 2-21):

- Cane River Conservation Park – located 100 m south of the Haul Road DE, vested under the Conservation Commission of Western Australia; and
- Unallocated Crown Land (LR3048/43) – located 2 km south of the Haul Road DE, vested under the department of Planning, Lands and Heritage.



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Figure 2-21: Land Based Local and Regional Context

2.3.2 Marine Environment

2.3.2.1 Bathymetry

The Proposal is located in relatively flat and shallow waters of the western Pilbara. The Nearshore DE is situated in water depths up to eight m (O2 Metocean 2021a). The Offshore DE incorporates the anchorage points. The navigation route that traverses water depths of eight to 40 m, between the Nearshore and Offshore DEs. There is a slight gradient from the coast to the 20 m contour, where there is a steeper slope from 20 to 50 m. Depths at the offshore anchorage areas range between 27 to 59 m (O2 Metocean 2021a).

2.3.2.2 Waves, Currents and Tides

Ocean waves, currents, tides and other water column properties are key drivers of marine ecosystems as they can influence sediment transport and turbidity patterns, primary production in the water column and bottom sediments, recruitment patterns for organisms with pelagic phases in their life cycles as well as the distribution of benthic communities (DSEWPac 2012a).

The northwest shelf of WA experiences waves generated from three primary sources: Indian Ocean swell, locally generated wind-waves and tropical cyclone waves. Along the shoreline the ambient (non-cyclonic) wave climate is generally mild. From August to December low amplitude swell originating in the Indian Ocean propagates to the site and occurs in conjunction with locally generated sea waves of short period (Baird 2020). From January to July the wave climate is locally generated sea waves from the west and northwest.

Whilst the non-cyclonic ambient wave conditions are generally mild, in contrast the strong winds in a tropical cyclone can generate extreme wave conditions. It is noted that the offshore islands would provide some natural protection from extreme wave conditions depending on the direction of propagation. Tropical cyclones cause an increase in water level due to storm surge, which is a dome of higher than normal sea water generated by strong winds and low atmospheric pressure (McInnes et al 2000). Waves also contribute to coastal sea levels during tropical cyclones (McInnes et al 2000). The impact of cyclonic waves on the study site is dependent on the prevailing water level conditions and direction of cyclone approach.

Dominant currents in the North-west Marine region include: the South Equatorial Current, the Indonesian Throughflow (ITF); the Eastern Gyral Current, and the Leeuwin Current (DEWHA, 2007). Overall, a key characteristic of the regional oceanography of the North-west Marine region is the pole-ward flows of the main surface currents (DEWHA 2007). The Pilbara system is a transitional oceanographic region between the strongly ITF-influences surface waters to the north and the Leeuwin Current-influenced surface waters to the south (DEWHA, 2007). Characteristically, inshore waters in this region are warmer and less saline than the subtropical waters further offshore (DSEWPac 2012a).

The Proposal is located in an area where tides are characterised by amplification of tidal range due to the shallow bathymetry over the North West Shelf and complex hydrographic and topographic features (Baird 2020). Ashburton experiences semi-diurnal tides (two highs and two lows a day) with a mean tidal range of 1.9 m in spring tides and 0.5 m in neaps (Baird 2020).

The maximum velocity of the tidal current in the project area is variable (0.05 - 0.40 m/s) (Baird 2020), with currents increasing in speed the further offshore.

2.3.2.3 Major Ecosystem Units

Four major ecosystem units (ECU) were derived from the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) hierarchical ecosystem classification framework and further developed by Lyne *et al.* (2006) for the North West Shelf and these units include:

- ECU0 – Onslow Onshore encompassing intertidal habitats;
- ECU1 – Onslow Nearshore encompassing waters between LAT and up to 10 m depth in relatively complex bathymetry, covering mainly soft substrates but including a ridge of scattered patch shoals which support corals and sponges;

- ECU2 – Onslow Offshore encompassing waters between 10–20 m depth and including most offshore islands and coral reefs and algal-dominated shoals; and
- ECU3 – Onslow Inner Shelf incorporating the relatively steep gradient shelf break from 20–70 m depth.

These ECUs are shown in **Figure 2-22**. Subsequently, Chevron utilised these ECUs to define Local Assessment Units (LAUs) within the ECUs based on bio-geomorphic attributes and the distribution of various types of BCH. A subset of the LAUs has been selected to enable evaluation of potential impacts to BCH for the Proposal.

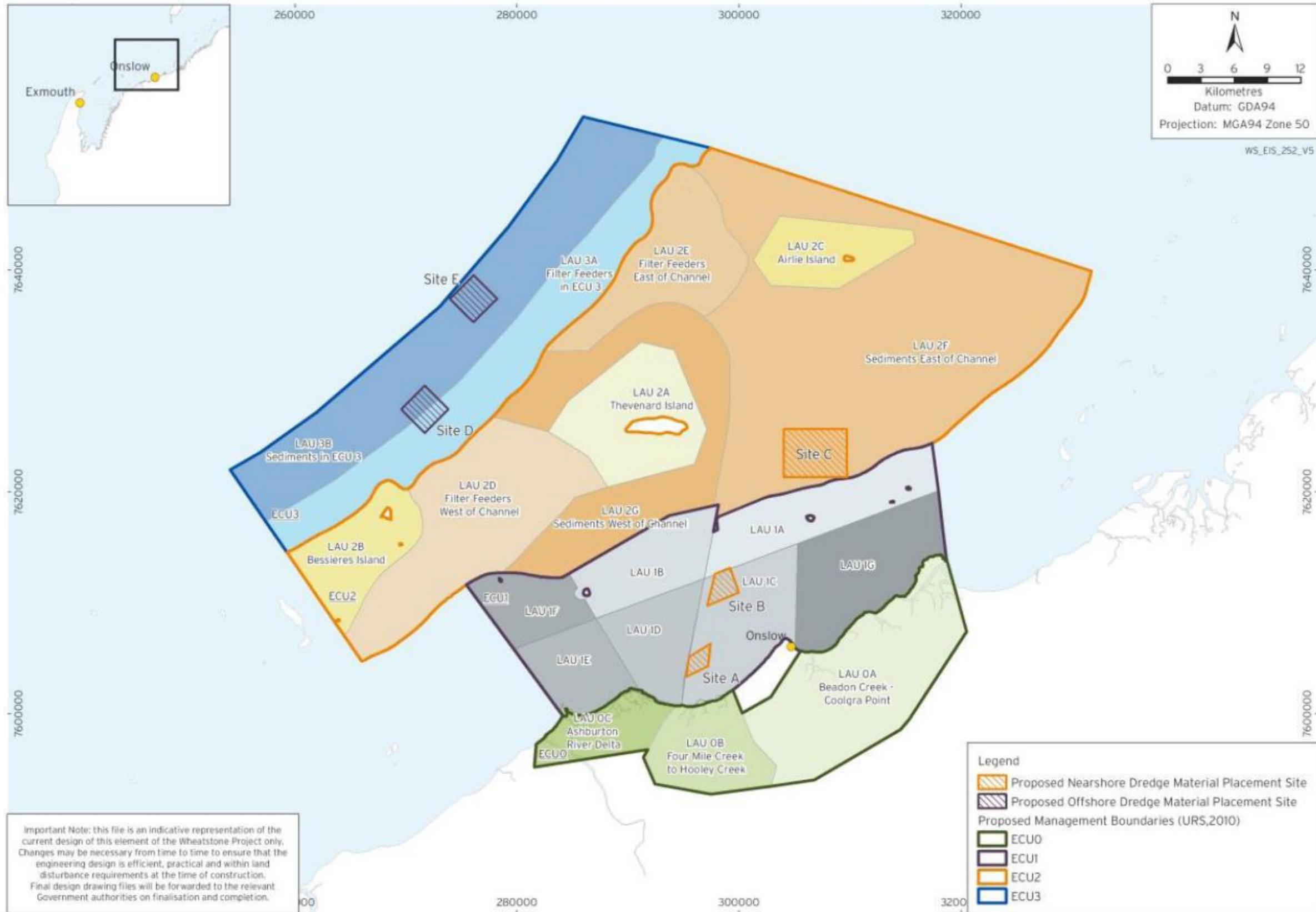


Figure 2-22: LAU in the Vicinity of the Proposal Area (Indicative Location Shown in Red) (Source: URS 2011a)

2.3.2.4 Key Ecological Features

Three Key Ecological Features of the North-west Marine Region have been identified in Commonwealth waters offshore (DSEWPaC 2012a; **Figure 2-23**):

- Ancient coastline at 125 m depth contour (~15 km);
- Continental slope demersal fish communities (~36 km); and
- Canyons linking the Curvier Abyssal Plain and the Cape Range Peninsula (~30 km).

The ancient coastline at the 125 m depth contour is thought to provide biologically important habitats (particularly in parts where it forms a rocky escarpment) in an area otherwise dominated by soft sediment. It may serve as a navigational aid for migrating whales and whale sharks. The continental slope demersal fish communities support a high level of endemism. Deep-water canyons and steep bathymetry where nutrient rich upwelling occurs are areas of high productivity and likely to support aggregations of marine predators.

2.3.2.5 Island Nature Reserves

A series of limestone island nature reserves are situated within the 20 m bathymetric contour, including Ashburton, Bessieres, Direction and Tortoise islands. The Proposal is located ~21 km from the nearest island nature reserve being Direction Island, with the exception of the anchorage areas which are approximately 15 km away from Thevenard Island (Pendoley, 2021) (**Figure 2-24**). Many have fringing coral reefs on the seaward side. Sandy beaches support turtle rookeries and suitable beaches and sandbars support shorebirds and seabird breeding colonies. There are limited tourist accommodation facilities on Thevenard Island. There is no development on Ashburton, Bessieres, Direction, or Tortoise islands. The orientation and low-lying elevation of the offshore islands within the Proposal area means that nesting turtle females have direct visibility of the Proposal area lighting, with the exception of the anchorage area.

The orientation and low-lying elevation of the offshore islands means that nesting turtle females have direct visibility of the Proposal lighting, with the exception of the anchorage area (Pendoley, 2021). The remote nature of these islands provides natural protection from introduced predators including cats and foxes

2.3.2.6 Biologically Important Areas

Biologically Important Areas (BIAs) are spatially defined zones where aggregations of individuals of a species are known to display biologically important behaviours such as breeding, foraging, resting or migration (DAWE 2021a). BIAs were first identified on a regional basis as they were developed as part of the Commonwealth Marine Bioregional Plans and have been identified using expert scientific knowledge about species' distribution, abundance, and behaviour in the region to inform decisions made under the EPBC Act. They are important components of Species' Recovery Plans, where those plans exist. A summary of BIAs around the DEs is presented in **Section 8.3.2.1**.

2.3.2.7 Regionally Significant Mangrove Management Areas

The Proposal area lies adjacent to the designated Ashburton River Delta 'Regionally Significant' mangrove area (EPA 2001), which is located on the Western extent of the Port.

EPA (2001) recognises all mangrove areas along the Pilbara coast as important and are considered to be of high conservation value. The Port lies adjacent to the Ashburton River Delta 'regionally significant' mangroves that occur inside industrial areas' (EPA 2001). The EPA's operational objective for this area is that:

"No development should take place that would significantly reduce the mangrove habitat or ecological function of the mangroves in these areas."

The nearest existing infrastructure to the Regionally Significant Mangrove Area is the ACW, adjacent to the Proposal, which is 1.31 km to the north of the mangrove area (**Figure 2-25**).

The Proposal does not impact any Mangrove areas, and the existing ACW provides a barrier between the Proposal's infrastructure and the closest mangrove area.

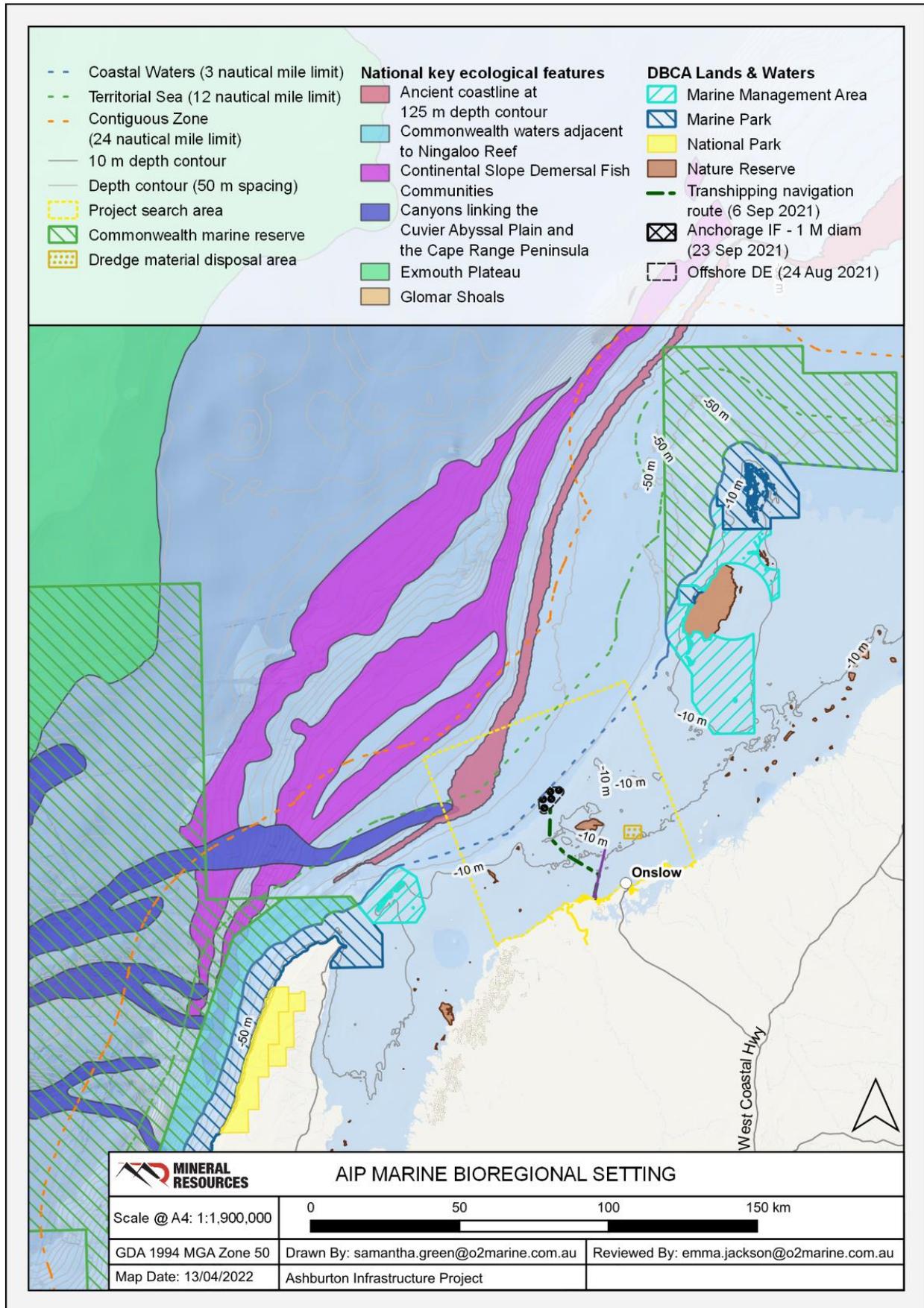


Figure 2-23: Key Ecological Features of the North-west Marine Region (DSEWPC 2012a)

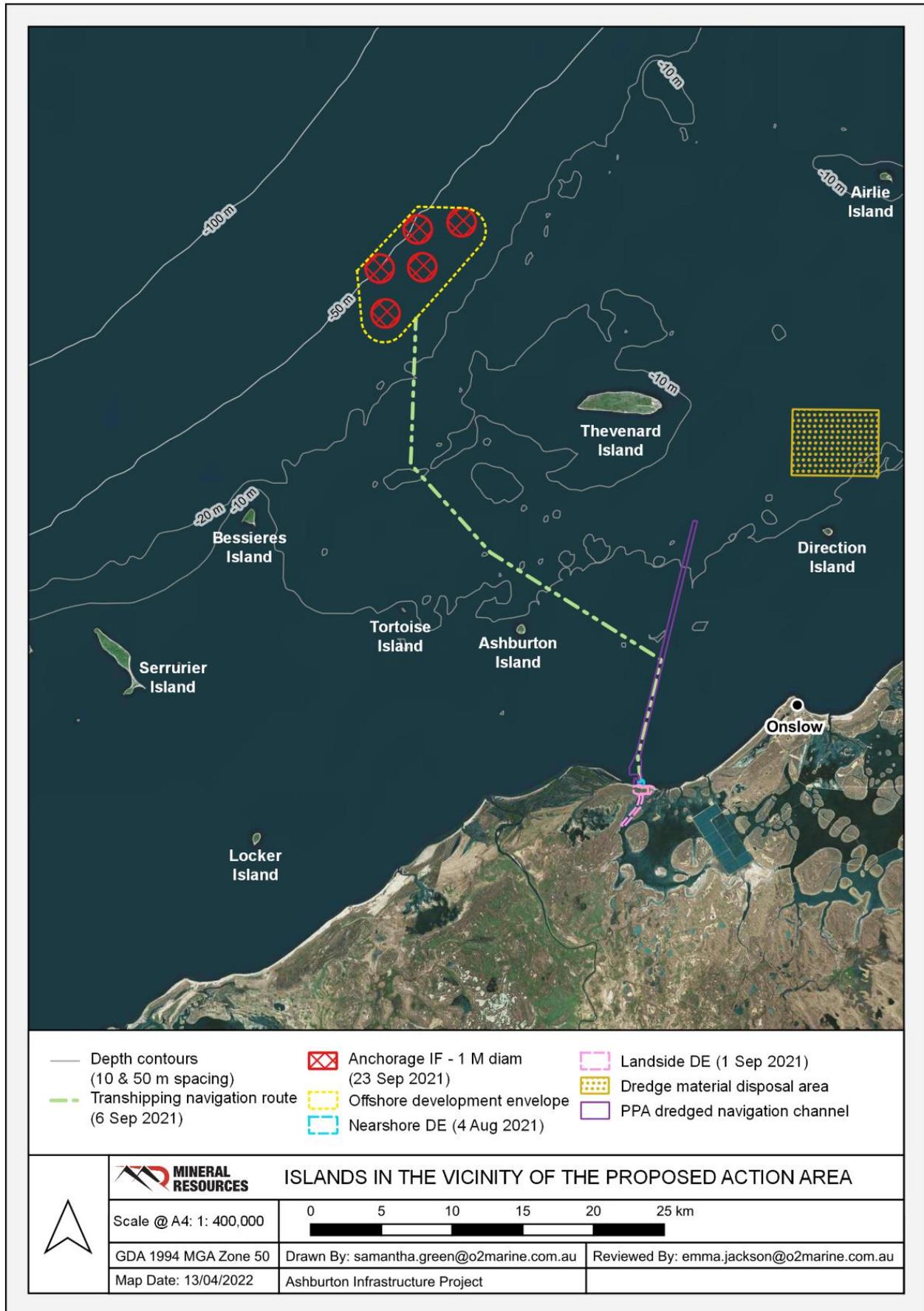


Figure 2-24: Islands in the Vicinity of the Proposal Area

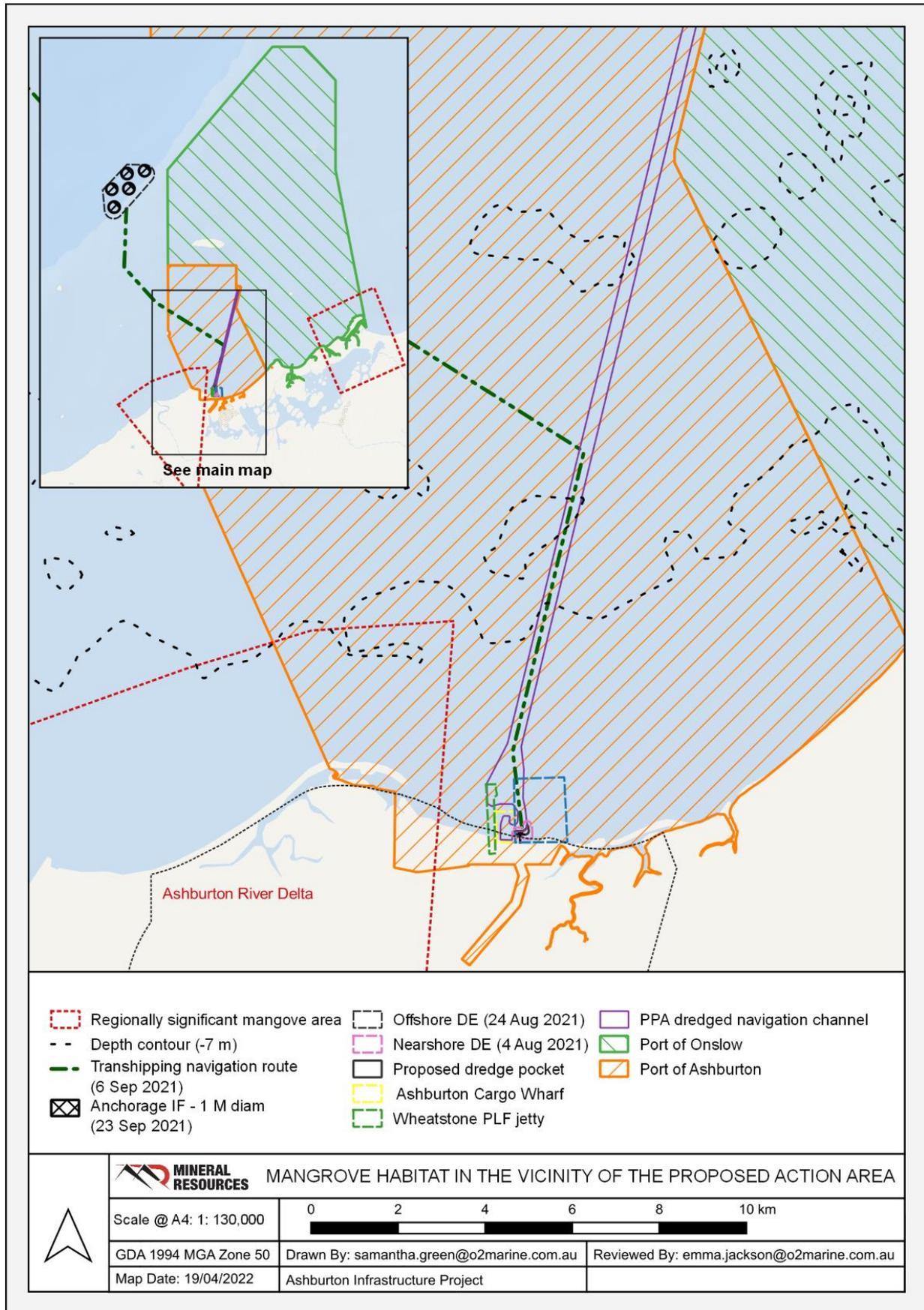


Figure 2-25: Mangrove Habitats in the Vicinity of the Proposal Area

2.3.2.8 Important Marine Mammal Areas

The project area is situated within the Ningaloo Reef to Montebello Islands has been identified as an Important Marine Mammal Area (IMMA) by the International Union for the Conservation of Nature due to the occurrence of Dugongs, inshore Dolphins and Humpback Whales in addition to occasional visits by pelagic cetacean species (MMPATF 2021). IMMAs are defined as discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation.

2.3.3 Land Use

The Proposal is located in the Pilbara region of WA, within the Shire of Ashburton. The Proposal begins about 45 km southwest of Pannawonica and extends westward towards Onslow. The marine components are located offshore at the Port, about 12 km southwest of the Onslow township. This region is serviced by the Great Northern Highway and Onslow Airport.

Primary land uses in the vicinity of the Haul Road DE are pastoral and mining purposes. The Haul Road DE crosses two significant pastoral leases; Red Hill Pastoral Station and Peedamulla Pastoral Station, approximately 7 km and 1.6 km from each respective homestead. Access agreement negotiations are well progressed with both station owners and are progressing towards long term agreements to compensate the station owners for impacts of the linear infrastructure. To date, discussions have been positive and progressing to the point where agreements can be finalised in the near future. In addition to Red Hill and Peedamulla Pastoral Stations, the haul road will run adjacent to Minderoo Station and approximately 22 km from the homestead. Whilst the Proposal will not intersect the station, the Proponent will ensure that Proposal activities do not interfere with pastoral interests.

The Proposal is also located on mineral and petroleum tenure. The Haul Road DE is surrounded by several exploration projects owned. There are no mining operations underway at present for any of these activities. The Haul Road DE also intersects with the Dampier to Bunbury Gas Pipeline and Goldfields Gas Pipeline.

The proposed Port facilities will be located within the Port which is a multi-user port and strategic industrial area. The following developments are located in proximity to the proposed facilities (**Figure 2-26**):

- Township of Onslow includes residences, schools and recreation areas approximately 12 km northeast;
- BHP Macedon Gas located approximately 6 km to the southwest;
- Chevron Wheatstone located immediately to the west; and
- Onslow Salt – evaporation ponds (3 km to the southeast) and stockpiles and export facilities (10 km to the northeast).

Recreational activities near the Port are mainly facilitated through the Onslow township and include fishing and walking in the seaside town.

2.3.4 Other Nearby Projects

There are a number of existing and reasonably foreseeable projects within 50 km of the Proposal, and more broadly within the Pilbara region. These are listed in **Table 2-8** and shown in **Figure 2-26**.

Table 2-8: Existing and Foreseeable Projects within the Pilbara and Carnarvon Bioregions

Project Name	Approximate Distance from Proposal Area
Existing Projects*	
MinRes' Bungaroo South	Adjacent to the Haul Road DE
Macedon's Domestic Gas Plant	5 km
Wheatstone's LNG Project	Overlapping the Landside DE
K + S's Ashburton Salt Project	1 km
Water Corporation's Onslow Water Infrastructure Upgrade Project	1 km
Onslow Resource's Ashburton River Sand and Shingle Excavation	13 km
Onslow Marine Support Base's Stage 2 Capital Dredging	8 km
Water Corporation's Onslow Seawater Desalination Plant	11 km
API's West Pilbara Iron Ore Project Stage 1 and Stage 2	Overlapping to the Haul Road DE
Shire of Ashburton's Pilbara Regional Waste Management Facility	15 km
MinRes' Onslow Camp Dunes Project	Adjacent to the Haul Road DE
MinRes' Accommodation Village	16 km
Reasonably Foreseeable Projects**	
Hasting's Onslow Rare Earths Plant	4 km
MRWA's Warrirda Road Corridor Project	Adjacent to the Haul Road DE
PPA's Eastern Port Precinct	Overlapping the Landside DE

*this includes projects that have been approved but are yet to be implemented.

** this is defined as projects that have not yet been approved but are currently being assessed.

A number of these projects are related to the Proposal including,:

- Bungaroo South;
- WPIOP Stage 1;
- Warrirda Road Corridor Project;
- PPA's Eastern Port Precinct;

- Onslow Camp Dunes project; and
- Accommodation Village.

Further details of these projects are provided below.

Implementation of the Bungaroo South mine is authorised via MS960 and MS1147. The Bungaroo South mine has not commenced: substantial commencement is required by July 2024. The Bungaroo South mine involves an 8 Mtpa mine, processing facilities and supporting infrastructure.

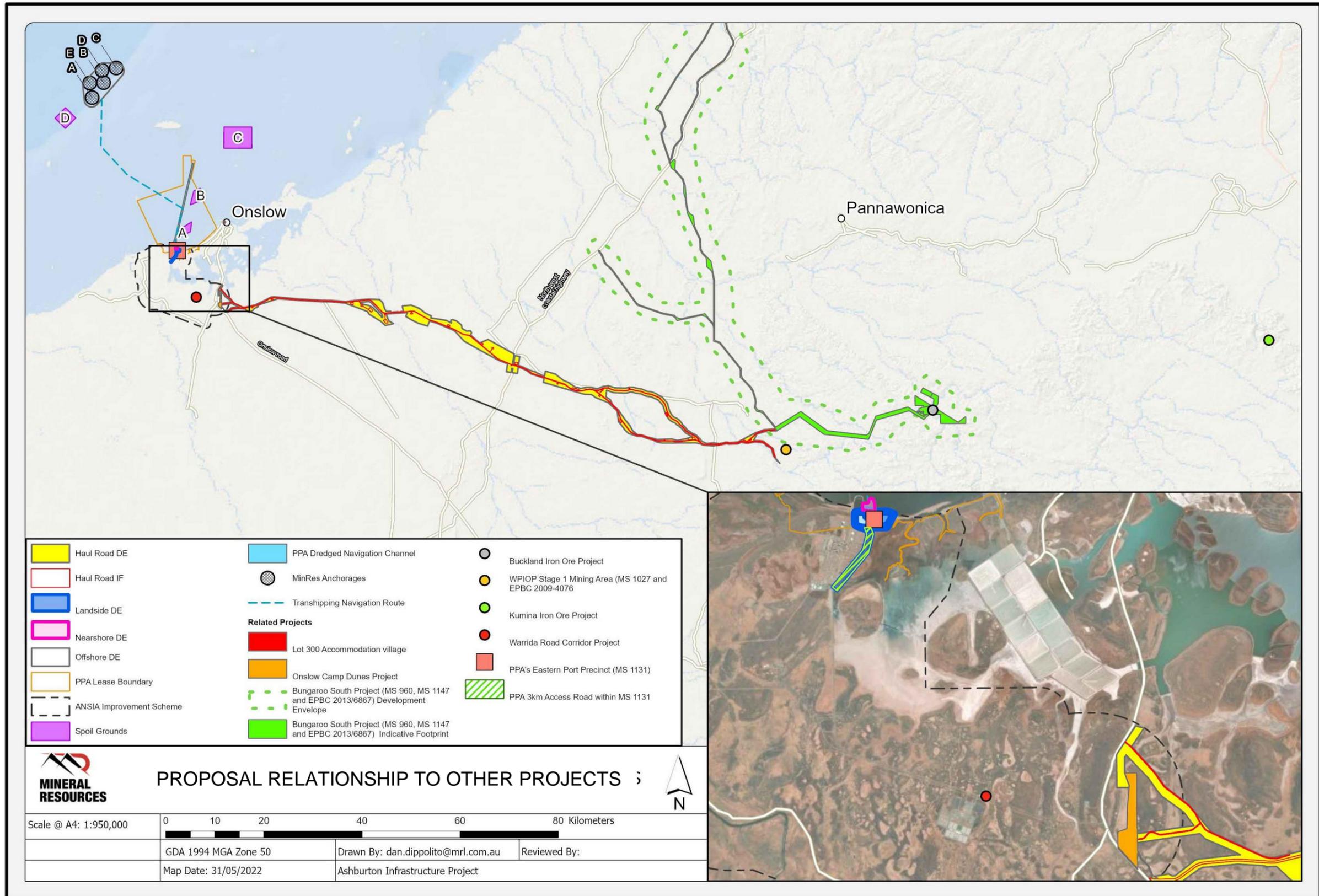
A 176 km haul road from the mine site to the customer delivery point near Cape Preston also formed part of the Bungaroo South mine however, a portion of this road will not be required if the Port is available to the Proponent. The Proponent considers the opportunity to use existing and proposed new facilities at the Port provides a more efficient and safe method of delivery of Bungaroo South mine ore to port for export. Additionally, the Proposal presents reduced potential for environmental impact and risk compared with the approved Bungaroo South project given the co-location of infrastructure. Future plans include amending the Bungaroo South mine approvals to permit increased production to 20 Mtpa.

Ministerial Approval was granted under Part IV of the EP Act to APIM for the WPIOP via Ministerial Statement 1027 (MS 1027) and controlled action EPBC2009/4706, with substantial commencement required by February 2021. APIM is progressing a Section 46 amendment under the EP Act for the WPIOP to extend the substantial commencement date. Due to overlapping tenure in a section of the Haul Road DE with APIM's WPIOP, the disturbance footprints of the two have been consolidated and progress is underway to incorporate the APIM gas pipeline and haul road link within the Haul Road DE. As such, the Proposal presents an immediate opportunity to minimise and consolidate currently approved, and reasonably foreseeable future environmental impacts.

Main Roads Western Australia (MRWA) require construction upgrades to the Onslow Road and Warrirda Road intersection and widening of Warrirda Road within the ANSIA, to support proposed activities out of the Port. The MRWA public road and Warrirda Road overpass is proposed to be a multi-user public road, with MRWA as the responsible authority. The Warrirda Road Proposal will improve road safety, ensuring haul vehicles entering and exiting Warrirda Road do not pose a safety risk to road traffic. The Proposal is located approximately 12 km south of Onslow in the Shire of Ashburton. MRWA are applying for a native vegetation clearing permit for these activities. The Proposal will utilise this road to access the Port.

The PPA is proposing to develop an area of land at the Port referred to as the EPP. The EPP development area footprint is under the control and management of the PPA under the *Port Authorities Act 1999*. The EPP will be developed through clearing, filling and construction of an outer revetment rock wall. The filling of the site will provide a development-ready hardstand area at an elevation suitable for the Port infrastructure proposed as part of this Proposal. PPA are currently requesting a change to a proposal for MS1131 under Section 45C of the EP Act to undertake these works.

Kumina Iron Pty Ltd (a subsidiary of the Proponent) have also recently acquired the Onslow Camp Dunes project located 15 km south of Onslow along the Onslow Road. The project includes the construction and operation of a crushing and screening plant and a 200-man accommodation facility with a WWTP. The crushing and screening plant (CSP) will have the capacity to operate at 300 tonnes per hour (tph), with an annual capacity of up to 500,000 tonnes per annum (tpa) of material. The WWTP has a capacity of 90 cubic metres (m³) per day. A Mining Proposal was submitted and approved under the Mining Act for these activities. A Native Vegetation Clearing Permit (NVCP) has also been submitted and approved under Part V of the EP Act (CPS 5807 & 5808). Kumina Iron Pty Ltd is currently in the process of renewing these permits.



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Figure 2-26: Existing and Foreseeable Projects within the Pilbara and Carnarvon Bioregions

3. LEGISLATIVE CONTEXT

3.1 Environmental Impact Assessment Process

The Proposal is subject to assessment under the WA EP Act. The Proposal was also referred to the Australian Governments Department of Agriculture, Water and the Environment (DAWE) under the Commonwealth EPBC Act and deemed a Controlled Action on 16 November 2021 with the potential to impact on Matters of National Environmental Significance (MNES).

The Proponent decided to split the approvals assessment process into two, opting for independent assessments under the Commonwealth (EPBC Act) and State (EP Act) in order to support the progress of a Minor and Preliminary Works Application (MPWA) under Section 41A (3) of the EP Act. Subsequently, the Proponent lodged a request with DAWE to proceed with an independent assessment of EPBC Referral 2021-9064 under the EPBC Act, rather than proceed with an accredited assessment under the WA EP Act. Further information on the State and Federal approvals processes are outlined in **Section 3.1.1** and **Section 3.1.2** respectively.

This RSD content, format and environmental assessment have considered the following EPA guidance:

- Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures (EPA 2016a); (Administrative Procedures);
- Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual (EPA 2020d) (Procedures Manual);
- Statement of Environmental Principles, Factors and Objectives (EPA 2020e);
- Instructions – How to identify the content of a Proposal (EPA 2020f; EPA 2021a);
- Instructions –How to prepare an Environmental Review Document (EPA 2020b, EPA 2021b);
- Instructions – Environmental outcomes and outcomes-based conditions (EPA 2020g);
- Instructions for preparing data packages for the Index of Biodiversity Surveys for Assessments (IBSA) (EPA 2020h); and
- Instructions on how to prepare EP Act Part IV Environmental Management Plans (EMPs) (EPA 2020c).

3.1.1 Western Australian *Environmental Protection Act 1986*

In WA, the principal legislation governing environmental assessment of development proposals is the EP Act. EIA of development proposals is undertaken by the EPA in accordance with Part IV Division 1 of the EP Act and the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016*.

Any proposal likely to have a significant environmental effect on the environment should be referred to the EPA under Section 38 of the EP Act. The EPA will decide whether or not to assess the proposal and if it is to be assessed will determine the level of assessment of the proposal and other proposal-specific information required. The EPA will assess the proposal based on referral information, additional assessment information where required (including an RSD that meets EPA's Environment Review Document preparation guidance) (ERD) prepared by the proponent or the EPA's own investigations and inquiries) and submissions if information is made available for public review.

At the completion of the assessment, the EPA will prepare a report and recommendations for the Western Australian Minister for Environment. The assessment report sets out what the EPA considers are the key environmental factors identified in the course of the assessment, the EPA's recommendations as to whether or not the proposal may be implemented and the conditions and procedures to which implementation should be subject. The Minister for Environment considers the EPA's report and any public appeals before determining, in consultation with other Ministers, whether the proposal should be allowed to proceed, and if so, under what conditions.

The Proponent has undertaken pre-referral consultation with the Western Australian Department of Water and Environmental Regulation EPA Services (DWER-EPAS) and Australian Department of Agriculture, Water and Environment (DAWE) regarding the EIA of the Proposal. The Proponent anticipates that the Proposal will be assessed under Part IV of the EP Act based on referred information.

3.1.2 Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*

The EPBC Act is the Australian Government's key piece of environmental legislation, which enables protection of the environment and in particular MNES. The EPBC Act is administered by the DAWE.

The Proposal (EPBC 2021/9064) was referred to DAWE under the EPBC Act and on 16 November 2021 was deemed a Controlled Action with the potential to impact on the following MNES:

- Listed threatened species and communities (sections 18 & 18A); and
- Listed migratory species (sections 20 & 20A).

The Proponent made the decision to split the approvals assessment process for the Proposal, to pursue separate assessment and approvals under the Commonwealth EPBC Act and the Part IV of the WA EP Act, in order to support the progress of a Minor and Preliminary Works application under s 41A(3) of the EP Act.

A determination was made by DAWE on 16 February 2022 that the Proposal would be assessed at the level of a Public Environment Report (PER). On the same date, DAWE provided guidelines for the preparation of a PER: Guidelines for the content of a draft Public Environment Report – Ashburton Infrastructure Project – *Environmental Protection and Biodiversity Conservation Act 1999* (Reference: 2021-9064). The Proponent has prepared and submitted a PER, supporting technical studies and Management Plans, with a proposed public release of the PER, for a 20 business day public comment period commencing in early July 2022.

Under the EPBC Act assessment process, the Proponent is required to provide a response to public comments submission for DAWE, and provided an updated version of the Final PER. DAWE is then required to prepare a recommendation report and Draft Proposed Decision briefing for the Commonwealth Environment Minister, to make a decision upon. The Commonwealth Environment Minister has four weeks to make a decision to approve the Proposal and proposed approval conditions. This decision is not appealable. The Proponent anticipates that the EPBC Act assessment and approvals process will be completed by Q4 2022.

3.1.3 Commonwealth *Environmental Protection (Sea Dumping) Permit Act 1981*

In Australia, the Commonwealth *Environmental Protection (Sea Dumping) Act 1981* requires that a Sea Dumping Permit be obtained for the placement of soil on the seabed. This Act is regulated by DAWE and actions obligations outlined under the London Protocol (1996). The National Assessment Guidelines for Dredging 2009 (NAGD) lay out the framework for EIA and requirements to gain a permit to undertake ocean disposal of a dredged material.

Currently the PPA's Long Term Dredge Management Plan (LTDMP) has been approved for maintenance dredging within the Port. However, to undertake the Proposal the Proponent will require a permit for capital dredging activities during the construction phase of the project. Future upkeep of the area will be maintained under the existing LTDMP for the Port, which will be amended to include the proposed dredge pocket.

The Proponent submitted a Sea Dumping Permit Application (SDPA) (SD2022/4018) to DAWE's Sea Dumping Section on 24 January 2022. The SDPA is currently under assessment by DAWE. The Proponent received a formal Request for Information (RFI) on 24 February 2022 and provided a revised SDPA and DSDMP on 12 May 2022. The SDPA will undergo assessment concurrently with the PER under EPBC Act assessment requirements. The Proponent anticipates the SDPA will be approved by November 2022.

3.2 Other Approvals and Regulations

3.2.1 Native Title

Native title is the set of rights and interests over land and waters in Australia and its Territories that have been established through traditional Aboriginal law and custom and is recognised under the Commonwealth *Native Title Act 1993*, balanced with other rights and interests in the area in question.

Native title rights and interests may include rights to:

- Decide who can access land.
- Access an area for traditional purposes, like camping or ceremonies.
- Visit and protect important places and sites.
- Hunt, fish and gather food or traditional resources like water, wood and ochre; and
- Teach law and custom on country.

Australian law recognises that native title exists where Aboriginal people have maintained a traditional connection to their land and waters, where acts of government have not extinguished it.

Portions of the Haul Road and Landside DEs are on the land the subject of two native title determinations (**Figure 3-1**):

- Thalanyji (WCD2008/003); and
- Kuruma Marthudunera Part B (WCD2018/003).

Buurabalayji Thalanyji Aboriginal Corporation (BTAC) is the prescribed body corporate (PBC) representing the Thalanyji People and the Robe River Kuruma Aboriginal Corporation (RRK) is the PBC that holds the native title rights and interests on trust for the Kuruma Marthudunera people.

The PPA has a heritage agreement with the Thalanyji People guiding consultation and other matters that may affect Thalanyji interests including within the Landside DE. The Proponent activities within the Landside DE will be managed under a Heritage Management Plan approved by the PPA.

No native title determination extends over the Nearshore and Marine DEs.

3.2.2 Tenure

The Haul Road DE is currently located on the Proponent granted miscellaneous licences 08/205, 08/206, 08/208, 08/215 and 08/216 and miscellaneous licence applications 08/202, 08/209, 08/210, 08/211, 08/212, 08/214, 08/219, 08/231, 08/232 and 08/253 and application for miscellaneous licence 08/199 (applied for by APIM).

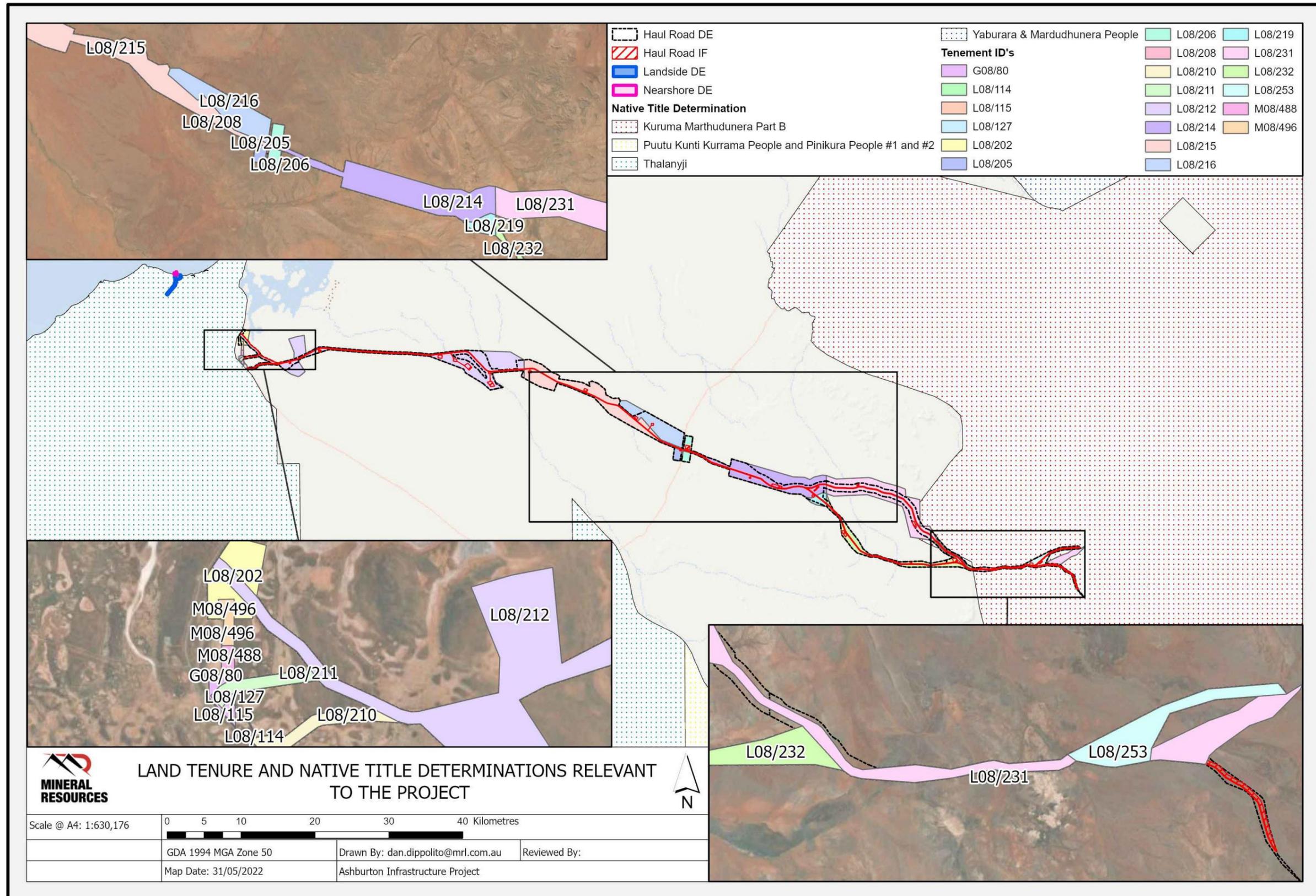
The Proponent is entering into a commercial arrangement with PPA (via approved Development Applications and negotiating Construction Applications). The Proponent is also negotiating a lease agreement with PPA, allowing the Proposal to be developed and for the Proponent to carry out activities on PPA vested lands, seabed or water areas. Land tenure relevant to the Proposal is shown in **Figure 3-1**.

3.2.3 Other Decision-Making Authorities and Approvals

Other Decision Making Authorities (DMAs), their statutory decision making processes and approvals that are required for the Proposal are summarised in **Table 3-1**.

Table 3-1: Other Approvals Required for the Proposal

Decision Making Authority	Legislation or Agreement regulating the Activity	Approval Required	Can the Statutory Decision Making Process Regulate Impacts on the Environment? (Yes/No and Summary of Reasons)
DAWE	EPBC Act	EPBC Act referral	Yes- Assessment of potential impacts to MNES associated with the haul road, port landside and marine activities.
	<i>Environment Protection (Sea Dumping) Act 1981</i>	Sea Dumping Permit – placement of spoil	Yes - Assessment of the change in purpose from maintenance spoil only to allowing capital spoil.
DWER	Rights in Water and Irrigation Act 1914 (RIWI Act)	Section 5c licence to take water	Yes - Assessment of the abstraction of groundwater associated with the water supply for haul road construction.
		Section 26D licence to construct or alter a well	Yes - Assessment of the construction of a bore to access water for haul road construction.
		Permit to Obstruct or Interfere with Bed/Banks	Yes - Assessment of the interference with bed and banks of a watercourse from haul road construction
DWER	EP Act Part V	Works Approval and Licence Operating Licence	Yes - Assessment of construction and operation of port landside facilities and crushing Facilities and assessment of the construction and operation of wharf and transshipping facilities
DMIRS	<i>Mining Act 1978</i>	Mining Proposal MCP Programme of Works	Yes - A Mining Proposal will be submitted to DMIRS in support of the application of a mining lease under the <i>Mining Act 1978</i> . A MCP will also be required to be submitted with the Mining Proposal. Separate to the above, a Project Management Plan (PMP) will be submitted to DMIRS addressing construction works. The PMP will be progressively augmented to address operational risks.
DMIRS	EP Act Part V	Native Vegetation Clearing Permit	Yes (If required), Assessing of impacts of clearing of native vegetation.
DMIRS	<i>Dangerous Goods Safety Act 2004 (DG Safety Act)</i>	Dangerous goods licence	Yes, Assessment of the storage and handling of dangerous goods.
DMIRS	Petroleum Pipelines (Environment) Regulations 2012	Environment Plan	Yes, Assessment of environmental factors and management measures for construction, commissioning, operation and maintenance of gas pipeline.
DMIRS	Petroleum Pipelines (Management of Safety of Pipeline Operations) Regulations 2010	Safety Case	Yes, for any activity associated with construction, commissioning and operation of gas pipelines.
DMIRS	<i>Petroleum Pipelines Act 1969</i>	Consent to Operate	Yes, Assessment of Environment Plan and Safety Case.
Department of Planning, Lands and Heritage (DPLH). Minister for Aboriginal Affairs	<i>Aboriginal Heritage Act 1972 (AH Act)</i>	S. 16 authorisation to enter, excavate, examine or remove anything on an Aboriginal site S. 18 consent where the impact on an Aboriginal site is unavoidable	Yes, provides authorisation to enter, excavate, examine or remove anything on an Aboriginal site and provides an assessment on impacts to Aboriginal sites if an impact is unavoidable.
Minister for Environment and Chief Executive Officer, Department of Biodiversity, Conservation and Attractions	<i>Biodiversity Conservation Act 2016 (BC Act)</i>	Impacts to threatened flora and fauna species are managed through DBCA:	Yes - Provides authorisations to take threatened flora species and authorisations to take or disturb threatened flora species
Western Australian Planning Commission	<i>Planning and Development Act 2005</i>	District Water Management Strategy (DWMS) and Local Water Management Strategy (LWMS).	Yes – The Port Landside Development will comply with the requirements of the DWMS and LWMS which have both been previously approved by DWER and are administered by WAPC. The primary objective of the DWMS is to minimise potential impacts on natural ecosystems relying on pre-development hydrological regimes and prevent unacceptable flooding and is supported by the LWMS.



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Figure 3-1: Land and Tenure and Native Title Determinations Relevant to the Proposal

4. STAKEHOLDER ENGAGEMENT

MinRes recognises the value of building positive relationships with key stakeholders and the communities in which we are active. The Proponent has undertaken research to understand the social landscape of the Shire of Ashburton and any impacts and issues, as well as identify the key community groups and stakeholders impacted by the Proponent's projects. They seek to build sustainable partnerships with business partners, governments, non-government organisations, host communities and other stakeholders to support mutually beneficial outcomes.

Underpinning MinRes' stakeholder engagement is the organisation's 'Six Pillars of Community Relations' which ensures a balanced approach across the following areas:

- Native Title.
- Aboriginal Heritage.
- Aboriginal Engagement.
- Stakeholder Engagement.
- Business Development and Capacity Building.
- Employment and Training.

The Proponent strives to engage early, openly, honestly and regularly with the communities impacted by their operations and consider their views in decision-making with respect to key planning, operational and closure aspects.

4.1 Key Stakeholders

The Proponent recognises the value of building positive relationships with key stakeholders and the communities in which they are active. They seek to build sustainable partnerships with business partners, governments, non-government organisations, host communities and other stakeholders to support mutually beneficial outcomes.

The Proponent strives to engage early, openly, honestly and regularly with the communities impacted by their operations and consider their views in decision-making with respect to key planning, operational and closure aspects.

The Proponent has identified the following key stakeholders for the Proposal listed in **Table 4-1**.

Table 4-1: Key Stakeholders to the Proposal

Stakeholder Sector	Organisation
Australian Government Agencies	Department of Agriculture, Water and the Environment (DAWE)
State Government Agencies & Members of Parliament	Conservation Council WA
	Department of Biodiversity, Conservation and Attractions (DBCA)
	Department of Jobs, Tourism, Science and Innovation (JTSI)
	Department of Planning, Lands and Heritage (DPLH)
	Department of the Premier and Cabinet (Ministers for Water and Environment)
	Department of Primary Industries and Regional Development

Stakeholder Sector	Organisation
	Department of Transport (DoT)
	Department of Water and Environmental Regulation (DWER)
	Department of Water and Environmental Regulation – Environmental Protection Authority Services (DWER – EPAS)
	Development WA (DevWA)
	Environmental Protection Authority (EPA)
	Main Roads WA (MRWA)
	Pilbara Port Authority (PPA)
	Department of Agriculture, Water and the Environment (DAWE)
	Alinta Energy
	Telstra
Local Government	Shire of Ashburton
Traditional Owners	Buurabalayji Thalanyji Aboriginal Corporation (Thalanyji)
	Jundaru Aboriginal Corporation (Peedamulla Station lessee, all consultation discussed as Peedamulla Station)
	Robe River Kuruma Aboriginal Corporation (RRK)
	Ashmulla Aboriginal Corporation (Peedamulla Station sub-lessee)
Private Industry	Australian Premium Iron Management's (APIM)
	Chamber of Minerals and Energy (CME)
	Chevron Australia Pty Ltd
	KUFPEC Australia (Julimar) Pty Ltd Kyushu Electric Wheatstone Pty Ltd
	Finder No 3 Pty Ltd
	Mackeral Islands Pty Ltd
	Mineral Edge Pty Ltd
	Mobil Resources Company Pty Ltd
	Onslow Chamber of Commerce and Industry (OCCI)
	Onslow Marine Support Base
	Onslow Salt
	Wheatstone Pty Ltd
	Pilbara Mesquite Management Committee

Stakeholder Sector	Organisation
	Pilbara Development Commission
	Sapuraomv Upstream (Western Australia) Pty Ltd
	Santos Offshore Pty Ltd
	Strike Resources
	Shell Australia Pty Ltd
	Regional Development Australia
	Rio Tinto
	WA Fishing Industry Council (WAFIC)
	Woodside Energy Julimar Pty Ltd
	Wildflower Society
Pastoralists	Peedamulla Station (Jundaru Aboriginal Corporation)
	Red Hill Station
	Minderoo Station
Community	Bird Life Western Australia
	Onslow Community
	Onslow School
	Onslow Police

4.2 Stakeholder Engagement Process

Community consultation and stakeholder engagement forms an integral part of the Proponent's activities within the Proposal Area. The Proponent undertakes consultation with the Ashburton community through regular community forums and community consultation groups.

The Proponent undertakes various avenues of consultation and differing initiatives to ensure community and stakeholder expectations within the Shire of Ashburton and Onslow community are met. The Proponent achieves this through engagement, consultation, and investment.

Stakeholder engagement commenced for the Proposal commenced in 2020 and is ongoing. The Proponent undertakes consultation with the Ashburton community through regular community forums and community consultation groups including:

- Briefings and presentations with key regulatory authorities and potentially affected parties to provide information on the Proposal, planned studies and request feedback.
- Face to face meetings, telephone calls and written correspondence with potentially affected stakeholders to provide updates on the Proposal and obtain additional feedback.

Through this variety of engagement forums, the Proponent has been able to identify the required studies and investigations and importantly, key social and environmental effects and associated mitigation and management strategies required to support this Proposal.

4.3 Stakeholder Consultation

MinRes understands that a project of this nature involves a diverse range of stakeholders including landholders and occupiers, government (Commonwealth, State, local), local businesses, suppliers, other mining and resource proponents, media, activists, indigenous groups, industry and interest groups and the wider local community. As a result, the Proponent has developed a project specific Stakeholder Engagement Plan (SEP) that documents relevant project stakeholders and information about the method and level of engagement they require. The primary target community is Onslow, with secondary target communities and groups from the Shire including Karratha, Tom Price, Bindi Bindi and Peedamulla. The key stakeholder consultation and engagement activities undertaken for the Proposal, to date by MinRes are summarised in **Table 4-2**.

Outcomes of historical and ongoing stakeholder consultation activities are recorded in a Stakeholder Consultation Register, which is a live document that interconnects with the SEP.

4.3.1 Documented Response to Consultation

The Proponent has a number of established systems and procedures in place to consult, inform and communicate with stakeholders, particularly landowners and occupiers of private or public land, and the local community including native title holders and indigenous groups.

The Proponent has a tailored consultation management database to support stakeholder consultation across its projects. The database is a platform from which all activities, discussions and communications are captured, monitored and tracked for reference as the project advances.

As new stakeholders become identified, their details are added to the system to ensure consultation is thorough and inclusive, and appropriately actioned.

The stakeholder consultation database will track actions against delivery and resolution of issues, commitments or grievances identified. Under this approach, accountability is assigned to appropriate points of contact internally at MinRes who are responsible for addressing any action outlined under the consultation record. This generates traceability and ensures the Proponent remains responsive to the requests of their stakeholders. The Proponent is also able to track trends that may occur with stakeholder issues, enabling the company to proactively identify issues and work towards a solution with affected parties.

4.4 Ongoing Engagement

Following the community forum presentation to the Onslow community in August, MinRes has committed to regular and ongoing consultation with local residents. MinRes' Principal Stakeholder Engagement has committed to (and maintained) being available in Onslow on a weekly basis for one-on-one consultations and to hear and address any concerns of the local community directly. This commitment will continue until such time that a local Community Development Officer is appointed – local candidates are currently being interviewed, with the role expected to be filled by the end of October 2021. An office will be opened in town to coincide with this appointment and will be made available on set hours for local engagement as required.

MinRes' has established a Community Reference Group (CRG) to provide a more formal, structured update to the community on a monthly basis and will ensure regular and ongoing consultation is maintained.

Table 4-2: Stakeholder Consultation for the Proposal

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
Regulators			
DAWE	<p>Consultation has taken place from August 2021, mainly through online and face-to-face meetings.</p> <p>Engagement has included initial pre-referral, various ongoing technical consultations followed, and agreed schedules developed</p> <p>Higher level meetings also provided strategic context in relation to the Proposal.</p> <p>Engagement took place in January 2022 to cover activity such as Minor & Preliminary Works.</p>	<p>Project scope and overview, baseline surveys, MNES terrestrial, MNES marine, avoidance and mitigate, predicted outcomes, expected time frames, process and approvals.</p> <p>Clarification on Controlled Action Decision for EPBC Referral 2021-9064</p> <p>Notification of lodgment of EPBC Referral 2021-9064</p> <p>Processing of EPBC2021-9064 via Gateway</p> <p>Receipt of Referral EPBC2021-9064, published online for comment.</p> <p>Minor & Preliminary Works</p> <p>Pre - Referral Meeting for the Ashburton Infrastructure Project - Sea Dumping Permit</p> <p>AIP DAWE Meeting - Independent EPBC assessment</p>	<p>MinRes provided update on the LOA expected timeframes.</p> <p>DAWE confirmed receipt of Sea Dumping Application.</p> <p>MinRes confirmed to cc DAWE into any correspondence with the EPA to progress with an accredited assessment to enable DAWE to make an official decision.</p> <p>MinRes briefed DAWE on MinRes' request for dredging as "early works" after application is lodged.</p> <p>Ongoing engagement.</p>
JTSI	<p>Updates provided as necessary to various stakeholders within JTSI since introducing the project in July 2020 and maintaining updates ongoing, mainly via face-to-face meetings.</p>	<p>Project introduction.</p> <p>Access locations for the ANSIA and interaction with other Proponents.</p> <p>General discussion about GIA and MinRes works.</p>	<p>No issues raised.</p>
Pilbara Ports Authority	<p>Regular and ongoing consultation has taken place between MinRes and PPA since July 2020.</p> <p>Weekly meetings between MinRes and PPA have been implemented at times throughout this period.</p>	<p>Project introduction.</p> <p>Port location options and road options.</p> <p>Approval's process and requirements.</p> <p>Proposed layouts for port lease area including site access path and loadout options.</p> <p>Landside layout and berth study.</p> <p>Dredging and sea dumping approvals.</p> <p>Request for further information relating to NVCP application, potential water sources, potential for background dust monitoring, and early works potential for bulk earthworks</p> <p>Port Landside layout</p> <p>Port Development Application</p> <p>EPP Stage 1 lot design kick off between PPA, MinRes and BGER.</p> <p>Commercial agreements to be drafted between MinRes and PPA, e.g. Infrastructure Agreement, Lease Agreement and licensing"</p> <p>MinRes activity in Onslow.</p> <p>MinRes presented to the PPA Technical Advisory Committee to give an overview of the project as well as detail regarding the port development, dredging requirements and environmental impacts and mitigation.</p>	<p>MinRes provided project definition document.</p> <p>MinRes provided further information relating to NVCP application, potential water sources, potential for background dust monitoring, and early works potential for bulk earthworks.</p> <p>Ongoing refinement of footprint to meet PPA access requirements and tie in with PPA stage 1 lot development.</p> <p>Ongoing resolution of technical queries.</p> <p>Ongoing weekly meetings between MinRes and PPA.</p>

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
		<p>Review Construction Application assessment (Earthworks and Landside), including outstanding Technical Queries.</p> <p>MinRes Environmental Management Plan Discussion. Succeeded meeting on required revision of CEMP to support CA process.</p> <p>Construction Application assessment (Earthworks and Landside), including outstanding Technical Queries</p> <p>AIP Dredging approvals update.</p> <p>Construction Application assessment (Earthworks and Landside), including outstanding Technical Queries</p> <p>Early works consultation meeting.</p> <p>Dredging maintenance contingency</p> <p>Mobilisation – MinRes targeting 6th June for establishment of facilities and 20th June for earthworks commencement.</p> <p>Dilapidation survey and baseline environmental audit.</p>	
DWER	<p>Project was introduced via consultation in July 2020 and since then there have been regular engagements between MinRes and DWER through to March 2022 and ongoing.</p>	<p>Proposal to the EPA, including the scope of the Proposal, required approvals and associated timeframe.</p> <p>Impacts associated with road, port and transshipping construction and operations.</p> <p>Presentation of the scope of the s38 referral and the additional survey effort being undertaken.</p> <p>Proposal and approvals pathway.</p> <p>Presentation of Preliminary Impact Assessment for the Proposal including the identification of Key Factors, level of assessment and additional technical studies underway (baseline and modelling).</p> <p>Approval targets and timeframes and supporting documents for the referral.</p> <p>Minor and Preliminary Works</p> <p>Ashburton Hub Water Strategy, short term construction water requirements, long term operational water requirements</p> <p>RIWI Act Assessments</p>	<p>MinRes to continue engagement as the Proposal develops and scope is finalised.</p> <p>MinRes to progress one s38 referral document.</p> <p>MinRes focused s41A (3) application on lower impact areas and reducing the linear extent. Prioritised degraded areas and factor this into a supporting impact assessment.</p> <p>Provided DWER water strategy presentation</p> <p>Attached cover letter to 26D applications - detailing link to MinRes water strategy'</p> <p>MinRes supplied a table of priorities, defined by when we are targeting an approval date.</p> <p>MinRes supplied investigative works letter recently submitted to the EPA</p> <p>Ongoing engagement required.</p>
EPA	<p>Ongoing and regular consultation has occurred between MinRes and EPA since July 2020 to date with engagement ongoing, significantly the engagements have been face-to-face meetings and at times involving other agencies such as DWER and DMIRS.</p>	<p>Project introduction, approval strategy and timeframes for approvals.</p> <p>Ashburton Project referrals under S.38 of the EP Act, proposed timings.</p> <p>Proposal to the EPA, including the scope of the Proposal at present, required approvals and associated timeframe.</p> <p>Impacts associated with road, port and transshipping construction and operations.</p> <p>Presentation of the scope of the s38 referral and the additional survey effort being undertaken.</p>	<p>MinRes continued engagement as the Proposal developed and scope was finalised.</p> <p>MinRes progressed one s38 referral document.</p> <p>MinRes have considered concerns raised by the EPA</p> <p>MinRes progressed request for s41A(3) Minor Preliminary Works.</p> <p>MinRes provided EPA with email correspondence notifying DAWE of independent assessment.</p> <p>MinRes provided EPA with Preliminary Works Application.</p> <p>Ongoing engagement.</p>

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
		<p>Presentation of Preliminary Impact Assessment for the Proposal including the identification of Key Factors, level of assessment and additional technical studies underway (baseline and modelling).</p> <p>Approval targets and timeframes and supporting documents for the referral.</p> <p>Presentation of the Proposal to the EPA Board including avoidance, mitigation and management measures incorporated into Proposal design and forward work plan.</p> <p>Minor and Preliminary Works</p> <p>Update on Ashburton was provided as part of a general joint meeting with DMIRS & DWER on MinRes activities.</p>	
DMIRS	<p>MinRes and DMIRS have engaged regularly since introducing the project in July 2020.</p> <p>Engagements have included regular updates on proposal status, heritage status and approval timelines as well as other engagements to focus on further specific issues and topics.</p>	<p>Project introduction.</p> <p>Presentation of the Proposal and discussion around approvals process, timeline and forward work plan. DMIRS preference is for one MP/MCP for the entire AIP.</p> <p>Update of Proposal status, heritage status and approval timelines.</p> <p>Project Management Plan for port and mine. Mostly an introductory meeting to outline project and provide a heads up on the pending PMP submissions.</p> <p>Notification of Principal Employer and Exploration Operation Notification.</p> <p>Management of RHIOJV and pending approvals for Kens Bore and Ashburton</p>	<p>MinRes planned for one mining proposal to cover the project area.</p> <p>Confirmation from DMIRS that blasting can be undertaken at the airport for construction purposes at Kens Bore within the current MP framework on the assumption that it is covered off in the PMP.</p> <p>Ongoing engagement.</p>
DPLH	<p>MinRes has engaged as necessary with DPLH throughout 2021, with ongoing consultation on various outstanding issues continuing.</p>	<p>Project introduction.</p> <p>S18 resubmission for Bungaroo south.</p> <p>Crossing of the De Grey Mullewa Stock Route.</p> <p>Seabed at Area C approval to deposition of spoils.</p> <p>Water bores and turkeys' nests.</p>	<p>Further engagement, as necessary.</p> <p>DPLH has no objection to MinRes carrying out deposition of spoils within Area C, subject to MinRes undertaking further consultation with Department of Transport and MinRes obtaining environmental approval to carry out the dumping of materials at Area C.</p>
MRWA	<p>Extensive engagement has been undertaken between MinRes and MRWA from July 2021.</p> <p>Fortnightly meetings have been implemented throughout this time to ensure regular engagement.</p>	<p>Project introduction.</p> <p>Proposal layout and approvals pathway within MRWA Corridor.</p> <p>Extra Heavy Vehicle Haul Road to Ashburton Port, Warrirda Road & Onslow Road</p> <p>Various engineering design options.</p> <p>Workshop with engineering consultants BG&E to discuss 60% design review.</p> <p>Discussion of Haul Road design elements and Warrirda Road.</p> <p>Proposal progress including design considerations and approval timeframes.</p> <p>Update of Proposal status, heritage status and approval timelines.</p> <p>Extent of MRWA Scope</p> <p>Traditional Owners and Heritage Survey</p> <p>Geotechnical Drilling</p> <p>MRWA Design Brief details etc.</p>	<p>MinRes to continue engagement through regular meetings and provide proposal updates.</p> <p>MinRes received conditional approval for application for new access road/Intersection Onslow Road.</p>

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
		<p>Dedicated Extra Heavy Vehicle Haul Road to Ashburton Port, Warrirda Road & Onslow Road.</p> <p>Warrirda Cross-Sections</p> <p>Warrirda Road/ North West Coastal Highway Agreements.</p>	
Department of Transport	Only minimal and necessary engagement has been undertaken with the Department of Transport from 2020 and continues to date.	<p>Project introduction.</p> <p>Present update on driver assist/automation project in discuss vehicle automation exemptions and permits.</p> <p>Seabed at Area C approval to deposition of spoils.</p> <p>Dredging and sea disposal activities</p> <p>Port landside construction</p> <p>Water bores and turkeys' nests.</p>	<p>MinRes provided project brief for automated vehicle trial.</p> <p>Continue to meet regularly for project updates</p> <p>Further engagement when and if necessary.</p>
Water Corporation	Initial engagement with Water Corporation began in July 2020 and has been only undertaken, when necessary, throughout 2021 and 2022.	<p>Proposal and Water Corp's involvement with the Chevron Desalination Plant.</p> <p>Fully executed CA signed by both MinRes and Water Corp.</p> <p>Birdrong Bore Report</p> <p>MinRes provided an update to Water Corp on the tenure investigations for Warrirda Road and the proposed entry to Onslow Road.</p> <p>Discussions on truck facility and resort water source and usage.</p>	Further engagement when and if necessary.
Development WA	Initial engagement with Development WA began in July 2020 and since then ongoing engagement has been undertaken on a regular basis. .	<p>Proposal location and roads within the Port of Ashburton.</p> <p>Submission of ANSIA Proposal and road alignment options.</p> <p>DevWA raised issues around Heritage clearance, and established survey work is still required.</p> <p>Discussion regarding Chevron Lease Area within the ANSIA.</p> <p>Meeting held with Development WA and JTSI to discuss the development of the MinRes Haul Road within the ANSIA area.</p>	Further engagement to be undertaken when necessary.
Traditional Owners			
Thalanyji	<p>Extensive and ongoing engagement has been undertaken between MinRes and Thalanyji since 2020.</p> <p>Engagement has included business development and employment opportunities as well as updates on the project and heritage work.</p>	<p>Introductory meeting, presentation of the proposal and discussed the background of the Thalanyji.</p> <p>Proposal updates and request to negotiate an access agreement.</p> <p>Proposal update and upcoming heritage surveys.</p> <p>Proposal update and its relationship to the ANSIA.</p> <p>Business development opportunities.</p> <p>Land opportunities.</p> <p>Globhill-KBSS Joint Venture and introduction to MinRes capabilities</p> <p>Business development and employment days in Perth and Onslow.</p>	<p>MinRes to provide further schedule updates.</p> <p>MinRes to continue engagement regarding business development and employment opportunities.</p> <p>MinRes to support 2022 NAIDOC week initiatives to further commit to working relationship with Thalanyji.</p>

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
		<p>LV workshop business potential for the Proposal.</p> <p>Hydraulic business potential for the Proposal.</p> <p>Proposal overview.</p> <p>Extensive discussions in regard to Lot 300.</p> <p>Facilitated meeting with WA Limestone and BTAC regarding sea wall construction at Onslow</p> <p>Heritage meetings to discuss Lot 300 and Warrida Road.</p> <p>Early Works Consultation update.</p>	
<p>Robe River Kuruma</p>	<p>Extensive and ongoing engagement has been undertaken between MinRes and RRK since 2020.</p> <p>Engagement has included business development and employment opportunities as well as updates on the project and heritage work.</p>	<p>Introductory meeting.</p> <p>Proposal and implementation of a committee meeting.</p> <p>Cultural Heritage Management Plan and upcoming survey schedule.</p> <p>Improving communication and heritage survey planning.</p> <p>Cultural Heritage Management Plan.</p> <p>Business and community development options associated with the proposal.</p> <p>Cultural awareness training, employment, and business opportunities.</p> <p>Project update delivered, environmental studies discussed and planning for upcoming heritage surveys commenced.</p> <p>MinRes' Aboriginal engagement program</p>	<p>MinRes to provide further schedule updates.</p> <p>MinRes to continue engagement regarding business development and employment opportunities.</p>
Local Government Agency			
<p>Shire of Ashburton</p>	<p>Extensive engagement has been undertaken with the Shire of Ashburton since 2020 through to 2022 mainly via face-to-face engagement.</p> <p>Engagement is ongoing to ensure Shire is kept up to date on any activity and current issues.</p>	<p>Introductory consultation.</p> <p>Meeting with Shire Officers regarding the Proposal.</p> <p>Proposal and the availability of dredge spoil material.</p> <p>MinRes in attendance of the Onslow Waste Management Facility opening. Discussion around Proposal timing and request from the community to be kept up to date.</p> <p>Presentation of the Proposal and opportunity to express concerns from the Shire.</p> <p>Community consultation opportunities.</p> <p>Proposal received from the Shire with potentials for community investment.</p> <p>Part-time appointment of an MinRes employee in Onslow,</p> <p>Discussions in regard to development on Lot 300</p> <p>Realignment of Peedamulla Road</p> <p>Access to the Onslow standpipe</p> <p>Attended Shire meetings with Council when voting taking place on development of Lot 300</p> <p>Project updates provided.</p>	<p>MinRes to continue engagement.</p> <p>MinRes to continue to deliver community consultation.</p> <p>Provide ongoing project updates</p> <p>MinRes to provide detailed haul road alignment when available</p> <p>MinRes confirmed there would be no concave pits or open excavations at the conclusion of the mining activities on the Yarri lease</p> <p>MinRes confirmed that Truck Maintenance Facility would contain any retail or other public facilities</p>

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
		<p>Community investment opportunities for the town of Onslow and surrounding areas</p> <p>MinRes proposal to develop a new haul road for transport of iron ore from Kens Bore to Port.</p> <p>Seeking Shire agreement to realign section of Peedamulla Road for safe separation of public traffic from MinRes' proposed haul road.</p> <p>Presented Yarri MP and MCP update.</p> <p>Overview and update on overall Onslow Iron project from Ken's Bore minesite through to the offshore transshipping operation</p> <p>Overview of measures taken during design phase to minimise community and environmental impacts for the life of the project including dust management, low impact marine structures with minimal dredging and disturbance, traffic management</p> <p>Overview of previously approved mining activity and land uses on Yarri</p> <p>Overview of proposed land uses on Yarri lease during construction phase</p> <p>Overview of permanent Road Train Maintenance Facilities on the Yarri mining lease</p> <p>Overview of MinRes Mine Closure and rehabilitation process and dedicated MinRes mine closure/rehab resources</p> <p>Discussion on options at end of mine life for key infrastructure such as roads</p>	
Pilbara Development Commission	Between March and November 2021 engagements with Pilbara Development Commission have taken place to provide updates on the project, timing and opportunities.	<p>Presentation of the project proposal via the Pilbara Summit</p> <p>Presentation to provide update and business opportunities</p>	MinRes to continue to provide updates when appropriate.
Onslow Primary School	Since early 2021 MinRes has been engaging with the local school.	<p>Opportunities to partner with school.</p> <p>Funding ideas - child safety, recycling, shade sails etc</p> <p>Potential to support school through scholarships</p> <p>Potential traffic impacts and possible mitigators</p>	<p>Ongoing engagement to provide updates, ease concerns and progress an ongoing partnership with the school.</p> <p>Engagement with the school has been more focused and strengthened since the employment of MinRes' local Community Engagement Officer on the ground in Onslow.</p>
Regional Development Australia Pilbara	Minimal engagement has been undertaken with RDA Pilbara over 2021 and only when necessary and appropriate has there been engagement, due to less of a need for extensive engagement with this stakeholder.	MinRes presented generic Ashburton Project slide pack and video.	<p>Supportive response from RDA of MinRes.</p> <p>MinRes to continue to provide updates where appropriate.</p>
Onslow Community			
Community Members	<p>Throughout 2021 and 2022 MinRes has increased community engagement and consultation.</p> <p>MinRes has implemented an Onslow Community Consultation Group with members of the community to further</p>	<p>Presented proposal with community members, including local business owners who requested that packages of work (e.g., transport opportunities) are open for tender as the Proposal develops</p> <p>Discussion around the Proposal including environmental impacts, closure plans and contributions from the proposal to the Onslow community.</p>	<p>Engagement with the community has been more focused and strengthened since the employment of MinRes' local Community Engagement Officer on the ground in Onslow.</p> <p>Launched MinRes Community Grants Program through feedback from the community.</p> <p>MinRes to continue to engage via:</p>

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
	<p>engagement. This group meets every three months.</p> <p>One-on-one consultation has been undertaken with community members on request to discuss any topics or issues.</p>	<p>Ashburton project and Lot 300 development.</p> <p>MinRes activity in town and what MinRes' presence will look like.</p> <p>MinRes held a community forum in Onslow where approximately 100 residents attended. Topics presented on were - MinRes overview, Ashburton project overview, Lot 300, town planning, environmental impact, design concepts, community investment.</p> <p>Sought interest from community members about joining the MinRes Community Consultation Group.</p> <p>Implemented Community Consultation Group and defined structure going forward.</p> <p>Community investment discussions and opportunities of what areas of the community requires investment or assistance.</p> <p>Environmental approvals</p> <p>Haul road construction</p> <p>Dust management</p> <p>MinRes housing to be built</p> <p>Haulage road and impact on public</p>	<p>MinRes Community Consultation Group Meetings</p> <p>One-on-one meetings with community members</p> <p>Community presentations to provide project and whole of community updates</p> <p>MinRes reiterate information to ease any concerns such as traffic impacts, dust management etc</p>
Private Industry – Mining and Tourism			
APIM	<p>Engagement has been undertaken since 2020 when relevant and necessary.</p> <p>Discussions have been heavily project based.</p>	<p>Environmental survey planning, timing, and access requirements.</p> <p>Ground disturbance procedures and environmental management measures, and heritage surveys.</p> <p>Proposal elements and forward planning</p> <p>Exploration Camps Associated with Kens Bore.</p>	Ongoing and regular engagement.
Chamber of Minerals and Energy	Initial engagement made with CME in August 2020 and since then only minor engagement when needed.	<p>Detailed introduction of project and required approvals.</p> <p>Presentation of the proposal and discussion of key environmental and community factors.</p> <p>Importance of heritage consultation.</p> <p>Progress of the Ashburton project and more detail on approvals.</p>	Ongoing engagement when necessary and appropriate.
Rio Tinto	Provided initial engagement in May 2021 and since then minimal engagement has been required.	Presentation of proposal and request of feedback on alignments.	<p>No issues raised.</p> <p>Only further engagement when relevant.</p>
Onslow Salt	Various engagements with Onslow Salt over 2021 and 2022 to provide relevant updates and respond to concerns raised.	<p>General project overview and interaction with Onslow Salt at the Port of Ashburton.</p> <p>Presentation of proposal overview, discussion of environmental mitigation and management options, modelling to date and road alignment.</p> <p>Comments on dust and shipping congestion raised.</p> <p>MinRes responded to various concerns raised by Onslow Salt.</p>	<p>MinRes to supply further environmental mitigation measures information.</p> <p>MinRes to continue to provide updates when relevant and respond to any issues or concerns raised by Onslow Salt.</p>

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
Chevron	Engagement with Chevron began in August 2021 and has been proactive and ongoing since. Various engagements in regard to project activity as well as community investment in Onslow.	Removal or potential use of infrastructure. Access requirements to Chevron leases cut-off by our Haul Road. Collaborative approach to community engagement to better understand and assist the Onslow community. Early works consultation meeting.	A positive ongoing relationship through providing updates and working together to support community investment. Increased engagement with Chevron since having MinRes Community Engagement Officer employed locally.
Onslow Chamber of Commerce and Industry	Since 2021 MinRes has undertaken face-to-face engagements and attended meetings with the OCCI to provide updates and strengthen relationships.	Opportunities for MinRes to start considering involvement through the Chamber through attendance at events and meetings. Provide updates on MinRes activity Community investment opportunities Attended OCCI COVID meetings with local businesses and representatives.	Positive relationship and feedback from the OCCI and its members.
Exmouth Sales	Minor engagement regarding building opportunities. No required engagement since.	Discussions regarding building opportunities.	No further engagement required currently.
Mackerel Islands Pty Ltd	Various engagements September 2021 have been undertaken	Informal presentation of the proposal and discussion of potential operational requirements and tourism opportunities. Project updates. Lot 300. Mackerel Islands and MinRes can develop a partnership in future.	MinRes to continue engagement and coordinate updates when necessary.
WA Fishing Industry Council	MinRes has provided relevant updates to WAFIC since September 2021 to ensure they are briefed on any activity that affects their industry.	Proposal including environmental impacts, closure plans and contributions from the proposal to the Onslow community. Project updates. Discussion on Jetty, Dredging, Sea dumping and Off Shore anchorages were the focus Early Works Consultation.	MinRes to continue engagement and provide updates when necessary.
RecFish West	MinRes has consulted with the Operations Team at RecFish West to provide update to ensure adequate consultation and proactive engagement.	Whole of project overview Port development and dredge program	Positive feedback Ongoing engagement when necessary
Pastoralists			
Peedamulla	Since initial engagement in August 2020, extensive engagement has been undertaken with Peedamulla Station to work collaboratively to progress Haul Road.	General interaction with the pastoral station and presentation of the Proposal. Forward work plan and contact arrangements. Proposal design options (Haul Road route) and feedback sought from Peedamulla. Traverses Haul Road with Peedamulla, areas of concern discussed and places where alignment changes required. Proposal and determination of communication personnel.	MinRes to continue engagement and ground traverse the Haul Road footprint with Peedamulla Station. MinRes to modify alignment in identified areas. MinRes to confirm that negotiations with the pastoral lessee and sub-lessee will occur. Ongoing further engagement to be undertaken.

Stakeholder	Date and Consultation Activities	Key Issues and Topics Raised	Outcomes
		<p>Proposal design and any assistance required from MinRes.</p> <p>Proposed infrastructure locations, potential early works, planned cultural heritage surveys and work to date.</p> <p>General update, as well as a more detailed discussion on the Haul Road alignment, haulage fleet and water sourcing for the project and the station.</p> <p>Early Works consultation.</p> <p>Peedamulla Station Stock Bore - Pump Testing Request</p> <p>Information about Geotech</p> <p>Heritage Survey with Peedamulla participation of the area earmarked for the initial camp on the NWCH.</p>	
Red Hill Station	<p>Consultation with Red Hill Station has been undertaken since February 2021 to determine land access and provide project updates.</p>	<p>Haul road alignment, (short and long term) access agreements and infrastructure requirements.</p> <p>Land Access Agreements.</p> <p>Notice - Change of Manager RHIOJV</p> <p>Upcoming drilling at Kens Bore</p>	<p>Further engagement required when necessary and appropriate.</p>

5. OBJECT AND PRINCIPLES OF THE EP ACT

5.1 Environmental Protection Principles

Table 5-1 shows how the EP Act principles have been considered in relation to the Proposal.

Table 5-1: *Principles of Environmental Protection Act 1986*

Principle	Consideration
<p>1. The Precautionary Principle</p> <p>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</p> <p>In application of this precautionary principle, decisions should be guided by:</p> <ul style="list-style-type: none"> a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and b) an assessment of the risk-weighted consequences of various options. 	<p>The Proponent has commissioned comprehensive baseline studies and investigations to understand the environmental and social values of the Proposal area and surrounds, and the potential impacts as a result of the Proposal. The Proponent engaged specialist environmental consultants to undertake EIAs on the terrestrial and marine components to support environmental approvals under s.38, Part IV of the EP Act, the EPBC Act and the <i>Environment Protection (Sea Dumping) Act 1981</i> required for the Proposal. Key technical experts were also engaged to peer review surveys, modelling and investigations and EIAs to demonstrate compliance with guidance and confirm a transparent scientific approach has been applied to our EIAs.</p> <p>This work has informed the Proposal design to avoid or minimise potential impacts as far as practicable.</p> <p>The Proposal presented in this document is the result of an iterative design and review process that has optimised specific elements, balanced with a precautionary approach to avoid, mitigate and manage potential environmental impacts.</p> <p>Key mitigation measures to prevent environmental degradation include:</p> <ul style="list-style-type: none"> • Reducing the size of the DE from 25,930 ha to 16,209 ha (by approx. 37%) and realigning the corridor to avoid all Mesas/Breakaways habitat which are considered of high value to many conservation significant species; • Utilise the Port navigation channels reducing the amount of overall capital dredging required; • Relocating anchorage points to avoid BCH; and • Progressive rehabilitation of temporarily disturbed areas. <p>The Proponent will also prepare a project-specific Framework Environmental Management Plan (FEMP, Appendix B) that incorporates necessary measures to implement the Proposal in a responsible and environmentally sustainable manner.</p> <p>The Proposal will not result in serious or irreversible damage.</p>
<p>2. The Principle of Intergenerational Equity</p> <p>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</p>	<p>The Proponent’s Environmental Policy (Appendix A) frames the way we work—we are committed to operating in an environmentally responsible and sustainable manner. The Proponent acknowledges that our operations have the potential to impact on the environment now and in the future. For this reason, the Proponent adopts a systematic approach to understand, minimise, manage and remediate the environmental impacts of our operations.</p>

Principle	Consideration
	<p>The Proponent’s decision-making processes incorporate sustainability principles and the principle of intergenerational equity. Throughout development of the Proposal concept, the Proponent has undertaken high level review followed by more detailed assessment of environmental factors and has designed the Proposal with careful consideration of sustainable outcomes.</p> <p>The Proposal has been designed to address the EPA’s objectives for the identified environmental factors, with mitigation measures to reduce residual environmental impacts and offsets proposed to compensate for any significant residual impacts.</p> <p>Some of the key environmental values that have been identified and will be maintained through application of the mitigation hierarchy:</p> <ul style="list-style-type: none"> • Mesas and Breakaway habitat; • Tanpool Land System Priority 1 Ecological Community; • Cane River Conservation Park; and • Benthic Communities and Habitat. <p>This assessment demonstrates that the Proposal can be implemented to avoid significant impacts on the health, diversity or productivity of the environment for the benefit of future generations.</p>
<p>3. Principles Relating to Improved Valuation, Pricing and Incentive Mechanisms</p> <p>(1) Environmental factors should be included in the valuation of assets and services.</p> <p>(2) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.</p> <p>(3) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.</p> <p>Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.</p>	<p>The Proponent acknowledges the need to assess environmental factors against asset valuation, pricing and incentive mechanisms and endeavours to pursue these principles when practicable. For example:</p> <ul style="list-style-type: none"> • Detailed flora and vegetation, terrestrial fauna and marine field surveys have been undertaken to identify and confirm the relative environmental values within the Development Envelope. From this, environmental factors have been considered in determining the haul road and Port design and location of infrastructure. • Procedures will be in place to ensure that emissions and discharges are minimised as far as practicable. • Potential impacts on the identified ecological attributes within the Proposals DEs have been fundamental in design consideration. The Proposal that is presented in this document is the result of an iterative design and review process which has optimised specific elements, balanced with a precautionary approach to avoid, mitigate and manage potential environmental impacts. • The Proponent has prepared project-specific Environmental Management Plans that incorporate necessary measures to implement the Proposal in a responsible and environmentally sustainable manner. This includes environmental training and awareness for all personnel, and ensuring sufficient resources are available for effective implementation of these Plans. <p>The Proponent has prepared a closure strategy for the Proposal (Appendix I). This will be further developed through ongoing consultation and the Proponent will prepare a Mining Proposal and MCP under the Mining Act incorporating environmental management/mitigation, rehabilitation and closure planning costs as appropriate.</p>

Principle	Consideration
	<p>All costs of monitoring, mitigation provisions, offsets and closure will be borne by the Proponent, and this has been included in the financial provisioning for the Proposal, therefore meeting the intent of Principle 3.</p>
<p>4. The Principle of the Conservation of Biological Diversity and Ecological Integrity</p> <p>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</p>	<p>The various comprehensive ecological studies undertaken for the Proposal to date have informed the design such that potential impacts to biological diversity have been avoided or minimised as far as practicable. Key technical experts were also engaged to peer review surveys, modelling and investigations and EIAs to demonstrate compliance with guidance and confirm a transparent scientific approach has been applied to our EIAs.</p> <ul style="list-style-type: none"> • Key mitigation measures that have been adopted to ensure conservation of biological diversity and ecological integrity include: • Reducing the size of the DE to 16,209 ha (by approx. 37%) to and realigning the corridor to avoid all Mesas/Breakaways habitat which are considered of high value to many conservation significant species • Utilising the Port navigation channels reducing the amount of overall capital dredging required; • Relocating anchorage points to avoid BCH; and • Progress rehabilitation of temporarily disturbed areas. <p>Therefore, the Proposal will ensure that conservation of biological diversity and ecological integrity will be maintained.</p>
<p>5. The Principle of Waste Minimisation</p> <p>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</p>	<p>As stated in the Proponent’s Environmental Policy, we are committed to undertaking activities with efficient use of natural resources such as energy and water, reduced wastes, and minimised emissions to air, including dust pollution and operational greenhouse gas.</p> <p>The hierarchy of waste controls: avoid, minimise, reuse, recycle and safe disposal would be adhered to during all Proposal phase, minimising the generation of waste.</p>

6. BENTHIC COMMUNITIES AND HABITATS

6.1 EPA Objective

The EPA’s environmental objective for the factor BCH is “to protect BCH so that biological diversity and ecological integrity are maintained”. (EPA 2016d).

6.2 Policy and Guidance

The relevant policy and guidance considered in the assessment of the BCH factor are summarised in **Table 6-1**.

Table 6-1: Policy Guidance for Benthic Communities and Habitat

Policy / Guidance	Considerations
Statement of Environmental Principles, Factors and Objectives (EPA 2020e)	Impacts of the Proposal have been assessed against the EPA objective for all relevant factors.
Instructions on how to prepare an Environmental Review Document (EPA 2020c)	This RSD has been prepared in accordance with this Instructions.
Environmental Factor Guideline – Benthic Communities and Habitats (EPA 2016d)	The information provided in this chapter addresses the ‘considerations for environmental impact assessment’ listed in this document.
Technical Guidance – Protection of Benthic Communities and Habitats (EPA 2016k)	<p>The assessment of BCH has been in accordance with this EPA technical guidance which includes:</p> <ul style="list-style-type: none"> Providing an overview of existing BCH within the Port. Characterising the existing BCH that is predicted to be impacted by the Project and describe the extent, severity and duration of those impacts. Providing a cumulative loss assessment of BCH in line with the EPA’s Technical Guidance - Benthic Communities and Habitats. The purpose of this is to determine whether the Proposal, in combination with other historical and approved losses, will significantly impact BCH, and any consequent impacts to ecological integrity and biodiversity.
Technical Guidance – Environmental Impact Assessment of Marine Dredging Proposals (EPA 2021c)	<p>The assessment of the proposed dredging has been in accordance with this EPA technical guidance which includes:</p> <ul style="list-style-type: none"> Plume modelling required to determine the extent, duration and severity of dredging related impacts to BCH. Evaluation of the probable and possible environmental impact associated with proposed dredging and spoil disposal.
Relevant Commonwealth Dredging and Sea Dumping Guidance	<p>The following dredging and sea dumping guidance has been considered when preparing the DSDMP (Appendix E):</p> <ul style="list-style-type: none"> Environmental Protection (Sea Dumping) Act 1981 Environment Protection (Sea Dumping) Regulations 1983 National Assessment Guidelines for Dredging (NAGD 2009) <p>Application Form under the <i>Environmental Protection (Sea Dumping) Act 1981</i> for a Disposal Application - Dredged Or Excavated Material</p>

6.3 Receiving Environment

6.3.1 Environmental Studies

Study and survey findings for the Proposal are summarised in **Table 6-2**. The impact assessment has been completed with a high degree of confidence based on a combination of comprehensive desktop, field and technical investigations. Where existing information was available this was collated into desktop studies, whilst specific field and technical investigations were conducted to address existing data gaps. Modelling technical studies have been conducted to provide an understanding of the spatial extent of predicted impacts associated with dredging activities and brine discharge originating from within the DEs. The studies specific to BCH are summarised in **Table 6-2**. For many of these studies, the Study Area extends beyond the existing Nearshore and Offshore DE in order to provide a holistic assessment of predicted impacts. All relevant studies are included with a link their specific Appendices. For detailed information on each study, please refer to the relevant technical report.

Additional relevant technical studies used for assessment of impacts to the factors Marine Fauna (**Section 8**) and Marine Environmental Quality (**Section 7**) have also been used to inform impact assessment to BCH.

Table 6-2: Studies for Benthic Communities and Habitats

Studies and surveys	Survey / study effort	Key findings
<p>Supplementary Benthic Communities and Habitat Survey of Spoil Ground C – March 2022 (O2 Marine 2022)</p> <p>(Appendix N)</p>	<p>A field survey including validation and update of Spoil Ground C mapping and the adjacent areas to consider any impacts to BCH arising from dredge spoil disposal at this location.</p> <p>The survey used drop camera footage to assign BCH classification throughout Spoil Ground C and surrounding perimeter.</p>	<p>Following detailed analysis of the raw drop camera footage, each site was assigned a BCH classification taking into account the entire transect length. Two BCH classifications were assigned:</p> <ul style="list-style-type: none"> • 81 sites (87 %) as 'Bare Substrate' • 12 sites (13%) as 'Sand with Sparse Filter Feeders'. <p>Finding of the March 2022 surveys were comparable with the previous BCH investigations undertaken within Spoil Ground C for the Wheatstone Project by URS (URS 2010).</p> <p>Based on results from this survey and URS (2010), BCH within and adjacent to Spoil Ground C is classified as sand substrate with a biota cover ranging from bare to sparse (<1% - 3%). Results support Spoil Ground C being historically established as a designated disposal ground. The small amount of biota identified within the spoil ground are not restricted to this area and are well represented across the entire Pilbara coastline.</p>
<p>Benthic Communities and Habitat Report. Ashburton Infrastructure Project (O2 Marine 2021a)</p> <p>(Appendix M)</p>	<p>A field survey including side scan sonar mapping of the seabed with drop camera video validation of key features identified from the side scan sonar backscatter data. This study has been aligned with relevant state and federal legislation and technical guidance relevant to BCH in the Proposal area.</p> <p>Survey area was split into nearshore and offshore survey areas in accordance with Proposal activities (wharf construction, transshipping, offshore anchorage, dredging, etc.) and the existing relevant LAUs.</p> <ul style="list-style-type: none"> • Nearshore survey: 15 to 18 December 2020 • Offshore survey: 7 to 8 February 2021 <p>LAUs for the Project were developed in accordance with the EPAs technical guidance (EPA 2016a) that form the spatial context for an assessment required for Environmental Impact Assessment (EIA) to express and present the cumulative loss of, or serious damage to, BCH that may arise as a result of the development proposal.</p> <p>This study involved a combination of historic desktop review and targeted validation surveys of both the Nearshore and Offshore DEs.</p>	<p>The outcomes of the investigation included:</p> <ul style="list-style-type: none"> • Identification of suitable anchoring areas that are largely devoid of benthic cover and are unlikely to be impacted by offshore anchoring activities. • Validation and refinement of existing maps of the subtidal BCH, which may be affected either directly (i.e., from bulk carrier anchoring) or indirectly (i.e. from increased TSS and reduced light availability during dredging) by the Proposal; and • Identification and evaluation of the regional significance and functional ecological value of the BCH in the vicinity of the Proposal to inform future environmental impact assessment of the Proposal, <p>BCH habitat mapping was generated based on assumptions based on technical guidance provided in EPA (2016d, 2016k, 2021c) and recommendations within documents published by the Western Australian Marine Science Institution Dredging Science Node.</p>
<p>Ashburton Infrastructure Project – Base Hydrodynamic Modelling (O2 Metocean 2021c)</p> <p>(Appendix BB)</p>	<p>The Proponent engaged O2 Marine to undertake a Proposal specific hydrodynamic modelling package that included the development of a base hydrodynamic model (tidal and waves) to force a dredge plume model and brine discharge model.</p>	<p>The hydrodynamic modelling study confirmed the presence of an eastward littoral drift current during the proposed dredge and construction period, and a weak wave and current climate in the vicinity of the Proposal, in agreement with previous numerical modelling studies undertaken for other larger projects.</p>
<p>Dredge Plume Modelling. Ashburton Infrastructure Project (O2 Metocean 2022)</p> <p>(Appendix J)</p>	<p>This study details the numerical modelling assessment of the proposed capital dredge program and associated offshore disposal. The study was undertaken in accordance with EPA Technical Guidance - Environmental impact assessment of marine dredging proposals (EPA 2021c) and the Guideline on dredge plume modelling for environmental impact assessment (Sun et al. 2020).</p> <p>The dredge and dredge-spoil disposal plumes were modelled using a 3D hydrodynamic and sediment transport model built upon O2 Metocean's existing model of the Pilbara region. Elements modelled were:</p> <ul style="list-style-type: none"> • Backhoe dredger: silt, clay and fine sands contributing to the passive plume. • Hopper barge overflow: Silt and clay contributing to the passive plume, and • Disposal: Silt, clay and fine sand contributing to the passive plume (with the assumed loss of silt and clay in the hopper barge overflow stage reduced from the total amount of disposed silt and clay). 	<p>The report defines the following predicted zones of impact to inform impact assessment as well as monitoring and management:</p> <ul style="list-style-type: none"> • Zone of High Impact (ZoHI) (Possible, Probable); • Zone of Moderate Impact (ZoMI) (Possible, Probable); and • Zone of Influence. <p>These predicted impact zones are also shown in Figure 6-3.</p>

6.3.2 Local Assessment Units

The EPA's *Technical Guidance for the Protection of Benthic Communities and Habitats* (EPA 2016k) identifies the need to map BCH at an appropriate scale to inform assessment of both regional and cumulative impacts to BCH. This nominal area is defined as a Local Assessment Unit (LAU). Generally, the size and dimensions of an LAU are determined on a case-by-case basis, however, where existing LAUs have been identified for past projects, these LAUs should be used to facilitate cumulative impact assessment of multiple projects.

For the Port and surrounding waters, the LAUs were previously defined through formal assessment of Chevron's Wheatstone Project (MS873) (URS, 2011a) (**Figure 2-22**). To enable evaluation of cumulative impacts, a subset of these existing LAUs were adopted to define the BCH mapping extent and inform impact assessment of the Proposal. This subset of LAUs is shown in the vicinity of the Nearshore (i.e., LAU 1C & 1D) and Offshore (i.e., LAU 3A & 3B, LAU 2F) DEs in **Figure 6-1** and **Figure 6-2** respectively.

6.3.3 Benthic Communities and Habitat

An O2 Marine (2021a) BCH Study (**Appendix BB**) was undertaken for the Proposal, whereby existing mapping was compiled and refined within the designated LAUs, and then targeted field surveys were undertaken to validate the BCH mapping within potential impact areas. An additional O2 Marine BCH study was undertaken for the Proponent to validate and update the existing mapping of Spoil Ground C and its surrounding LAU. These O2 Marine (2021a, 2022) studies identified and mapped six key BCH classes within these designated LAUs:

- Bare substrate;
- Sand with sparse filter feeders;
- Sand with sparse seagrass;
- Sand veneered limestone pavement;
- Coral; and
- Low Profile Reef.

The extent and distribution of these BCH classes are shown in **Figure 6-1** (Nearshore LAUs) and **Figure 6-2** (Offshore LAUs) and the classes are described in further detail within **Appendix CC** (O2 Marine 2021a).

The Offshore LAUs (i.e., 3A and 3B) were found to be characterised by a low-profile reef system between 20-30 m depth range, with primarily bare substrate occurring beyond (i.e., deeper) within this zone (O2 Marine 2021a). Although well represented in the Pilbara region, this Low-Profile Reef BCH is recognised as providing important habitat for a wide variety of reef and demersal fish species (O2 Marine 2021a).

The Nearshore LAUs (i.e., 1C & 1D) adopted for the Proposal are characterised by generally bare substrate with occasional areas of limestone pavement. Two areas of low cover coral habitat were identified from previous mapping (URS 2010b) at Ward Reef, and at a small, isolated reef West of Beadon Point, both areas of coral BCH are mapped within LAU 1C (**Figure 6-1**).

Sand with sparse seagrass is mapped in the north-eastern extent of LAU 1C. The O2 Marine (2021a) BCH nearshore survey was aimed at capturing optimal seagrass cover to best determine potential impacts on this community, however, no seagrass was identified within the O2 Marine (2021a) nearshore survey area. This finding is consistent with previous mapping, which showed sand with sparse seagrass in the north-eastern extent of LAU 1C (**Figure 6-1**) (URS 2010b), which found the nearest seagrass BCH to be located approximately 7 km west of the Nearshore DE, beyond Ashburton Island and approximately 10 km northeast in Beadon Bay (**Figure 6-2**). In Beadon Bay, within LAU1C, the seagrass is ephemeral in nature (i.e. dormant in winter) and typically characterised by sparse (generally <5%) cover of *Halophila ovalis* (URS 2010b).

Additional survey work has shown that the spoil ground and adjacent area (LAU 2F) was found to be characterised predominantly as bare substrate with areas of sand with sparse filter feeders (Marine O2 2022). These findings are comparable to the previous mapping of the area which found the area to be predominantly flat substrate with

sparse epibenthic biota (URS2010b). Previous mapping by URS 2010 found small patches of sparse *Halophila spinulosa*, however no seagrass was identified in the 2022 survey. The sparse biota identified within Spoil Ground C are not restricted to this area and are well represented across the entire Pilbara coastline.

Historically, dredging impacts to 'coral / filter feeder' and 'seagrass / macroalgae' BCH within the designated nearshore LAUs were approved for the Wheatstone Project (MS873) and the associated ZoHI and ZoMI, respectively) are shown in **Appendix CC** (O2 Marine 2021a; Figure 6 and Figure 7). Following completion of the Wheatstone dredging, Wahab *et al.* (2017) demonstrated that the filter feeder communities were largely unaffected beyond the predicted ZoHI and this was likely due to the resilience of these communities to naturally turbid waters and low light conditions that are common in the Ashburton region. Unfortunately, the accuracy of predicted impacts to other BCH (i.e., coral, seagrass and macroalgae) has not yet been published, however, it is noted, that given the time since the Wheatstone capital dredging (i.e., eight years), coral, seagrass and macroalgal BCH within the predicted ZoMI may have now recovered. Although, it is likely that ongoing, frequent (i.e., ~ biannual) maintenance dredging would have impacted the ability for BCH within the predicted ZoHI to recover.

Although not surveyed or mapped for the Proposal, six species of mangrove are found within the intertidal zone in the vicinity of the Proposal area. Immediately to the west of the Port (~2km west of the Nearshore DE), the mangroves are generally considered to be in pristine condition (URS 2010c) and are designated as part of the Ashburton River Delta 'Regionally Significant' mangrove area (EPA 2001); **Figure 2-25**). The mangrove communities in this area are considered to be of great ecological and economic importance, supporting a varied number of organisms such as snails, crabs, shrimps, oysters, barnacles, fish and birds.

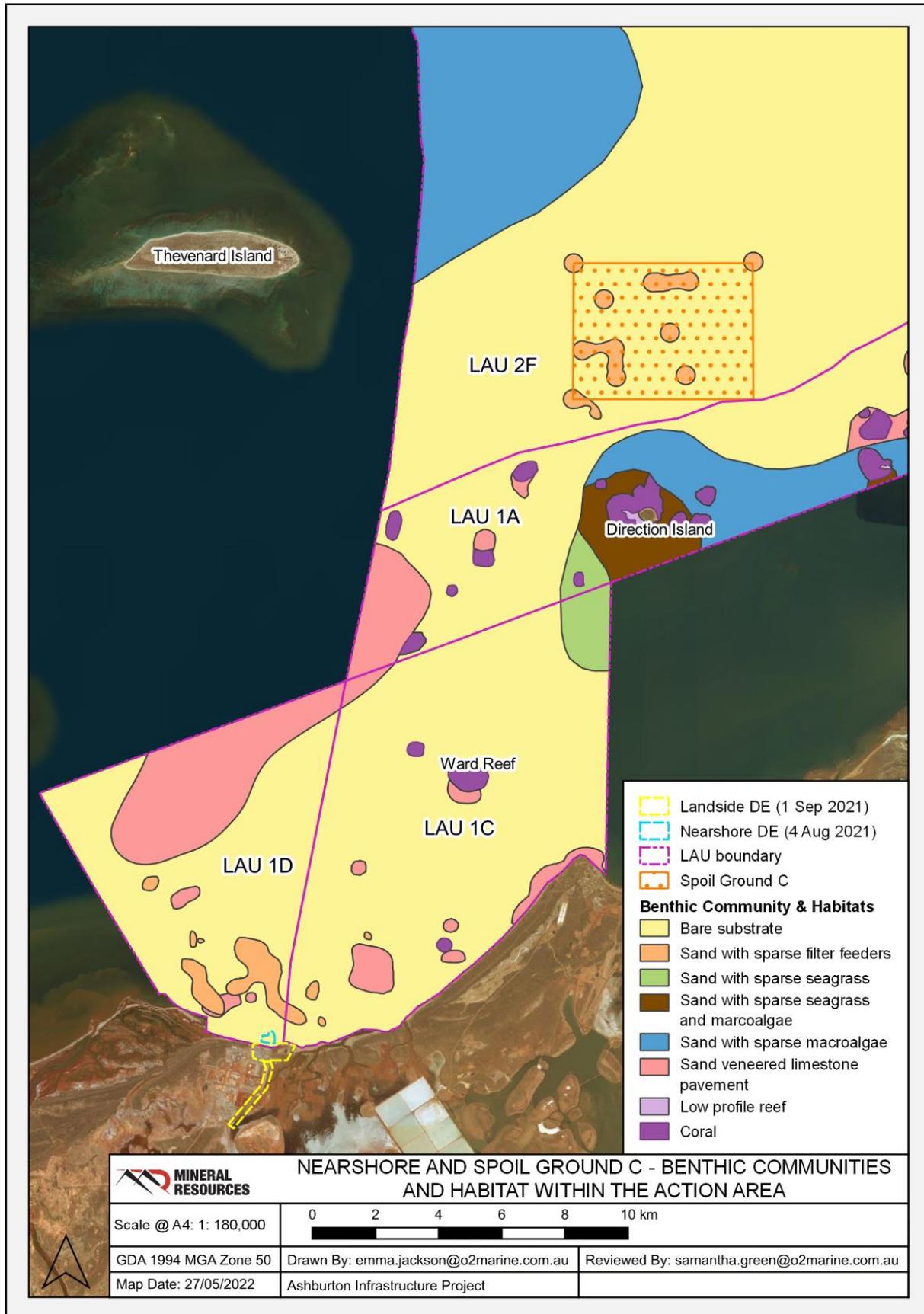


Figure 6-1: BCH in the Vicinity of the Nearshore and Spoil Ground C within the Proposal Area

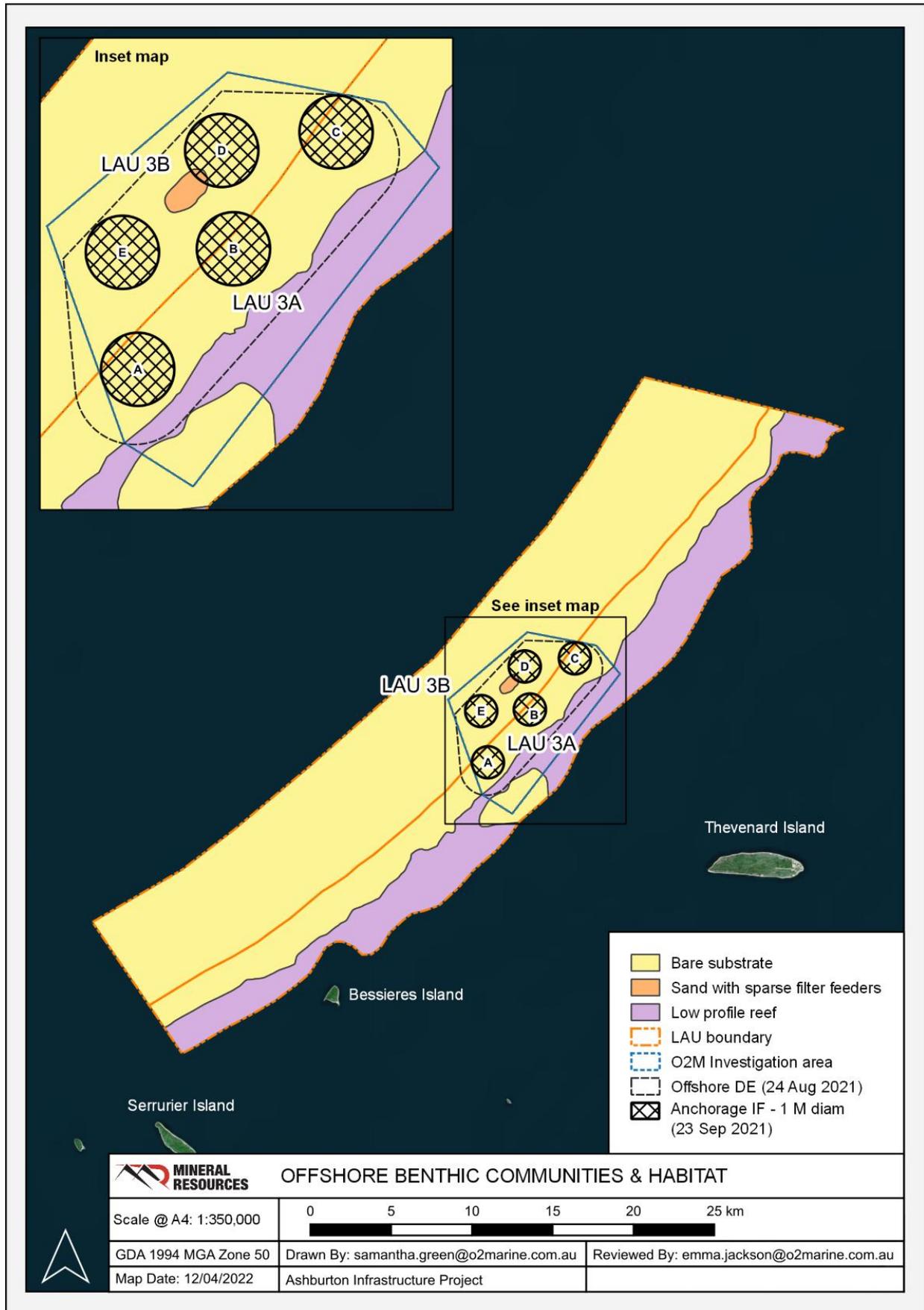


Figure 6-2: Offshore Benthic Communities and Habitat within the Proposal Area

6.4 Potential Impacts

Potential impacts to benthic communities and habitats may occur through construction and operational activities from the Proposal.

6.4.1 Construction Phase Impacts

6.4.1.1 Direct impacts

During the construction phase the Proposal has the potential to result in direct impacts to BCH:

- Direct removal/ disturbance of Bare Substrate BCH;
- Introduction/translocation of Invasive Marine Species (IMS) from contaminated hulls and/or ballast waters of interstate and/or overseas vessels used during construction/operations which could impact benthic communities; and
- Accidental fuel spillage from construction vessels & vehicles with subsequent impacts to marine and intertidal BCH. Note the risk of a spill occurring is considered highly unlikely and the assessment of impact to MEQ as the primary receptor, including avoidance and mitigation, is discussed in **Section 7.6.1.3**. No further discussion in relation to impacts to BCH is discussed in this Section.

6.4.1.2 Indirect impacts

During the construction phase the Proposal has the potential to result in indirect impacts to BCH:

- Indirect impacts during construction may arise from disturbance to Bare Substrate BCH through increased suspended sediment and associated benthic light reduction within the predicted ZoMI (**Figure 6-3**);
- No indirect irreversible or recoverable impacts are predicted to Coral, Seagrass, Filter Feeder or Macroalgae BCH. Further information regarding predicted dredging zones of impact is provided in **Appendix J** (O2 Metocean 2022); and
- Additionally, the dredge material placement area (Spoil Ground C) is already impacted from dredging and is not likely to be further impacted as a result of the proposed disposal.
- No indirect impacts (irreversible or recoverable) to BCH beyond the dredge material placement area (Spoil Ground C) is predicted.

6.4.2 Operational Phase Impacts

During the operational phase of this project there is unlikely to be any impact to BCH. However, for completeness, possible direct and indirect impacts are discussed below.

6.4.2.1 Direct impacts

During the operation phase of the Proposal, the following activities have the potential to directly impact the BCH in the vicinity of the proposed DEs:

- Direct disturbance to Bare Substrate BCH from OGVs anchoring in the designated area within Offshore IFs within the Offshore DE (**Figure 6-3**). Note anchorage locations have been designed to avoid any areas of significance that would be affected by anchor chains.

6.4.2.2 Indirect impacts

Indirect impacts to BCH during operations may arise from:

- Accidental product spills during loading and unloading. Note the risk of a product spill occurring is considered highly unlikely and the assessment of impact to MEQ as the primary receptor, including

avoidance and mitigation, is discussed in **Section 7.6.2.3**. No further discussion in relation to impacts to BCH is discussed in this Section.

- Hydrocarbon and waste spills from operational vessels. Note the risk of a hydrocarbon or waste spill occurring is considered highly unlikely and the assessment of impact to MEQ as the primary receptor, including avoidance and mitigation, is discussed in Section 6.6.3.3. No further discussion in relation to impacts to BCH is discussed in this Section.

6.4.3 Zones of Impact

EPA Technical Guidance for EIA of Marine Dredging Proposals (EPA 2021) provides guidance for identifying three distinct zones of potential impact:

- Zone of High Impact (ZoHI): The area where serious damage to benthic communities is predicted or where impacts are considered irreversible. Serious damage is defined as damage that is irreversible or damage that is unlikely to be recovered for at least five years following the completion of dredging activities.
- Zone of Moderate Impact (ZoMI): The area within which predicted impacts on benthic organisms are sub-lethal, and/or the impacts are recoverable within a period of five years.
- Zone of Influence (Zol): The area within which changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectable impact on benthic biota. This area can be very large, but at any point in time the dredge plume is likely to be restricted to a relatively small portion of the Zol.

In accordance with EPA (2021), Dredge Plume Modelling was undertaken to develop predictions of the ZoHI, ZoMI and Zol in the vicinity of the proposed dredging and spoil disposal (O2 Metocean 2022, **Appendix J**). The predicted ZoHI and ZoMI from dredging are presented in **Figure 6-3**.

6.4.3.1 Intersection of Zones of Impact and Mapped BCH

Following determination of the dredging zones of impact it was determined if they overlap with mapped BCH. **Figure 6-3** shows that the ZoHI (from dredging) is limited to the dredge footprint (which includes area of direct impacts from wharf construction) and that that no ZoHI was observed within or outside any of the dredge material placement area (Spoil Ground C). Therefore, no indirect permanent loss of BCH from dredging is expected outside of the dredging footprint (beyond a small area of loss where proposed marine infrastructure (jetty and associated components) is being constructed). No indirect recoverable impact (ZoMI) of BCH from spoil disposal was predicted. The possible ZoMI around the dredging footprint was therefore used as the extent of predicted indirect recoverable impacts to BCH as a result of dredging. The predicted recoverable impact to BCH (within the possible ZoMI) is shown in **Figure 6-3**.



Figure 6-3 Dredge Plume Model Outcomes: Zones of Impact

6.5 Mitigation

The Proponent has applied the mitigation hierarchy (avoid and minimise) to reduce the potential impacts to marine fauna during Proposal design. Potential impacts have been avoided or minimised through design of the DE and conceptual footprint, which along with specific mitigation measures are summarised in **Table 6-3**.

A number of management plans have been prepared for the Proposal to minimise the potential impacts of project construction and operational activities on BCH. The specific management plans that have been prepared that will assist to mitigate potential impacts on BCH and include:

- **Marine Construction Environmental Management Plan (MCEMP).** The MCEMP has been prepared to detail how underwater noise, collision with vessels, hydrocarbon spills, invasive marine species and marine debris will be managed by the Proponent during construction of the marine components of the Proposal. The MCEMP provides the overall environmental management framework and specific management measures to address relevant environmental factors and mitigate potential impacts of the marine construction activities. Key management measures are summarised in **Table 6-3** and the MCEMP is provided in **Appendix C**.
- **Dredging and Spoil Disposal Management Plan (DSDMP).** The DSDMP has been prepared to detail how environmental impacts will be managed during the dredging phase. Key management measures are summarised in **Table 6-3** and the DSDMP is provided in **Appendix E**.
- **Marine Operational Environmental Monitoring and Management Plan (MOEMMP).** The purpose of this MOEMMP is to establish a framework to ensure that the implementation of the Proposal does not compromise the EVs and EQOs and outlines management measures to minimise the risk of vessel strike during vessel operations. Key management measures are summarised in **Table 6-3** and the MOEMMP is provided in **Appendix D**.

Table 6-3: Proposed Mitigation Measures for Benthic Communities and Habitats

Potential Impact	Proposed Mitigation		
	Avoid	Minimise	Offset required?
Construction Phase Impacts			
Construction Phase impacts will be managed through development and implementation of a Marine Construction Environmental Management Plan (MCEMP), prior to commencement of construction works. The following mitigation measures will be included in the MCEMP to mitigate impacts on Benthic Communities and Habitats during construction.			
Direct disturbance of 0.2 ha of Bare Substrate BCH (Excludes direct impacts from dredging (refer below) within the Nearshore DE.	The port infrastructure has been designated within an area of bare substrate (Figure 6-1), resulting in no impacts to sensitive BCH within the Nearshore DE.	Implement MCEMP (Appendix C)	No
Direct removal/disturbance of 3.1 ha of Bare Substrate BCH within the predicted ZoHI (Figure 6-3) (Includes area of direct impacts from wharf construction)	The ZoHI and ZoMI are entirely within an area of bare substrate (Figure 6-3) resulting in no impacts to sensitive BCH. An existing dredge material placement area (Spoil Ground C) has been selected and is within and surrounded by an area of bare substrate, resulting in no impacts to sensitive BCH.	Implement DSDMP (Appendix E), which includes monitoring and mitigation measures to ensure that actual impacts are as predicted or less.	No
Introduction/translocation of Invasive Marine Species (IMS) during construction/operations	NA	Implement MCEMP (Appendix C) and DSDMP (Appendix E), which includes mitigation measures for IMS.	No
Accidental fuel spillage to marine and intertidal environment from construction vessels & vehicles.	NA	Implement MCEMP (Appendix C) and DSDMP (Appendix E), which includes mitigation measures for hydrocarbon storage and refuelling	No
Indirect disturbance within the predicted ZoMI to 113.62 ha of Bare Substrate BCH through increased suspended sediment and associated benthic light reduction	The ZoHI and ZoMI are entirely within an area of bare substrate (Figure 6-3), resulting in no impacts to sensitive BCH.	Implement DSDMP (Appendix E), which includes monitoring and mitigation measures to ensure that actual impacts are as predicted or less.	No
Operational Phase Impacts			
Operational phase impacts will be managed through development and implementation of a Marine Operational Environmental Management and Monitoring Plan (MOEMMP), prior to commencement of operations. The following mitigation measures will be included in the MOEMMP to mitigate impacts on Marine Fauna during operations			
Direct removal/ disturbance of up to 1,347 ha of Bare Substrate BCH	The final location of the five offshore transshipment anchorage points were selected to avoid benthic habitat. High and moderate value benthic habitat within the anchorage investigation area is limited to the 30 m depth contour, with the seabed beyond this depth predominantly bare sand (low benthic habitat value). Initial design locations were moved to avoid impacts to mapped benthic communities. Therefore, the proposed anchorage points are within a low value benthic habitat and avoid potential impact to marine fauna. As the anchorage area is devoid of BCH and was specifically selected in consideration of the mitigation hierarchy, whereby impacts to BCH are avoided through site selection. The anchorage zones (Offshore IF) within the proposed Offshore DE have been designated within an area of bare substrate (see Section 2.1.4.4), resulting in no impacts to sensitive BCH.	NA	No
Hydrocarbon and waste spills from operational vessels	NA	Implement MOEMMP (Appendix D).	No
Release of hypersaline brine resulting in change to physico-chemical conditions within the designated LEPA	Brine diffuser and associated mixing zone has been positioned in an area of bare substrate (Figure 7-2 and Section 8) resulting in no impacts to sensitive BCH.	Implement MOEMMP (Appendix D).	No
Accidental product spill during loading and unloading	The anchorage zones (Offshore IF) within the proposed Offshore DE have been designated within an area of bare substrate (Figure 6-2), resulting in no impacts to sensitive BCH.	Implement MOEMMP (Appendix D).	No
Accidental fuel spillage from vessels and vehicles	NA	Implement MOEMMP (Appendix D).	No

6.6 Assessment and Significance of Residual Impacts

6.6.1 Construction Impacts

Direct Impacts

6.6.1.1 Removal / Disturbance of Bare Substrate BCH

Proposal dredging and construction activities will result in combined direct removal / disturbance of up to 3 ha of bare substrate which includes:

- 0.2 ha within the Nearshore DE where proposed marine infrastructure (jetty and associated components) is being constructed (excludes direct impacts from dredging, refer below); and
- 3.1 ha within the predicted dredging ZoHI (**Figure 6-3**) (includes area of direct impacts from wharf construction).

Given that bare substrate does not represent regionally significant BCH or BCH of high functional ecological value, these impacts are not considered to be significant. Most of the dredging footprint will remain classified as bare substrate after the completion of dredging so has not been considered further in the BCH assessment.

The Port infrastructure (jetty and wharf) is also within an area of bare substrate (**Figure 6-3**), resulting in no additional impacts to sensitive BCH within the Nearshore DE.

The dredge material placement area (Spoil Ground C) has no predicted direct or indirect irreversible impact (ZoHI or ZOMI) to BCH from proposed disposal activities. It has also already impacted from previous dredging and is not likely to be further impacted as a result of the proposed placement of spoil material.

6.6.1.2 Introduction / Translocation of Invasive Marine Species (IMS) during Construction

IMS may be introduced during the construction phase either through the disposal of ballast water or dislodgment of biofouling from vessels. The highest risk vector during the construction phase is normally considered to be the dredging vessel, which is likely to have transited foreign ports in tropical waters.

The introduction and possible proliferation of IMS will be managed using the National System for the prevention and Management of Marine Pest Incursions, the Australian Ballast Water management requirements and the National biofouling management guidelines for commercial vessels. Where the guidelines are followed, and the appropriate mitigation measures are adopted, the risk of IMS becoming established and affecting the biodiversity values and/or ecological integrity of the Port (Nearshore DE) and anchorage areas (Offshore DE) are low. The lack of BCH in the vicinity of the Port together further reduces the risk of IMS impacting on BCH.

Management measures to mitigate the risk of IMS (including implementation of the MCEMP, **Appendix C** and DSDMP, **Appendix E**) are outlined in **Section 6.5**.

Indirect

6.6.1.3 Disturbance to Bare Substrate BCH through increased suspended sediment and associated benthic light reduction including:

In addition to the direct impacts identified in **Section 6.6.1.1**, dredge plume modelling (O2 Metocean 2022) using the latest EPA (2021c) threshold values for coral, found that 113.62 ha of Bare Substrate BCH, would be exposed to indirect effects of increased TSS and reduced benthic light availability within the possible ZoMI (**Figure 6-3**). These threshold values are more conservative than the threshold values for seagrass and as such were suitable to confirm that impacts to seagrass BCH were also unlikely. Given that bare substrate is not affected by increased TSS and reduced light, there are essentially no indirect impacts to BCH from dredging.

It is further noted that much of the predicted ZoMI, occurs within the predicted ZoHI for the Wheatstone Capital Dredging Project (Refer **Appendix CC** and **Figure 6-3**).

Additionally, no indirect impacts to BCH are predicted beyond the dredge material placement area (Spoil Ground C) (O2 Metocean 2022).

6.6.2 Operational Impacts

Direct Impacts

6.6.2.1 Direct removal/ disturbance of Bare Substrate BCH

An iterative process was undertaken to determine the final location of the five offshore transshipment anchorage points. Initial locations for suitable anchorage points were investigated with a number of options being considered. Surveys of the sea floor were completed before the final location of the five offshore transshipment anchorage points were selected (to avoid benthic habitat). Survey mapping indicated that within the anchorage area, BCH was limited to the 30 m contour, with the seabed beyond this depth being predominantly bare sand. The selection of the final sites results in a reduced potential impact to marine fauna, including listed species by avoiding impacts to benthic habitats.

Although there is potential for direct disturbance of up to 1,347 ha of Bare Substrate BCH within the offshore anchorage zones within the proposed Offshore DE; this is likely a worst case impact scenario as there is no predicted direct physical impacts from anchoring to sensitive BCH.

As the anchorage area is devoid of BCH and was specifically selected in consideration of the mitigation hierarchy, the impacts to BCH have been avoided through site selection, and no further mitigation was considered warranted.

Indirect

The lack of BCH in the vicinity of the Port together with implementation of the MOEMMP, effectively mitigates the risk of Proposal marine operations from impacting on sensitive BCH.

Given the designated anchorage areas (Offshore IF) within the Offshore DE occur in areas of Bare Substrate BCH. Anchoring in these areas will not have any impact on any sensitive BCH.

6.6.2.2 Introduction / Translocation of Invasive Marine Species (IMS) during Construction

IMS may be introduced during the operation phase either through the disposal of ballast water or dislodgment of biofouling from vessels. The highest risk vector during the construction phase is normally considered to be the dredging vessel, which is likely to have transited foreign ports in tropical waters.

The introduction and possible proliferation of IMS will be managed using the National System for the prevention and Management of Marine Pest Incursions, the Australian Ballast Water management requirements and the National biofouling management guidelines for commercial vessels. Where the guidelines are followed, and the appropriate mitigation measures are adopted, the risk of IMS becoming established and affecting the biodiversity values and/or ecological integrity of the Port (Nearshore DE) and anchorage areas (Offshore DE) are low. The lack of BCH in the vicinity of the Port together further reduces the risk of IMS impacting on BCH.

Management measures to mitigate the risk of IMS (including implementation of the MOEMMP - **Appendix D**) are outlined in **Section 6.5**.

6.6.3 Cumulative Impacts

Ultimately, given the lack of impacts to any BCH other than Bare Substrate, potential cumulative impacts within the LAUs were not evaluated as part of this assessment.

6.7 Environmental Outcomes

If this Proposal is approved and implemented, it will result in a small loss of bare sediment and no loss of sensitive BCH (i.e., coral, seagrass, filter feeders, etc). Considered within this context, the predicted irreversible impact to

BCH and cumulative loss from the Project is **not considered** to pose a significant risk to ecological integrity and biological diversity within the LAU or the broader Port environment.

Following the proposed dredging the Proponent is confident that the environmental outcome '*No areas of sensitive BCH (i.e., coral, seagrass, filter feeders, etc) to be either directly or indirectly impacted from dredging, construction or operational activities*' **can be achieved**.

Based on no predicted direct or indirect loss of sensitive BCH it is considered that the Proposal will not contribute to loss of BCH such that biological diversity and ecological integrity are at risk at either a local or regional scale. Overall, the impacts to BCH are not considered to be significant and the EPA objective for BCH is considered to be met.

7. MARINE ENVIRONMENTAL QUALITY

7.1 EPA Objective

The EPA's environmental objective for the factor Marine Environmental Quality (MEQ) is '*To maintain the quality of water, sediment and biota so that environmental values are protected* (EPA 2016j).

7.2 Policy and Guidance

The Proponent has considered published policy and guidance relevant to this factor as summarised in **Table 7-1**.

Table 7-1: Policy and Guidance for Marine Environmental Quality

Policy / Guidance	Considerations
Statement of Environmental Principles, Factors and Objectives (EPA 2020e)	Impacts of the Proposal have been assessed against the EPA objective for all relevant factors.
Instructions on how to prepare an Environmental Review Document (EPA 2020c)	This RSD has been prepared in accordance with the Instructions.
Environmental Factor Guideline – Marine Environmental Quality (EPA 2016j)	The information provided in this chapter addresses the 'considerations for environmental impact assessment' listed in this document
Technical Guidance – Protecting the Quality of Western Australia's Marine Environment (EPA2016c)	The assessment of MEQ has been in accordance with EPA (2016) including application of an Environmental Quality Management Framework (EQMF) and identification of Environmental Values (EVs), Environmental Quality Objectives (EQOs), Levels of Ecological Protection (LEPs) and Environmental Quality Criteria (EQC). The focus of the approach is on maintaining existing MEQ and identifying where management and/or remediation may be required.
Relevant Commonwealth Dredging and Sea Dumping Guidance	<p>The following dredging and sea dumping guidance has been considered when preparing the DSDMP (Appendix E):</p> <ul style="list-style-type: none"> • <i>Environmental Protection (Sea Dumping) Act 1981</i>; • Environment Protection (Sea Dumping) Regulations 1983; and • National Assessment Guidelines for Dredging (NAGD 2009) <p>Application Form under the <i>Environmental Protection (Sea Dumping) Act 1981</i> for a Disposal Application - Dredged Or Excavated Material.</p>

7.3 Receiving Environment

7.3.1 Environmental Studies

The impact assessment has been completed with a high degree of confidence based on a combination of comprehensive desktop, field and technical investigations. Where existing information was available this was collated into desktop studies, whilst specific field and technical investigations were conducted to address existing data gaps. Modelling technical studies have been conducted to provide an understanding of the spatial extent of predicted impacts associated with dredging activities and brine discharge originating from within the DEs. The studies specific to MEQ are summarised in **Table 7-3**. For many of these studies, the study area extends beyond the existing Nearshore and Offshore DE in order to provide a holistic assessment of predicted impacts. All relevant

studies are included with a link to their specific Appendix number. For detailed information on each study, please refer to the complete technical report.

Additional relevant technical studies used for assessment of impacts to the factors Marine Fauna (**Section 8**) and BCH (**Section 6**) have also been used to inform impact assessment to MEQ in this Section.

7.3.2 Environmental Quality Management Framework

The assessment of MEQ has been in accordance with the EPA's Technical Guidance for Protecting the Quality of Western Australia's Marine Environment (EPA 2016j) including application of an Environmental Quality Management Framework (EQMF). The approach to establishing an EQMF, including identification of Environmental Values (EVs), Environmental Quality Objectives (EQOs), LEPs and Environmental Quality Conditions (EQCs) is clearly described in EPA (2016j). The approach is based on the principles and guidelines of the National Water Quality Management Strategy (NWQMS), with particular regard to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). The focus of the approach is on maintaining existing MEQ and identifying where management and/or remediation may be required and to measure its effectiveness. The EQMF can also be used to provide measurable performance objectives for unplanned events or discharges (EPA 2016j).

The EVs and associated EQOs for the local marine environment are already well established in the Pilbara Coastal Waters Consultation Outcomes (DoE 2006). Five EVs and eight corresponding EQOs apply to the Port (**Table 7-2**).

Table 7-2: EVs and EQ Objectives Applicable to the Port and Surrounding Waters

Environmental Values	Environmental Quality Objectives
Ecosystem Health	EQO1: Maintenance of ecosystem integrity. EQO1 is split into four sub-objectives, being: Maximum, High, Moderate and Low Levels of Ecological Protection (LEPs) (Refer Section 7.3.3).
Fishing and Aquaculture	EQO2: Seafood (caught) is of quality safe for human consumption. EQO3: Water quality is suitable for aquaculture purposes
Recreation and Aesthetics	EQO4: Water quality is safe for primary contact recreation (e.g., swimming and diving). EQO5: Water quality is safe for secondary contact recreation (e.g., fishing and boating). EQO6: Aesthetic values of the marine environment are protected
Cultural and Spiritual	EQO7: Cultural and spiritual values of the marine environment are protected
Industrial Water Supply	EQO8: Water quality is suitable for industrial supply purposes

Table 7-3: Studies for Marine Environmental Quality

Studies and surveys	Survey / study effort	Key findings
Ashburton Infrastructure Project - Sediment Sampling and Analysis Plan (O2 Marine 2021f) (Appendix Z)	Desktop study to conduct a preliminary site assessment and determine the sampling and analysis (SAP) requirements relative to guidance requirements to allow determination of assessment against contamination and acid sulfate soils (ASS) guideline values to determine suitability of sediments for dredging and offshore disposal. Study reviewed approximately nine previous technical reports typically undertaken for the adjacent Wheatstone Project, or regionally within the Project location as relevant.	This SAP focused on the following construction components of the Nearshore and Offshore DE: <ul style="list-style-type: none"> • Capital dredging of a berth pocket and the construction of a dedicated wharf for loading of TSVs located immediately east of the existing Port Materials Offloading Facility (MOF), • Marine disposal locations for spoil removed from the berthing pocket; and The transshipment area in ~30-50 m water depth approximately 10 km to the west/north-west of Thevenard Island for anchorage of Cape Size vessels.
Water Quality Desktop Review. Ashburton Infrastructure Project (O2 Marine 2021b) (Appendix Q)	Desktop study to conduct a review of available water quality data locally collected and assessed, typically to determine background water quality values intended to inform the dredge plume modelling and desalination outfall modelling. This study reviewed approximately 14 previous technical reports, typically undertaken regionally or specific to the adjacent Wheatstone project. The scope of this study was not limited to the nearshore and offshore DEs, as both regional and local data was assessed, reviewed and collated.	The report presented a synthesis of the results in the context of an environmental quality management framework and presented the environmental quality criteria applicable to MEQ for physicochemical, light, biological and toxicant stressors. The report identified the existing marine environment to be typically representative of natural conditions with contaminants at very low levels, physical parameters and nutrients identified as variable, though generally within published guideline levels.
Ashburton Infrastructure Project - Sediment Sampling and Analysis Plan Implementation Report (O2 Marine 2021g) (Appendix AA)	Detailed site investigation to implement the SAP (O2 Marine 2021g). Sediment sampling and analysis of the material to be dredged was undertaken following the SAP (O2 Marine 2021). Note that until the SAP is approved by DAWE the Sediment Sampling and Analysis Plan Implementation Report is in draft format.	Samples were collected from nine sampling locations and analysed for particle size distribution, total organic carbon, metals, total petroleum hydrocarbon, polycyclic aromatic hydrocarbon, organotins and acid sulfate soils. Analytical results were assessed against industry guidelines, including DEWHA 2009 and ANZG 2018, to inform the level of ecological impact posed to MEQ from dredging and offshore disposal. Based on the assessment, sediment impacts are considered low to MEQ and suitable for offshore disposal. Further details from this study are summarised in Section 7.3.4
Ashburton Infrastructure Project – Base Hydrodynamic Modelling (O2 Metocean 2021c) (Appendix BB)	The Proponent engaged O2 Marine to undertake a Proposal -specific hydrodynamic modelling package that included the development of a base hydrodynamic model (tidal and waves) to force a dredge plume model and brine discharge model.	The hydrodynamic modelling study confirmed the presence of an eastward littoral drift current during the proposed dredge and construction period, and a weak wave and current climate in the vicinity of the Proposal, in agreement with previous numerical modelling studies undertaken for other larger projects.
Dredge Plume Modelling. Ashburton Infrastructure Project (O2 Metocean 2022) (Appendix J)	This study details the numerical modelling assessment of the proposed capital dredge program and associated offshore disposal. The study was undertaken in accordance with EPA Technical Guidance - Environmental impact assessment of marine dredging proposals (EPA 2021c) and the Guideline on dredge plume modelling for environmental impact assessment (Sun et al. 2020).	The dredge and dredge-spoil disposal plumes were modelled using a 3D hydrodynamic and sediment transport model built upon O2 Metocean's existing model of the Pilbara region. Elements modelled were: <ul style="list-style-type: none"> • Backhoe dredger: silt, clay and fine sands contributing to the passive plume; • Hopper barge overflow: Silt and clay contributing to the passive plume, and • Disposal: Silt, clay and fine sand contributing to the passive plume (with the assumed loss of silt and clay in the hopper barge overflow stage reduced from the total amount of disposed silt and clay). The report defines the following predicted zones of impact to inform impact assessment as well as monitoring and management: <ul style="list-style-type: none"> • Zone of High Impact (ZoHI) (Possible, Probable); • Zone of Moderate Impact (ZoMI) (Possible, Probable); and • Zone of Influence. These predicted impact zones are also shown in Figure 6-3..
Ashburton Infrastructure Project - Desalination Brine Plume Modelling Report (O2 Metocean 2021b) (Appendix K)	This report details a desktop ecotoxicology assessment, conceptual diffuser design, near-field mixing assessment, and far-field dispersion assessment for a brine outfall associated with the Proposal.	The results are interpreted in terms of the guidance of EPA (2016c), where Environmental Quality Objectives (EQO) for specific Species Protection Levels (SPL) are defined. The results are interpreted in terms of general guidance on the spatial Ecological Protection Areas in which these EQOs are to be met (EPA 2016c), specifically: <ul style="list-style-type: none"> • A moderate level of ecological protection (90% SPL) must be met within 70 m of the outfall - a zone referred to as the 70 m mixing-zone; and

Studies and surveys	Survey / study effort	Key findings
		<ul style="list-style-type: none"> A high level of ecological protection (99% SPL) must be met within 250 m from the proposed port infrastructure, inclusive of berth infrastructure and ship turning basin – a zone referred to as the Moderate Ecological Protection Area (MEPA). <p>The near-field modelling assessment indicates that the target dilutions required to meet the 90% and 99% SPLs, as applied to the moderate and high LEPs, respectively, are readily achieved within the 70 m mixing zone. Based on the model outputs a reduced Low Level of Ecological Protection (LEP) boundary has been established at a 30 m distance from the discharge points to reflect the small size of the predicted mixing zone and to allow for a practical distance to accurately monitor and manage the outfall dilution requirements.</p> <p>3D far-field dispersion modelling shows that the EQOs would readily be met with this discharge configuration. The same 3D far-field dispersion model revealed that a brine intake located at the western side of the proposed berth to the outfall, and just below the low tide mark (-1 m LAT) is unlikely to experience any appreciable outfall salinity signature.</p> <p>The results indicate that satisfactory dilutions could readily be achieved within short distances of the Proposal infrastructure, with relatively simple diffuser designs.</p>

7.3.3 Water Quality

The desktop assessment undertaken by O2 Marine (2021b) provides a detailed review of the existing water quality of the local and regional area of the proposed Proposal. The desktop review typically involved detailed analysis of approximately 14 technical reports, along with management plans and technical guidance and synthesis reports relevant to the Proposal site. This desktop study is provided in **Appendix Q**. Please refer to this document for detailed information of the water quality receiving environment.

O2 Marine (2021b) identified the area around Onslow as characterised by relatively turbid inshore/nearshore waters that are subject to moderate tidal and residual flows (non-harmonic currents driven primarily by meteorological forcing, generally in the longshore direction over a period of days or weeks) and episodic highly turbid runoff from the Ashburton River. The mid and outer waters are generally clear (MScience 2013). The coastal waters generally have very low levels of anthropogenic contamination and are oligotrophic with low availability of nitrogen limiting rates of primary production (Wenziker *et al* 2006).

Toxicants in water as reported by Wenziker *et al* (2006) are typically very low and can be summarised as:

- Baseline 95th percentile concentrations of cadmium, chromium, manganese, molybdenum, nickel, vanadium and mercury were always below the ANZECC & ARMICANZ (2000) guideline values for 99 or 90% species protection.
- Concentrations of arsenic, copper, lead, aluminium and selenium were always below the reporting limit and/or the ANZECC & ARMICANZ (2000) guideline values for 99 or 90% species protection: and
- Oil and Grease, Total Solvent Extractable (O&G TSE) was rarely detectable and median concentration was usually below 5 mg/L.

Nutrients and physicochemical parameters as reported by MScience (2013) are considered variable with the following characteristics:

- Nitrogen-based water quality parameters (total nitrogen, nitrates + nitrites) baseline median concentrations in were above the recommended guidelines specified in ANZECC & ARMICANZ (2000).
- Median concentrations for both total phosphorous and filterable reactive phosphorus in were below the ANZECC & ARMICANZ (2000);
- Regional median turbidity was usually <1 Nephelometric Turbidity Units (NTU) and the 80th percentile was <3 NTU during non-cyclonic periods. A turbidity maximum of 100 NTU was recorded during cyclonic activity.
- Water temperatures are highly variable and can range from below 20°C in winter to above 30°C in late summer/early autumn; and
- Salinity is highly variable with a median baseline of 37.7 psu and a maximum of approximately 40 psu.

7.3.4 Sediment Quality

The desktop assessment (O2 Marine 2021f) and field technical investigation (O2 Marine 2021g) undertaken provides a detailed review of the existing sediment quality of the local and regional area of the Proposal. The desktop review typically involved detailed analysis of approximately nine technical reports, along with management plans, technical guidance and synthesis reports relevant to the Proposal site. The field technical investigation collected marine sediments from the Nearshore and Offshore DEs at nine locations. An assessment against industry guidelines was conducted to determine the suitability of sediments for dredging and offshore disposal. The desktop study is provided in **Appendix Z** and the field technical investigation provided in **Appendix AA**. Please refer to these documents for detailed information of the water quality receiving environment.

The marine sediments in the region mainly consist of silt and sand sheets of varying thickness overlying Pleistocene limestone. Near the Ashburton Delta, sediments are generally fine silts and clays with high silica content. Two broad types of sediments occur within the area: sands intermixed with variable fractions of clays, silts

and or gravels, and rock (siltstone, claystone and sandstone) that is generally weathered and weak. Sediments in the area are typically considered free from anthropogenic contamination with levels of metals previously analysed either below the laboratory detection levels or relevant guideline trigger values for assessment (O2 Marine 2021g). Regional sediments are considered to have low acid generated capacities and therefore the chance of encountering actual or potential acid sulphate soils if considered low (O2 Marine 2021g).

7.4 Potential Impacts

Potential impacts to marine environmental quality may occur through construction and operational activities from the Proposal.

7.4.1 Construction Phase Impacts

Direct Impacts

During the construction phase of the Proposal, the following activities and resulting impacts have the potential to adversely affect the Marine Environmental Quality in the vicinity of the proposed DEs:

- Release of contaminated sediments during dredging within the proposed dredge footprint and disposal at the existing Spoil Ground C;
- Temporary, localised turbidity increase from dredging and disposal activities; and
- Accidental fuel spillage to marine and intertidal environment from construction vessels & vehicles.

7.4.2 Operational Phase Impacts

Direct Impacts

During the operation phase of the Proposal, the following activities and resulting direct impacts have the potential to adversely affect the Marine Environmental Quality in the vicinity of the proposed DEs:

- Release of hypersaline brine to the marine environment resulting in altered physicochemical conditions (i.e., increased temperature and salinity) around the diffusers within the Nearshore DE.

Indirect Impacts

During the operation phase of the Proposal, the following activities and resulting indirect impacts have the potential to adversely affect the Marine Environmental Quality in the vicinity of the proposed DEs:

- Accidental product spills to the marine environment, resulting from loading at the port infrastructure in the nearshore DE and at the transshipment location in the offshore DE; and
- Accidental fuel spillage or pollution from vessels

7.5 Mitigation

The Proponent has applied the mitigation hierarchy (avoid and minimise) to reduce the potential impacts to marine fauna during Proposal design. Potential impacts have been avoided or minimised through design of the DE and conceptual footprint, which along with specific mitigation measures are summarised in **Table 7-4**.

A number of management plans have been prepared for the Proposal to minimise the potential impacts of project construction and operational activities on MEQ. The specific management plans that have been prepared that will assist to mitigate potential impacts on MEQ and include:

- **Marine Construction Environmental Management Plan (MCEMP)**. The MCEMP has been prepared to detail how underwater noise, collision with vessels, hydrocarbon spills, invasive marine species and marine debris will be managed by the Proponent during construction of the marine components of the

Proposal. The MCEMP provides the overall environmental management framework and specific management measures to address relevant environmental factors and mitigate potential impacts of the marine construction activities. Key management measures are summarised in **Table 7-4** and the MCEMP is provided in **Appendix C**.

- **Dredging and Spoil Disposal Management Plan (DSDMP).** The DSDMP has been prepared to detail how environmental impacts will be managed during the dredging phase. Key management measures are summarised in **Table 7-4** and the DSDMP is provided in **Appendix E**.
- **Marine Operational Environmental Management Plan (MOEMP).** The purpose of this MOEMP is to establish a framework to ensure that the implementation of the Proposal does not compromise the EVs and EQOs and outlines management measures to minimise the risk of vessel strike during vessel operations. Key management measures are summarised in **Table 7-4** and the MOEMP is provided in **Appendix D**.

Table 7-4: Proposed Mitigation Measures for Marine Environmental Quality

Potential Impact	Proposed Mitigation		
	Avoid	Minimise	Offset required?
<p>Construction Phase Impacts</p> <p>Construction Phase impacts will be managed through development and implementation of a Marine Construction Environmental Management Plan (MCEMP), prior to commencement of construction works. The following mitigation measures will be included in the MCEMP to mitigate impacts on Marine Environmental Quality during construction.</p>			
<p>Release of contaminated sediments during dredging within the proposed dredge footprint and disposal at the existing Spoil Ground C (Figure 7-1).</p>	<ul style="list-style-type: none"> Dredge sediments to be disposed offshore in and existing and approved offshore dredge material disposal area (Spoil Ground C), (Figure 2-5). Sediments have been analysed against the DEWHA 2009 guidelines' screening levels and are considered free from contaminants. 	<p>Implement DSDMP (Appendix E).</p>	<p>No</p>
<p>Temporary, localised turbidity increase from dredging and disposal activities</p>	<p>NA</p>	<p>Impacts relevant to the Factor BCH are assessed in Section 6.6</p> <p>Impacts relevant to the Factor Marine Fauna are assessed in Section 8.6</p> <p>Dredge plume modelling was completed to determine the zones of impact to ensure no unacceptable risk to MEQ (or other factors) would result from proposed activities.</p> <p>Implement DSDMP (Appendix E) including:</p> <ul style="list-style-type: none"> Dredge schedule developed for efficiency and to reduce duration of dredging activities. Maintain equipment and complete inspection checks. Implement all environmental monitoring, reactive monitoring and reporting commitments. Ensure dredging complies with the defined dredge footprint and offshore spoil disposal area. Compliance with Sea-Dumping Permit (not yet approved) conditions. 	<p>No</p>
<p>Accidental fuel spillage to marine and intertidal environment from construction vessels & vehicles</p>	<p>NA</p>	<p>Implement MCEMP (Appendix C) & DSDMP (Appendix E), which includes mitigation measures for hydrocarbon storage and refuelling</p>	<p>No</p>
<p>Operational Phase Impacts</p> <p>Operational phase impacts will be managed through development and implementation of a Marine Operational Environmental Management and Monitoring Plan (MOEMMP), prior to commencement of operations. The following mitigation measures will be included in the MOEMMP to mitigate impacts on Marine Environmental Quality during operations</p>			
<p>Release of hypersaline brine to the marine environment resulting in altered physicochemical conditions (i.e. increased temperature and salinity) within the proposed LEPA located within the Nearshore DE (Figure 7-2).</p>	<p>Brine diffuser and associated mixing zone has been positioned within the Nearshore IF, affixed to the jetty infrastructure and within a dredged berthing pocket so as to avoid further impacts to BCH or Marine Fauna.</p>	<p>Brine discharge modelling was conducted to ensure appropriate species protection levels are met at LEP boundaries. The near-field modelling assessment indicates that the target dilutions required to meet the 90% and 99% SPLs, as applied to the moderate and high LEPs, respectively, are readily achieved within the 70 m mixing zone. The results indicate that satisfactory dilutions could readily be achieved within short distances of the Proposal infrastructure, with relatively simple diffuser designs.</p> <p>Implement MOEMMP (Appendix D) including:</p> <ul style="list-style-type: none"> Conduct whole effluent toxicity (WET) testing of actual brine and remodelling of actual dilution contours required to meet the 90% and 99% SPLs. Implement the commissioning and validation MEQ monitoring and management commitments. Implement the ongoing operational MEQ monitoring and management commitments. Implement reactive monitoring and management programs as determined by performance target exceedances (if required). 	<p>No</p>

Potential Impact	Proposed Mitigation		
	Avoid	Minimise	Offset required?
		<ul style="list-style-type: none"> Operate all plant in accordance with design specifications, typically brine quality prior to discharge and flow volumes/velocities for diffuser performance. 	
<p>Accidental product spills to the marine environment, resulting from loading at the port infrastructure in the nearshore DE and at the transshipment location in the Offshore DE (Figure 7-2).</p>	<p>Operate all vessels within the requirements of the existing PoA requirements as stipulated by Pilbara Ports Authority and directed by the Harbour Master.</p>	<p>Cargo handling infrastructure designed to industry best practice to minimise spillage.</p> <p>Development of specific procedures for transshipping operations within the proposed anchorage typically including:</p> <ul style="list-style-type: none"> Identification of sea state and wind loading parameters for offshore transshipping. Implement industry standards for hydrocarbon storage and management. Facility and vessel cargo infrastructure maintenance and inspections. <p>Implement MOEMMP (Appendix D) typically including:</p> <ul style="list-style-type: none"> Implement the ongoing operational MEQ monitoring and management commitments. Implement reactive monitoring and management programs as determined by performance target exceedances (if required). 	No
<p>Accidental fuel spillage or pollution from vessels</p>	NA	<p>Implement existing PPA PoA procedures typically including:</p> <ul style="list-style-type: none"> Inspect and maintain all refuelling equipment on a daily basis or at least prior to each and every use. Implement existing PoA refuelling procedures. Store all fuels, oils and lubricants on site to ensure that they do not pose a threat to the environment or the safety of staff and the public. All vessel movements are subject to the Harbourmaster's approval to ensure they are all planned, no incompatible operations co-occur, and that weather and tidal movements are factored into all operations. All vessel movements subject to PoAs procedures, including qualified and experienced vessel operators. All shipping movements are subject to PoAs scheduling and Pilotage requirements to ensure the highest level of planning, which includes all vessel movements, weather and tides. Follow all reasonable directions given by the harbour master to ensure vessel collisions are avoided. <p>Oils Spill Contingency Management:</p> <ul style="list-style-type: none"> The Proponent is committed to updating and reviewing the Oil Spill Response and Tactical Response Plans to accommodate the increased levels of risk posed by additional vessel movements. Operational staff shall be appropriately trained in oil spill response. The Proponent is committed to working alongside the PoA to ensure oil spill response capabilities are met. Ensure all operational vessels are compliant with the MARPOL. 	No

7.6 Assessment and Significance of Residual Impacts

7.6.1 Construction Impacts

Direct Impacts

7.6.1.1 Release of Contaminated Sediments During Dredging within the Proposed Dredge Footprint and Disposal at existing Spoil Ground C.

Dredging has the potential to mobilise contaminants and reduce MEQ within the Nearshore DE and surrounding areas. Sediment contamination assessment was conducted by O2 Marine (2021g) to determine the suitability of sediments for offshore disposal. The assessment determined the sediments are typically free from contaminants (metals, total petroleum hydrocarbon, polyaromatic hydrocarbon, organotins) and pose a very low risk of acid sulfate soils. It was concluded that risk to MEQ from contaminants and acid sulfate soils during dredging and offshore spoil disposal of proposed sediments is not considered significant. Therefore, in consideration of potential impacts associated with mobilisation of contaminants, EQO1 for the EV 'Ecosystem Health' is unlikely to be affected in either the Moderate, High or maximum LEP areas shown in **Figure 7-1**.

7.6.1.2 Temporary, Localised Turbidity Increase from Dredging and Disposal Activities

The potential for impacts due to changes in turbidity and suspended sediment concentrations was examined using an integrated hydrodynamic and sediment transport model, described in O2 Metocean (2022). Dredging will take place over a 2-month period. The dredge plume modelling predicts that dredging activities will result in a temporary, localised turbidity plume within the nearshore and offshore DEs, including sediment disposal at Spoil Ground C (**Figure 6-3**). These impacts are presented in the context of zones of influence and impact as they relate to BCH and are assessed further in **Section 6.6**. Impacts from reduced MEQ resulting from dredge plumes are also assessed in the context of Marine Fauna in **Section 88**. A DSDMP (**Appendix E**) has been developed to manage and mitigate further impacts from dredge operations.

Outside of localised, temporary effects on turbidity, the dredging and disposal program is not considered to represent a significant impact to MEQ.

7.6.1.3 Accidental Fuel Spillage to Marine and Intertidal Environment from Construction Vessels & Vehicles

There will be a broad range of marine based vessels/related equipment which have a risk of hydrocarbon spillage (e.g., backhoe dredge, crew transfer vessel, support vessels, piling plant). There is potential for a hydrocarbon release into the marine environment from these vessels during construction. However, this risk is inherent in all dredging operations and can be effectively managed through application of standard operating procedures. Vessel activities within the Port are all subject to existing management processes in accordance with MARPOL and PPA Harbour Master requirements and will be required to have a Shipboard Oil Pollution Emergency Plan (SOPEP) and SOPEP equipment to prevent release of hazardous materials into the marine environment, and to respond when such releases do happen. Vessel operations are also required to comply with the DSDMP and MCEMP further reducing associated risk profile. Adjacent terrestrial hydrocarbon and vehicle operations will be managed in accordance with the TEMP, thus considered also to pose minimal risk to MEQ.

Therefore, if managed in accordance with existing and Proposal specific management plans, the Proposal is not considered to represent a significant impact to MEQ.

7.6.2 Operational Impacts

Direct Impacts

7.6.2.1 Osmotic Stress from Brine Discharge

The release of brine from the outfall has the potential to alter natural physical properties, such as temperature, dissolved oxygen and salinity of the adjacent water column within the Nearshore DE. The potential impacts from altered physical properties include temperature and osmotic stress and reduced available benthic dissolved oxygen.

To determine the predicted impacts from brine discharge, outfall modelling was conducted in accordance with EPA (2016c) (O2 Metocean 2021b). Brine outfall modelling determined that the dilution factors to conservatively achieve 90% and 99% SPLs were 20 and 46, respectively, to achieve the assigned moderate and high levels of ecological protection. Results from the modelling indicate that the required number of dilutions to achieve 90% and 99% species protection are achieved within the EPA's recommended 70 m maximum distance from the diffuser. In fact, these dilutions would be met closer to the discharge point. Based on the model outputs a reduced Low LEP boundary has been established at a 30 m distance from the discharge points to reflect the small size of the predicted mixing zone and to allow for a practical distance to accurately monitor and manage the outfall dilution requirements. The Moderate LEP boundary was not impacted by the 250 m buffer as the dilution contour for 90% SPL was met well within this buffer. The existing High LEP area did not require any modification resulting from Brine discharge impacts.

As the proposed LEPs include a small Low LEP area based on dilution contours required to meet the 90% SPL (30 m) and a revised Moderate LEP buffered 250 m around project infrastructure they are considered consistent with the EPA technical guidance for a mixing zone and MEQ management. It is therefore considered that brine discharge poses no significant impacts to MEQ. The existing and proposed low and moderate LEPs for the Proposal are shown in **Figure 7-2**.

Indirect Impacts

7.6.2.2 Accidental Product Spills to the Marine Environment, from Loading at the Port Infrastructure in the Nearshore DE and at the Transshipment Location in the offshore DE.

General operations, including transshipping ore (cargo handling operations) and vessel and wharf activities have the potential for accidental product spillage. All activities relevant to vessel operations are to be managed in accordance with existing PPA policies and procedures for the Port. These activities are therefore considered low risk as the existing management is considered industry best practice. Cargo operations and transshipping will be undertaken using industry best standard equipment and transshippers and will be subject to operational procedures to reduce the potential for spillages. Typical measures required to reduce spillages will include landside cargo handling procedures, whilst offshore transshipping operation will be subject to weather and sea-state loading parameters, maintenance and vessel inspections and hydrocarbon storage in accordance with Australian standards. Additionally, surveillance monitoring, reactive monitoring and contingency management actions are all identified within the MOEMMP to ensure that all impacts are within the limits of acceptable change as applicable to the proposed and existing LEPs (**Figure 7-1** and **Figure 7-2**).

Therefore, if managed in accordance with existing and project specific management plans, the Proposal is not considered to represent a significant impact to MEQ.

7.6.2.3 Accidental Fuel Spillage or Pollution from Vessels

Increased vessel traffic within the Port during the Proposal has the potential to increase the risk of vessel collision and associated accidental hydrocarbon spill. Hydrocarbon spills are possible however the risk of a significant hydrocarbon spill is considered to be very low, with the risk inherent in all operational port facilities. Standard operational management practices regulated by PPA and response measures within PPA's Port of Ashburton Marine Pollution Contingency Plan are considered adequate to effectively mitigate this risk. This includes compliance with the PPA Port of Ashburton Port Handbook for discharge of oils/wastes from ships and PPA Incident Reporting requirements (PPA 2022).

Vessel activities within the Port are all subject to existing management processes in accordance with MARPOL and PPA Harbour Master requirements and will be required to have a SOPEP and SOPEP equipment to prevent release of hazardous materials into the marine environment, and to respond when such releases do happen. Vessel operations are also required to comply with the MOEMMP further reducing associated risk profile.

Therefore, if managed in accordance with existing and Proposal specific management plans, the Proposal is not considered to represent a significant impact to MEQ.

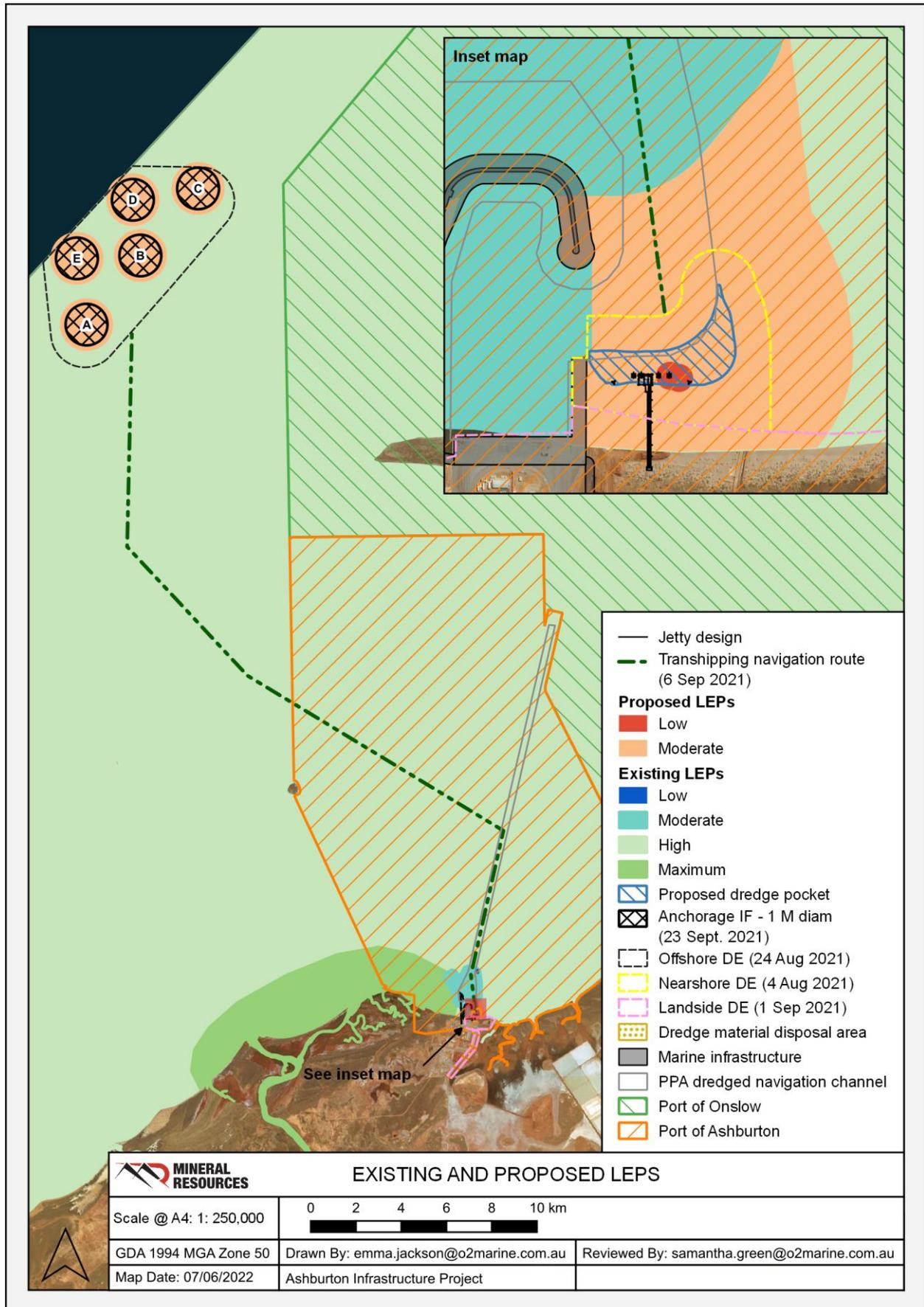


Figure 7-1: Existing and Proposed Construction Ecological Protection Areas for the Proposal

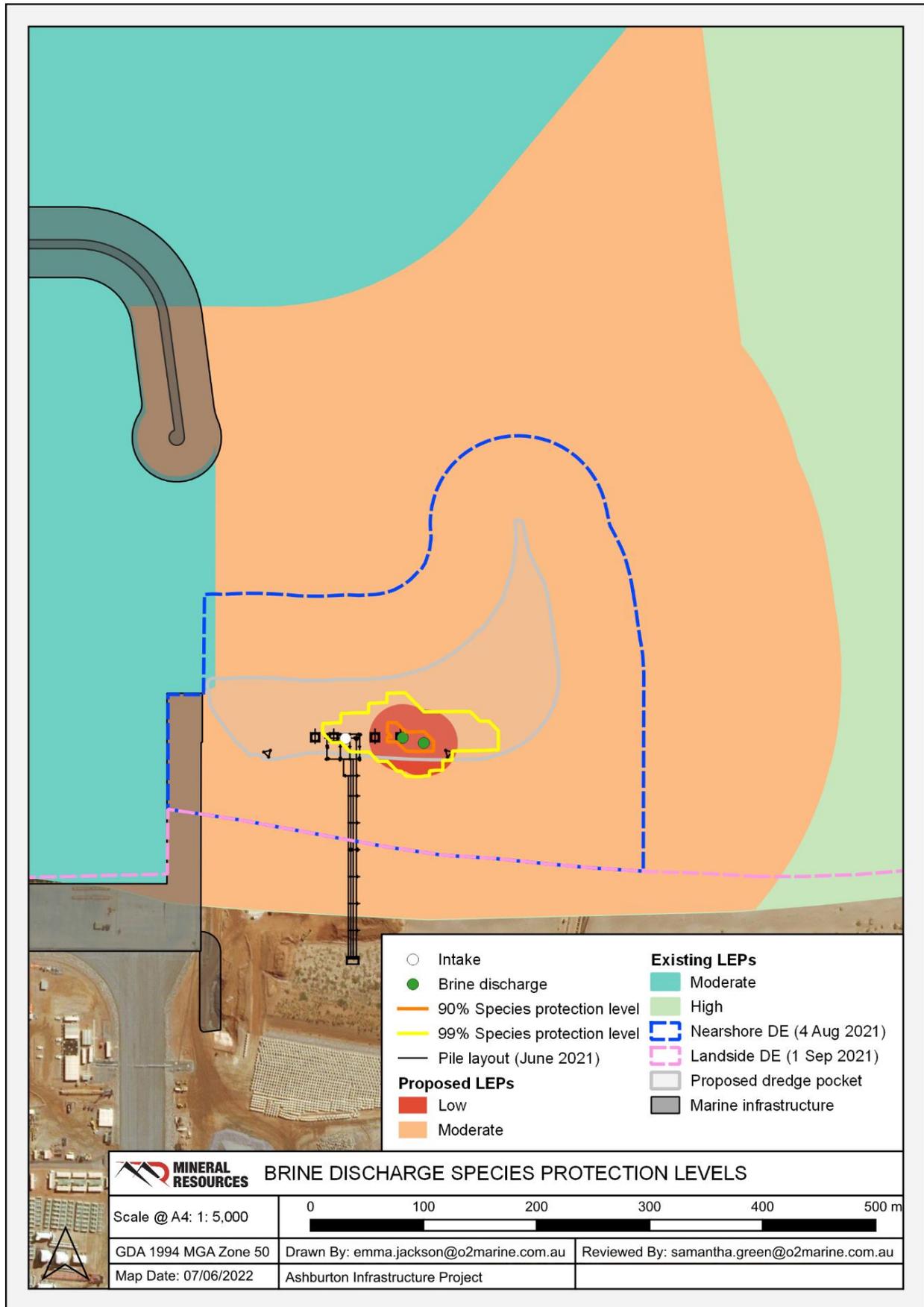


Figure 7-2: Proposed Operations Low and Moderate Ecological Protection Areas for the Proposal

7.6.3 Cumulative Impacts

The EQMF provides a basis for considering cumulative effects to MEQ and the EIA of port developments. The Proponent has assessed impacts to MEQ in the context of the EQMF, as defined in the EPA's Technical Guidance (EPA 2016j). Cumulative effects are addressed by protecting the quality of the receiving marine environment in the long term in line with established EVs, EQOs and LEPs. The objective of this approach is to allow the Proponent and other port users to manage project specific impacts as well as cumulative impacts to surrounding marine waters.

The proponent considers that potential impacts to MEQ from the Project are not significant. The only expected long-term change to MEQ from this Proposal is from the proposed brine discharge which requires a small LEP area to be established around it. The Proponent considers, therefore, that the Proposal will not contribute significant adverse cumulative effects to MEQ.

7.7 Environmental Outcomes

The Proponent's assessment of impacts to MEQ included the following aspects:

- The established EQMF, EVs and EQOs across the Port.
- Review of existing baseline water quality for the project area.
- Consistency with EPA Technical Guidance - Protecting the Quality of Western Australia's Marine Environment.

The Proponent considers that potential impacts to MEQ from the Proposal would be minor and temporary for the duration of marine construction activities (dredging and piling) is expected to be less than three months. The receiving environment has a degree of resilience to turbidity as the waters are naturally turbid. The dredge material is also likely to be clean due to the low levels of contaminants recorded in the sediment quality assessment.

After the mitigation hierarchy has been applied (**Table 7-4**), the Proponent has committed to protecting EVs and maintaining ecosystem integrity during operations as per the established Port of Ashburton LEPs and proposed LEP modifications (around nearshore infrastructure and diffuser) and considers there is a high level of confidence that the proposed water quality monitoring program and contingency management measures within the DSDMP, MCEMP and MOEMMP for the Proposal will achieve this.

Based on no predicted long-term impacts to MEQ and the implementation of all mitigation measures to limit the impact of the Proposal on the environment. Overall, the impacts to MEQ are not considered to be significant and the EPA objective for MEQ is considered to be met.

8. MARINE FAUNA

8.1 EPA Objective

The EPA's objective for the factor 'Marine Fauna' is *to protect marine fauna so that biological diversity and ecological integrity are maintained* (EPA 2016b).

8.2 Policy and Guidance

The Proponent has considered published policy and guidance relevant to this factor as summarised in **Table 8-1**.

Table 8-1: Policy and Guidance for Marine Fauna

Policy / Guidance	Considerations
Instructions on how to prepare an Environmental Review Document (EPA 2021b)	This RSD has been prepared in accordance with the Instructions.
<i>Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans</i> (EPA 2020c)	The MCEMP (Appendix C) and MOEMMP (Appendix D) have been prepared in accordance with this guidance.
Environmental Factor Guideline: Marine Fauna (EPA 2016b)	The information provided in this chapter addresses the 'considerations for environmental impact assessment' listed in this document
The MNES Significant Impact Guidelines (DoE 2013)	Criteria to assess potential for significant impacts to species listed as matters of national environmental significance and their habitats have been considered.
Relevant Commonwealth Marine Fauna Management Guidance.	The following management guidance have been incorporated within the MCEMP (Appendix C), MOEMMP (Appendix D), and other plans to ensure that appropriate avoidance, minimisation and mitigation measures are employed: <ul style="list-style-type: none"> National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds (DotEE 2020); National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (DotEE 2017a); Australian National Guidelines for Whale and Dolphin Watching (DotEE 2017b); and Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DEWHA 2018).
Relevant Commonwealth Dredging and Sea Dumping Guidance	The following dredging and sea dumping guidance has been considered when preparing the DSDMP (Appendix E) <ul style="list-style-type: none"> <i>Environmental Protection (Sea Dumping) Act 1981</i>; Environment Protection (Sea Dumping) Regulations 1983; National Assessment Guidelines for Dredging (NAGD 2009); and Application Form under the <i>Environmental Protection (Sea Dumping) Act 1981</i> for a Disposal Application - Dredged or Excavated Material.

Policy / Guidance	Considerations
Relevant EPBC Act listed marine fauna species specific Recovery Plans and Approved Conservation Advice.	Impact assessment and management plans have been developed with consideration of: <ul style="list-style-type: none"> • Recovery Plan for Marine Turtles in Australia (DotEE 2017c); and • Sawfish and River Sharks: Multispecies Recovery Plan (DoE 2015a).

8.3 Receiving Environment

8.3.1 Environmental Studies

Environmental studies specifically undertaken for this Proposal are presented in **Table 8-2**. These studies have enabled the impact assessment to be undertaken with a high degree of certainty.

The Marine Fauna Desktop (**Appendix L**) identified marine fauna species present in the waters surrounding the Proposal area and which have the highest potential for impact. The report included publicly available information that has been collected at the site, including those undertaken for the Wheatstone Project. These studies include:

- Wheatstone Dugong aerial survey and tagging study (Murdoch University). Wheatstone Conservation Significant Management Plan (Chevron 2016).
- Wheatstone sawfish survey (Murdoch University) (Morgan et al. 2015);
- Marine Megafauna Aerial Survey (Centre for Whale Research) - Wheatstone EIS / Environmental Review and Management Plan (ERMP) Marine Mammals Technical Appendix (RPS 2010a).
- Sea Noise Logger Deployment Wheatstone and Onslow 2019 (RPS 2010a);
- Wheatstone in-water turtle study (RPS Australia), Wheatstone EIS / ERMP Marine Turtles Technical Appendix (RPS 2010b).
- Wheatstone turtle nesting beach study (RPS 2010b); and
- Wheatstone Project Offset C – Understanding and Managing Critical Habitat for Marine Mammals in the Pilbara, Dolphin boat surveys (Raudino et al. 2018).

As there are inherent links between the Marine Fauna factor and other environmental factors, and that impact assessment and management measures must consider those (EPA 2016b), a number of other marine studies have also been included here. These studies include:

- Benthic Communities and Habitat Report (O2 Marine 2021a).
- Desalination Brine Plume Modelling Technical Note (O2 Metocean 2021b); and
- Dredge Plume Modelling Report (O2 Metocean 2022).

Table 8-2: Studies for Marine Fauna

Studies and Surveys	Survey / Study Effort	Key Findings
Supplementary Benthic Communities and Habitat Survey of Spoil Ground C – March 2022 (O2 Marine 2022) (Appendix N)	<p>A field survey including validation and update of Spoil Ground C mapping and the adjacent areas to consider any impacts to BCH arising from dredge spoil disposal at this location.</p> <p>The survey used drop camera footage to assign BCH classification throughout Spoil Ground C and surrounding perimeter.</p>	<p>Following detailed analysis of the raw drop camera footage, each site was assigned a BCH classification taking into account the entire transect length. Two BCH classifications were assigned:</p> <ul style="list-style-type: none"> 81 sites (87 %) as 'Bare Substrate'; and 12 sites (13%) as 'Sand with Sparse Filter Feeders'. <p>Finding of the March 2022 surveys were comparable with the previous BCH investigations undertaken within Spoil Ground C for the Wheatstone Project by URS (URS 2010).</p> <p>Based on results from this survey and URS (2010), BCH within and adjacent to Spoil Ground C is classified as sand substrate with a biota cover ranging from bare to sparse (<1% - 3%). Results support Spoil Ground C being historically established as a designated disposal ground. The small amount of biota identified within the spoil ground are not restricted to this area and are well represented across the entire Pilbara coastline.</p>
Marine Fauna Desktop Study. Ashburton Infrastructure Project (O2 Marine. 2021a) (Appendix L)	<p>A desktop review of marine fauna species in and around the Proposal undertaken using government databases and reports.</p> <p>A broad area (approx.30 km radius from the Offshore DE) was searched to include all project elements and cover varying bathymetry of the surrounding area which can influence the occurrence of highly mobile marine fauna species.</p>	<p>Key mammal species are the Humpback Whale, Dugong, Australian Humpback Dolphin and Indo-Pacific Bottlenose Dolphin. Key marine reptile species are the Green Turtle, Flatback Turtle and Hawksbill Turtle. The key fish species is the green sawfish. Key seabird and shorebirds include the Australian Fairy Tern, northern Siberian Bar-tailed Godwit, Curlew Sandpiper and Eastern Curlew.</p> <p>No conservation significant or commercially important marine fauna species populations are restricted to the Proposal or transshipping navigational route. Habitats surrounding the Proposal are widespread and well represented throughout the region.</p>
Benthic Communities and Habitat Report. Ashburton Infrastructure Project (O2 Marine. 2021a) (Appendix M)	<p>A field survey including side scan sonar mapping of the seabed with drop camera video validation of key features identified from the side scan sonar backscatter data.</p> <p>Survey area was split into nearshore and offshore survey areas in accordance with Proposal activities (wharf construction, transshipping, offshore anchorage, dredging, etc) and the existing relevant LAUs.</p> <ul style="list-style-type: none"> Nearshore survey: 15 to 18 December 2020 Offshore survey: 7 to 8 February 2021 	<p>The outcomes of the investigation included:</p> <ul style="list-style-type: none"> Identification of suitable anchoring areas that are largely devoid of benthic cover and are unlikely to be impacted by offshore anchoring activities; Validation and refinement of existing maps of the subtidal BCH, which may be affected either directly (i.e. from bulk carrier anchoring) or indirectly (i.e. from increased TSS and reduced light availability during dredging) by the Proposal; and Identification and evaluation of the regional significance and functional ecological value of the BCH in the vicinity of the Proposal to inform future environmental impact assessment of the Proposal.
Marine Pest Risk Assessment. Ashburton Infrastructure Project (O2 Marine. 2021d) (Appendix O)	<p>A desktop Introduced Marine Pests (IMPs) investigation and risk assessment that is aligned with the National System for the Prevention and Management of Marine Pests Incursions (The National System) and the Marine Pest Plan.</p>	<p>An IMP species on the NIMPCG list (<i>Didemnum perlucidum</i>) has been previously identified at the Port of Ashburton and (<i>Perna viridis</i>) was identified during a vessel inspection at nearby Barrow Island (85 km from the Proposal) in 2013.</p> <p>Based on the risk assessment conducted in this report, the construction phase presents a higher risk of IMP introduction than the operational phase of the Proposal.</p>
Underwater Noise Modelling. Ashburton Infrastructure Project (Talis 2022) (Appendix P)	<p>Presents the underwater noise modelling methods, results and discussion.</p> <p>The bathymetry applied to the model extended out to 15 km from the shoreline. The water depth is shallow (0 and ~30 m) and progressively gets deeper on the seaward side of the jetty</p>	<p>The model results indicate that noise will travel further at high tide than low tide.</p> <p>Dredging – Depending on the hearing group the TTS threshold will be exceeded at distances between 25 m and 70m (high tide), and <20m (low tide). Piling – The TTS threshold will be exceeded at distances between 215m (i.e., for turtles and sawfish) and 1,440m (i.e. for low frequency hearing groups) at high tide. The distances at low tide are far shorter, with 840m for low frequency hearing groups and 100m for turtles and sawfish. TTS threshold levels are not expected to be exceeded for the other fauna types.</p>
Ashburton Artificial Light Impact Assessment and Management Plan (Pendoley Environmental 2021) (Appendix F)	<p>The Proposal is a 20 km buffer surrounding the landside and nearshore facilities, the TSV's while transiting along a navigation route between the Port and the anchorage area (Offshore DE), and the OGV(s) when at the anchorage area</p>	<p>Significant impacts to marine turtles are unlikely because of project lighting.</p> <p>Significant impacts to seabirds or migratory shorebirds are unlikely because of project lighting</p>

Studies and Surveys	Survey / Study Effort	Key Findings
<p>Ashburton Infrastructure Project: Desalination Brine Plume Modelling Report (O2 Metocean. 2021b)</p> <p>(Appendix K)</p>	<p>This report details a desktop ecotoxicology assessment, conceptual diffuser design, near-field mixing assessment, and far-field dispersion assessment for a brine outfall associated with the Proposal.</p>	<p>The results are interpreted in terms of the guidance of EPA (2016c), where EQO for specific Species Protection Levels (SPL) are defined. The results are interpreted in terms of general guidance on the spatial Ecological Protection Areas in which these EQOs are to be met (EPA 2016c), specifically:</p> <ul style="list-style-type: none"> • A moderate level of ecological protection (90% SPL) must be met within 70 m of the outfall - a zone referred to as the 70 m mixing-zone: and • A high level of ecological protection (99% SPL) must be met within 250 m from the proposed port infrastructure, inclusive of berth infrastructure and ship turning basin – a zone referred to as the Moderate Ecological Protection Area (MEPA). <p>The near-field modelling assessment indicates that the target dilutions required to meet the 90% and 99% SPLs, as applied to the moderate and high LEPs, respectively, are readily achieved within the 70 m mixing zone. Based on the model outputs a reduced Low LEP boundary has been established at a 30 m distance from the discharge points to reflect the small size of the predicted mixing zone and to allow for a practical distance to accurately monitor and manage the outfall dilution requirements.</p> <p>3D far-field dispersion modelling shows that the EQOs would readily be met with this discharge configuration. The same 3D far-field dispersion model revealed that a brine intake located at the western side of the proposed berth to the outfall, and just below the low tide mark (-1 m LAT) is unlikely to experience any appreciable outfall salinity signature.</p> <p>The results indicate that satisfactory dilutions could readily be achieved within short distances of the Proposal infrastructure, with relatively simple diffuser designs.</p>
<p>Dredge Plume Modelling. Ashburton Infrastructure Project (O2 Metocean 2022)</p> <p>(Appendix J)</p>	<p>This study details the numerical modelling assessment of the proposed capital dredge program and associated offshore disposal. The study was undertaken in accordance with EPA Technical Guidance - Environmental impact assessment of marine dredging proposals (EPA 2021c) and the Guideline on dredge plume modelling for environmental impact assessment (Sun et al. 2020).</p>	<p>The dredge and dredge-spoil disposal plumes were modelled using a 3D hydrodynamic and sediment transport model built upon O2 Metocean's existing model of the Pilbara region. Elements modelled were:</p> <ul style="list-style-type: none"> • Backhoe dredger: silt, clay and fine sands contributing to the passive plume; • Hopper barge overflow: Silt and clay contributing to the passive plume, and • Disposal: Silt, clay and fine sand contributing to the passive plume (with the assumed loss of silt and clay in the hopper barge overflow stage reduced from the total amount of disposed silt and clay). <p>The report defines the following predicted zones of impact to inform impact assessment as well as monitoring and management:</p> <ul style="list-style-type: none"> • Zone of High Impact (ZoHI) (Possible, Probable); • Zone of Moderate Impact (ZoMI) (Possible, Probable); and • Zone of Influence. <p>These predicted impact zones are also shown in Figure 6-3.</p>
<p>Water Quality Desktop Review. Ashburton Infrastructure Project (O2 Marine 2021b)</p> <p>(Appendix Q)</p>	<p>Desktop study to conduct a review of available water quality data locally collected and assessed, typically to determine background water quality values intended to inform the dredge plume modelling and desalination outfall modelling. This study reviewed approximately 14 previous technical reports, typically undertaken regionally or specific to the adjacent Wheatstone project. The scope of this study was not limited to the nearshore and offshore DEs, as both regional and local data was assessed, reviewed and collated.</p>	<p>The report presented a synthesis of the results in the context of an environmental quality management framework and presented the environmental quality criteria applicable to MEQ for physicochemical, light, biological and toxicant stressors.</p> <p>The report identified the existing marine environment to be typically representative of natural conditions with contaminants at very low levels, physical parameters and nutrients identified as variable, though generally within published guideline levels.</p>

8.3.2 Marine Fauna Habitats

A detailed account of marine fauna habitats within and surrounding the Proposal area is presented in the Marine Fauna Desktop Report (**Appendix L**). Marine elements of the Proposal Landside and Nearshore DEs are located on the coast and within the relatively flat and shallow waters of the Pilbara 'nearshore' IMCRA meso-scale bioregions, within the broader North-west Marine Region (DSEWPaC 2012a; IMCRA 1998) (**Figure 8-1**). The Offshore DE is situated on a slope at the 30 m bathymetric contour, near the landward edge of the Pilbara offshore' IMCRA bioregion (DSEWPaC 2012a). The habitats present are widespread and well represented throughout the region.

The western Pilbara coastline is characterised by mangrove communities, intertidal creeks and sandy beaches. Six species of mangrove occur in the region and are generally considered to be in pristine condition. The DEs lie within and adjacent to the designated Ashburton River Delta 'Regionally Significant' mangrove area (EPA 2001), which are located on the Western extent of the Port (**Figure 2-25**). The mangrove communities in this area are of great ecological and economic importance, supporting a varied number of organisms such as snails, crabs, shrimps, oysters, barnacles, fish and birds. The intertidal mud and sand flat burrowing invertebrate fauna are abundant and species-rich which is extremely important as a food source for migratory birds. The benthic fauna is typical of the coastal habitats of the Northern Australian region with the suite of endemic coastal species well represented (DSEWPaC 2012a). An assessment of BCH at the site (O2 Marine 2021a; O2 Marine 2022) six key BCH classes within these designated LAUs (**Figure 6-1, Figure 6-2**):

- Bare substrate;
- Sand with sparse filter feeders;
- Sand with sparse seagrass;
- Sand veneered limestone pavement;
- Coral; and
- Low Profile Reef.

The Nearshore DE is located in turbid waters, with turbidity increasing during periods of spring tides (DSEWPaC 2012a) and following high rainfall events. Patchy and ephemeral seagrass communities, low cover macroalgae, bare sand with sparse filter feeders and limestone pavement (O2 Marine 2021a) are present throughout the area. Coral communities present in the area do not form reefs but are found on exposed hard substrate and are typically in the shallower nearshore waters to 10 m depth, an area that is characterised by a ridge of scattered patch shoals. However, the Nearshore DE is characterised by bare substrate with occasional areas of limestone pavement. No seagrass was identified in the inshore Survey Area either from literature review or field survey (**Figure 6-1**).

A series of limestone island nature reserves are situated within the 20 m bathymetric contour and may receive Proposal light spill and / or glow. Many have fringing coral reefs on the seaward side, of moderate, but variable, percent coral cover. Biogenic reefs are primarily associated with the ecosystem unit between 10-20 m depth. Sandy beaches support turtle rookeries and suitable beaches and sandbars support shorebirds and seabird breeding colonies. The remote nature of these islands provides natural protection from introduced predators including cats and foxes.

The Offshore DE is located within clearer waters, with anchorage on sandy substrate. Spoil Ground C is predominately bare substrate with sparse filter feeders (**Figure 6-2**). Between the Offshore and Nearshore DEs, a low-profile reef system occurs between 20-30 m depth range, with primarily bare substrate occurring beyond (i.e., deeper) within this zone. Widespread throughout the region, this low-profile reef system is recognised as providing important habitat for a wide variety of reef and demersal fish species.

Two Key Ecological Features (DSEWPaC 2012a) are situated further offshore (**Figure 2-23**). The ancient coastline at the 125 m depth contour is thought to provide biologically important habitats in the form of a rocky escarpment in an area otherwise dominated by soft sediment. It may serve a navigational aid for migrating whales and whale shark.

The continental slope demersal fish communities support a high level of endemism. Deep-water canyons and steep bathymetry where nutrient rich upwelling occurs are areas of high productivity and likely to be support aggregations of marine predators. These areas are well outside of the Proposal's activities, but highly mobile pelagic species may occur within the Proposal at some time.

8.3.2.1 Biologically Important Areas

Biologically Important Areas (BIAs) are spatially defined zones where aggregations of individuals of a species are known to display biologically important behaviours such as breeding, foraging, resting or migration (DAWE 2020). BIAs were first identified on a regional basis as they were developed as part of the Commonwealth Marine Bioregional Plans and have been identified using expert scientific knowledge about species' distribution, abundance, and behaviour in the region to inform decisions made under the EPBC Act. They are important components of Species' Recovery Plans, where those plans exist. A search of the Conservation Values Atlas identified BIAs around the DEs, which are presented in **Table 8-3** and **Figure 8-2** to **Figure 8-5**.

Table 8-3: Biologically Important Areas that Spatially Overlap with Proposal Marine Components

Species	Type	Marine Component
Humpback Whale	Migration	Nearshore DE, navigation route and Offshore DE (Figure 8-2)
Pygmy Blue	Distribution	Nearshore DE, navigation route and Offshore DE (Figure 8-2)
Whale Shark	Foraging	Offshore DE, southwestern boundary of BIA (Figure 8-4)
Flatback Turtle	Nesting and inter-nesting	Nearshore DE, navigation route Offshore DE (Figure 8-5)
Hawksbill Turtle	Inter-nesting	Not in DE, >30km east from Nearshore (Figure 8-5)
Green Turtle	Foraging	Not in DE, >40 km north east of Offshore (Figure 8-5)

8.3.2.2 Critical Habitat Areas

The Recovery Plan for Marine Turtles in Australian 2017-2027 (DotEE 2017c) identifies habitat critical for the survival of turtle species, in relation to the various stocks (**Table 8-4**). These areas have been identified by consensus of a panel of experts in marine turtle biology. They are not on the Register of Critical Habitat under the EPBC Act, but they are relevant when applying the significant impact criteria.

Table 8-4: Critical Habitat Areas that Spatially Overlap with Proposal Port DEs

Species	Genetic Stock	Relevant/Proximal Nesting Locations	Internesting buffer	Relevant DE
Flatback Turtle	Pilbara	Coastal islands from Cape Preston to Locker Island	60 km radius	Nearshore DE, Transshipment Navigation Route (NR), Offshore DE
Green Turtle	North West Shelf	Serrurier Island, Thevenard Island, Northwest Cape	20 km radius	Nearshore DE, Transshipment NR, Offshore DE
Hawksbill Turtle	Western Australia	Cape Preston to mouth of Exmouth Gulf, Sholl Island	20 km radius	Offshore DE, Transshipment NR
Loggerhead Turtle	Western Australia	Muiron Islands	20 km radius	Offshore DE, Transshipment NR

Although not listed formally as a critical habitat, the Ashburton River estuary/delta (5 km to the west of the Proposal on the other side of the existing Port facilities) provides important breeding and foraging habitat for the green sawfish. Other creeks in the southern Pilbara, are also speculated to provide critical habitat for various species of sawfish, including the Green and Dwarf Sawfishes, but are yet to be classified as such formally (Morgan et al. 2016).

8.3.2.3 Important Marine Turtle Nesting Areas

Marine turtles are known to utilise nesting and internesting habitat in the vicinity of the Proposal Area. These areas are known to be of regional importance for Marine Turtle species. These areas include Ashburton, Direction, Thevenard, Bessieres and Tortoise islands, and on the mainland, notably at Ashburton River Delta and Onslow Back Beach (Pendoley Environmental 2021, **Figure 8-6**). **Table 8-5** presents the distances of the distances from the Proposed Action's Nearshore, Landside and Offshore DEs from Marine Turtle nesting habitat locations.

Table 8-5: Marine Turtle Nesting Habitat Locations and Distances from the Proposal DEs

Marine Turtle Nesting Habitat Locations	Marine Turtle Species	Approximate Nearshore / Landside DEs (km)	Approximate Distance from Offshore DE (km)
Ashburton River Delta	Flatback	12	31
Onslow Back Beach	Flatback	3	35
Ashburton Island	Flatback, Green, Hawksbill	20	12
Tortoise Island	Flatback, Green	17	19
Bessieres Island	Green, Hawksbill	30	14
Direction Island	Flatback	30	21
Thevenard Island	Flatback, Green, Hawksbill	24	12.5

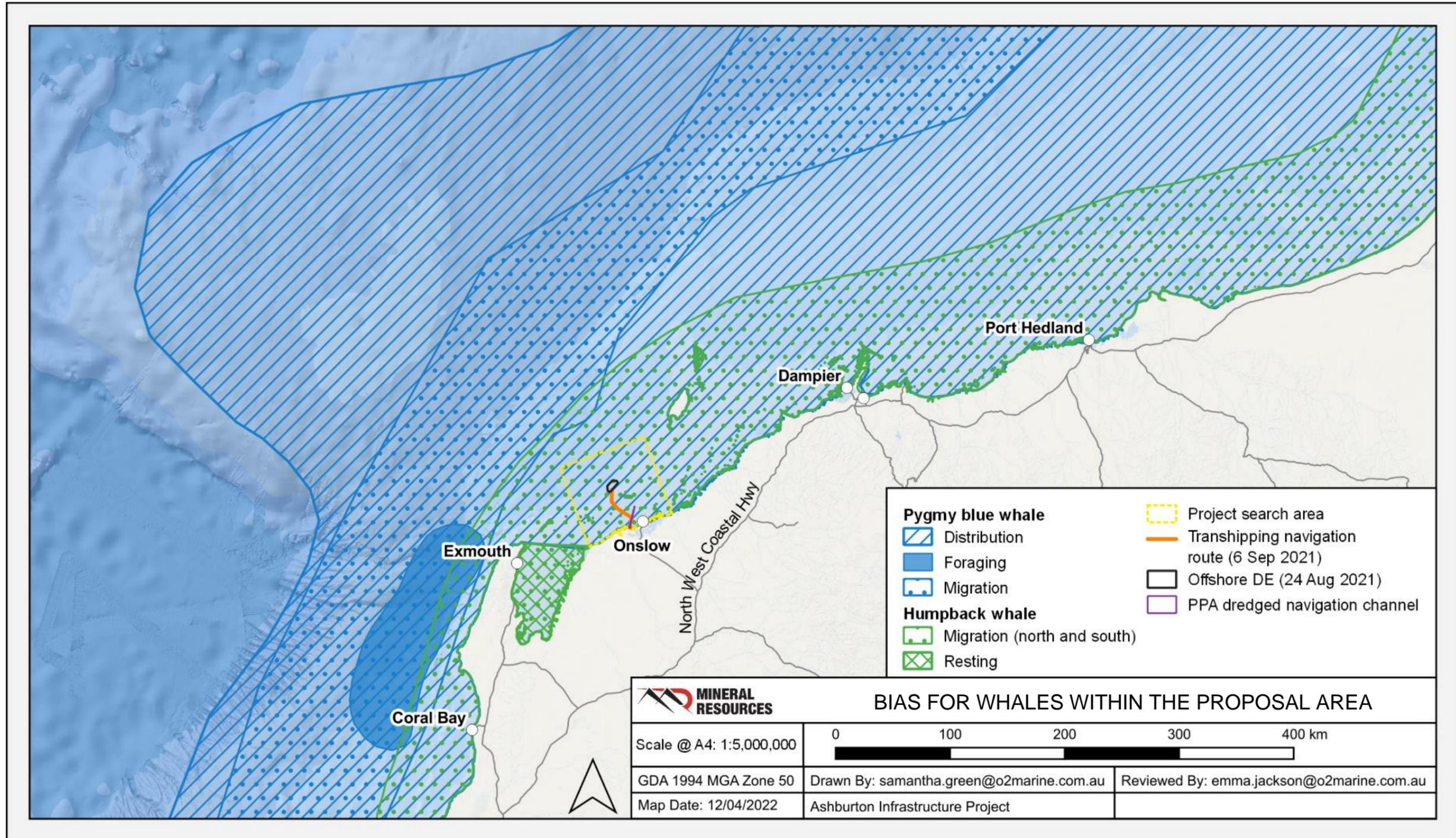


Figure 8-2: BIA's for Humpback and Pygmy Whales within the Proposal Area

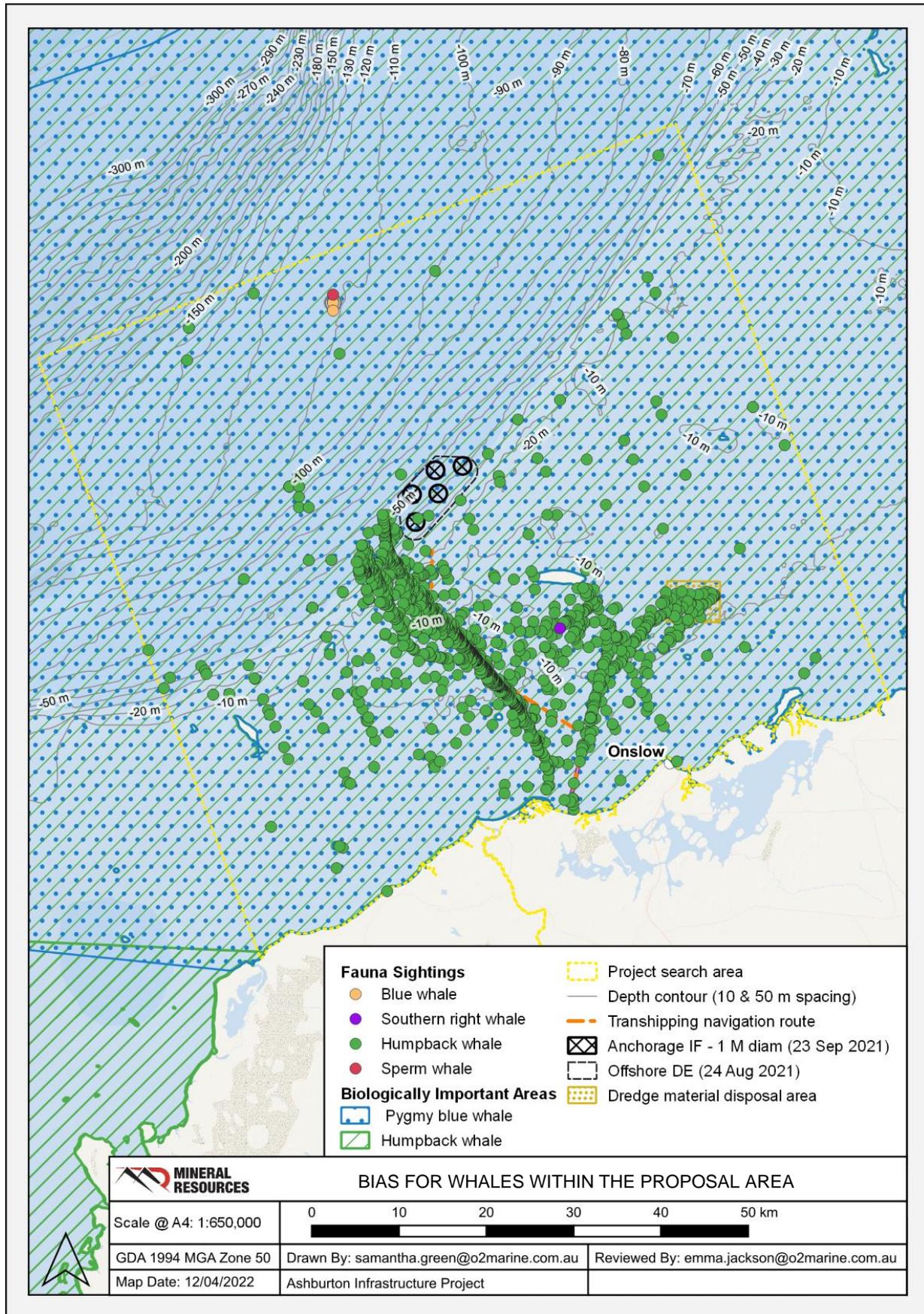


Figure 8-3: BIA's for Whales within the Proposal Area

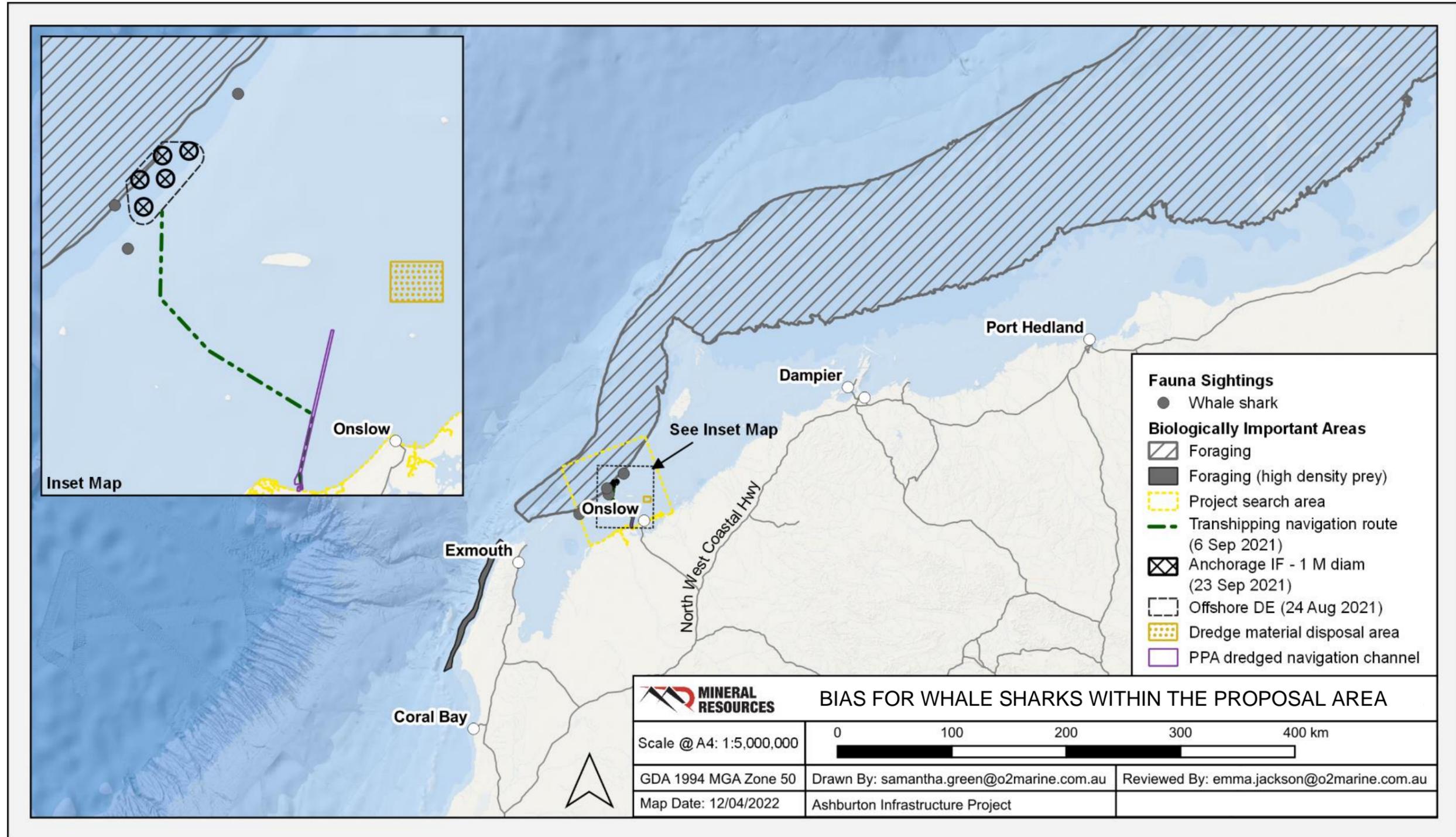


Figure 8-4: BIA's for Whale Sharks within the Proposal Area

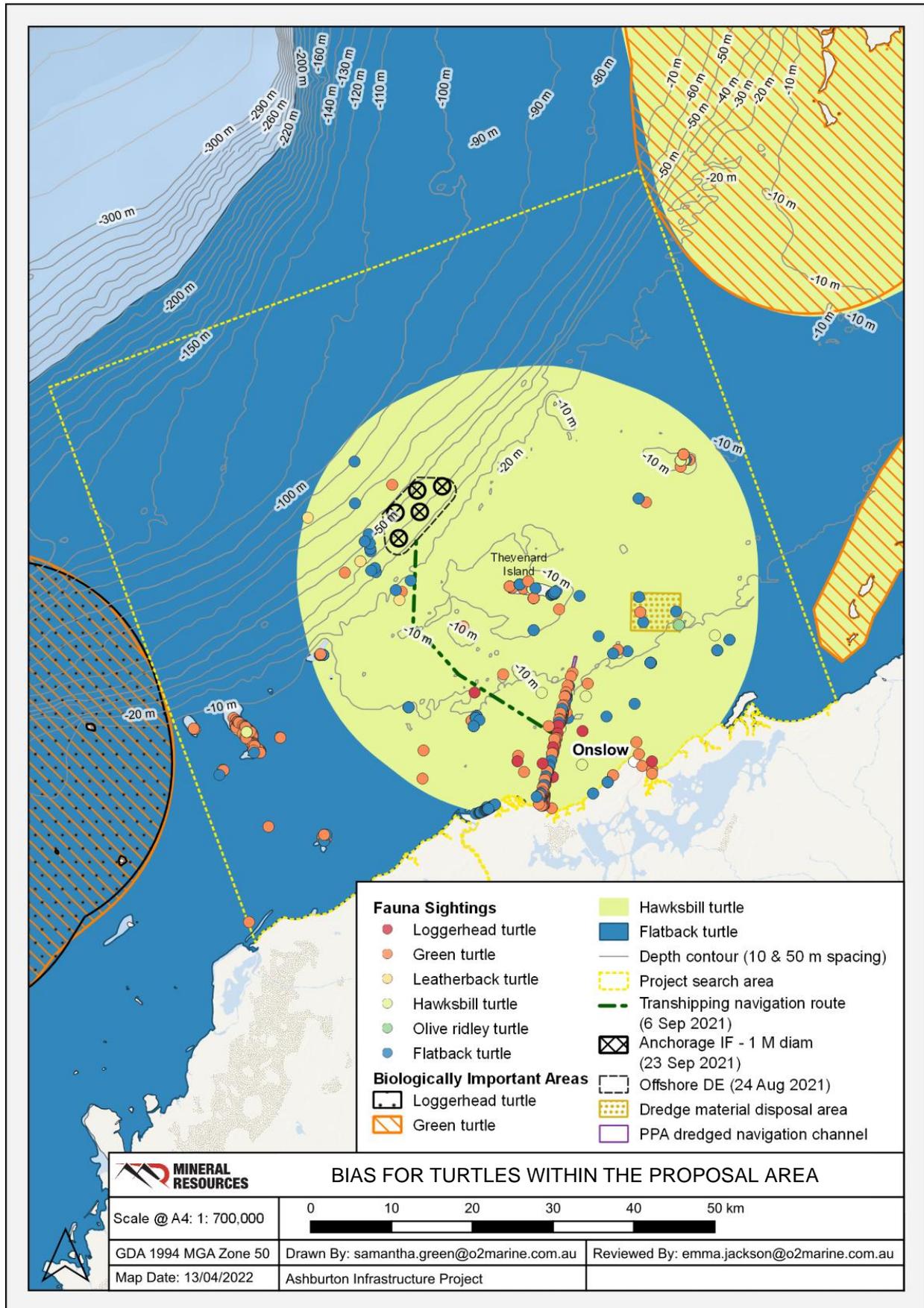


Figure 8-5: BIA's for Turtles within the Proposal Area

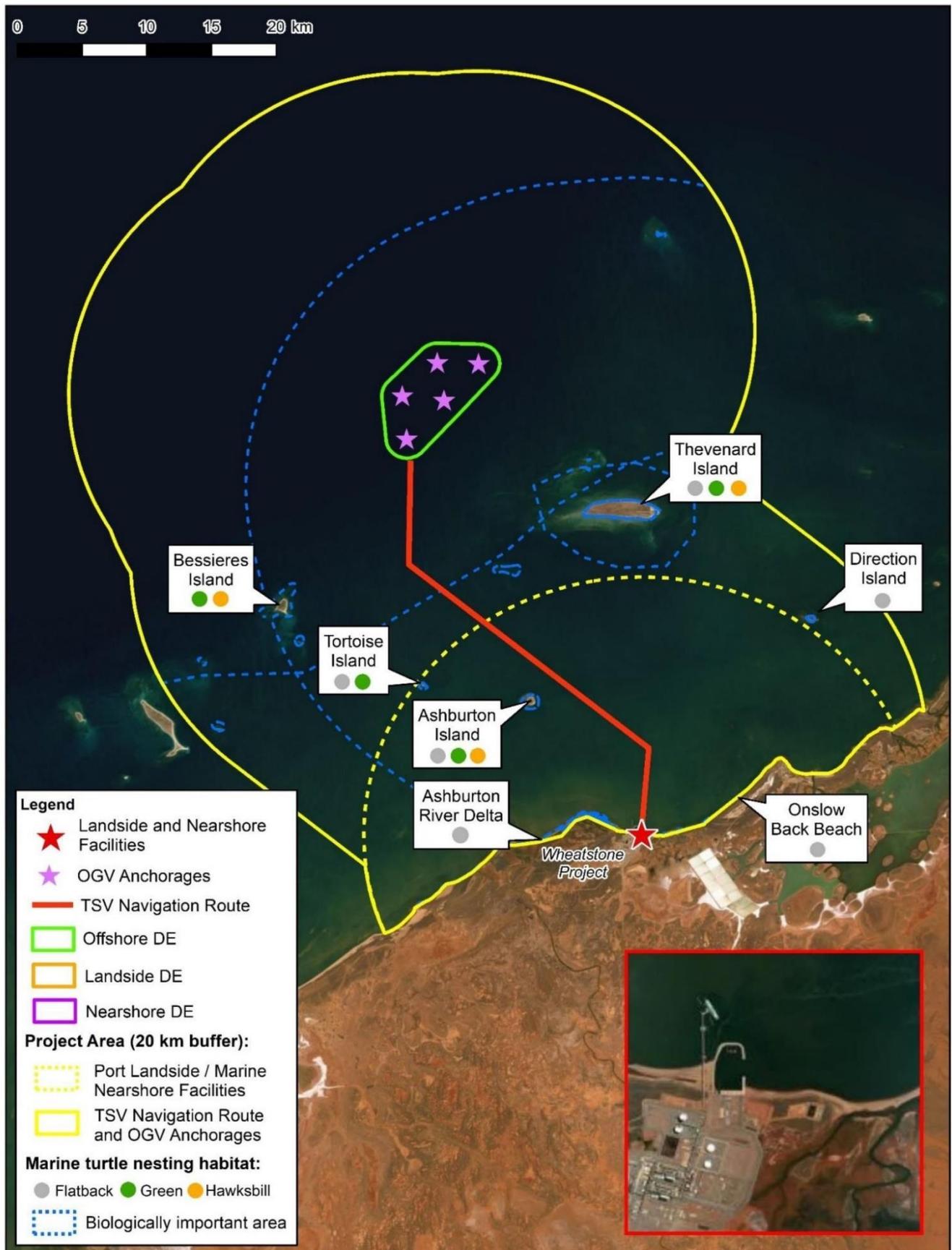


Figure 8-6: Marine Turtle Nesting Habitat in the Vicinity of the Proposed Action

8.3.3 Occurrence of Marine Fauna

For the purposes of EIA, marine fauna are defined as ‘animals that live in the ocean or rely on the ocean for all or part of their lives.’ Key species were identified so that the correct proportionality of information is considered when assessing the nature and risk of potentially significant impacts. Key species were defined as those with:

- A high conservation status under the EPBC Act as MNES, or the BC Act as threatened or priority species; or
- Target commercial or recreational fish species; and
- A high likelihood of occurrence within the DEs.

Commercially and recreationally valued fish and invertebrate species were considered during the desktop reviewed but were ruled out as being key species for the impact assessment due to the very low likelihood that species distribution or habitat suitability would be restricted to the small spatial extents of Project DE and footprint including dredge plume and brine outfall.

The marine waters within and adjacent to the Proposal area support a variety of fauna, several of which are listed as being of conservation significance and protected under the EPBC Act and/or BC Act. Database searches of the online EPBC Act Protected Matters Search Tool and DBCA NatureMap databases were conducted with a 30km radius (from the Offshore DE, including Nearshore DE and full extent of potential indirect impacts) to include all project elements and cover varying bathymetry of the surrounding area which can influence the occurrence of highly mobile marine fauna species (**Figure 8-1, Table 8-6**).

Additional searches for marine fauna species in and around the Proposal were undertaken using several databases and reports including, DBCA threatened species database, State of Fisheries Report, DBCA threatened species database, State of Fisheries Report, State-wide Recreational Fishing Survey. All searches were undertaken in April 2021. A desktop review of relevant publications and reports was also undertaken, to conduct a Likelihood of Occurrence Assessment based on the criteria presented in **Table 8-6 (Appendix L)**.

Table 8-6: Likelihood of Occurrence Criteria

Likelihood	Definition
High	Individuals of the species have been repeatedly recorded in the DEs and / or surrounding habitat. The DEs are within the species' known range and surrounding habitat is expected to support populations of the species.
Medium	Individuals of the species have been infrequently recorded in the DEs and / or surrounding habitat. The high likelihood of occurrence criteria has not been met, however suitable (not necessarily preferred) habitat may occur within the DE, or nearby. The surrounding habitat may support individuals or populations of the species.
Low	The DEs are well outside of the species' range, or the species has not been recorded there. Suitable habitat is not likely to be present.

Some 95 threatened and migratory fauna have been previously recorded within 30 km of the Proposal area, comprising 45 fish (inclusive of sharks and rays), 29 mammals (including cetaceans) and 21 reptiles. Their likelihood of occurrence within the Proposal area was informed by survey work and the results of the desktop study. Based on this assessment, and in conjunction with database searches from the desktop review, the species classified as ‘likely’ or ‘known to have occurred’ within a 30km radius were deemed to have a moderate to high likelihood of occurring directly within the Proposal area (O2 Marine 2021a).

Of the MNES species recorded within the 30 km search radius, 18 species, identified by DAWE, through the EPBC Act assessment process, were assessed to determine their likelihood of occurrence in the Proposal Area, comprising six fish (inclusive of sharks and rays), seven mammals (including cetaceans) and five reptiles (O2 Marine 2021b) (**Table 8-7**).

Table 8-7: Marine Species Assessed for Likelihood of Occurrence in the Proposal Area

Fish	Reptiles	Mammals
Whale Shark (<i>Rhincodon typus</i>) – Listed as Other protected fauna (BC Act), Vulnerable (EPBC Act) Migratory (EPBC Act) – Medium likelihood of occurrence (Offshore DE).	Flatback Turtle (<i>Natator depressus</i>) – Vulnerable (BC Act), Vulnerable (EPBC Act) – High likelihood of occurrence (Nearshore DE, Transshipping NR, Offshore DE).	Blue Whale (<i>Balaenoptera musculus</i>) – Endangered (BC Act), Endangered (EPBC Act), Migratory (EPBC Act) – Low Likelihood of occurrence (Offshore DE).
Green Sawfish (<i>Pristis zijsron</i>) – Vulnerable (BC Act), Vulnerable (EPBC Act), Migratory (EPBC Act) – High Likelihood of Occurrence (Nearshore DE).	Loggerhead Turtle (<i>Caretta caretta</i>) – Endangered (BC Act), Endangered (EPBC Act), Migratory (EPBC Act).	Humpback Whale (<i>Megaptera novaeangliae</i>) – Conservation Dependant (BC Act), Vulnerable (EPBC Act), Migratory (EPBC Act) – High likelihood of occurrence (Nearshore DE, Transshipping NR, Offshore DE)
Dwarf Sawfish (<i>Pristis clavata</i>) – Vulnerable (EPBC Act), Migratory (EPBC Act) – Medium Likelihood of Occurrence (Nearshore DE).	Green Turtle (<i>Chelonia mydas</i>) – Vulnerable (BC Act), Vulnerability (EPBC Act), Migratory (EPBC Act) – High likelihood of occurrence (Nearshore DE, Transshipping NR, Offshore DE).	Southern Right Whale (<i>Eubalaena australis</i>)* - Vulnerable (BC Act), Endangered (EPBC Act), Migratory (EPBC Act) – Low likelihood of occurrence.
Large-tooth Sawfish (<i>Pristis pristis</i>) – Vulnerable (EPBC Act), Migratory (EPBC Act) – Medium likelihood of occurrence (Nearshore DE).	Hawksbill Turtle (<i>Eretmochelys imbricata</i>) – Vulnerable (BC Act), Vulnerable (EPBC Act), Migratory (EPBC Act) – High Likelihood of occurrence (Nearshore DE, Transshipping Navigation Route, Offshore DE).	Dugong (<i>Dugong dugon</i>) – Other Protected Fauna (BC Act), Migratory (EPBC Act) – High likelihood of occurrence (Nearshore DE, Transshipping Navigation Route).
Giant Manta Ray (<i>Mobula birostris</i>) – Vulnerable (EPBC Act), Migratory (EPBC Act) – Medium Likelihood of occurrence (Offshore DE).	Leatherback Turtle (<i>Dermochelys coriacea</i>) – vulnerable (BC Act), Endangered (EPBC Act), Migratory (EPBC Act) – Low likelihood of occurrence.	Australian Humpback Dolphin (<i>Sousa sahulensis</i>) – Vulnerable (EPBC Act), Migratory (EPBC Act) – High likelihood of occurrence (Nearshore DE, Transshipping Navigation Route, Offshore DE).
Reef Manta Ray (<i>Mobula alfredi</i>) – Migratory (EPBC Act) – Medium likelihood Occurrence (Transshipping Navigation Route, Offshore DE).	-	Australian Snubfin Dolphin (<i>Orcaella heinsohni</i>)* - Endangered (EPBC Act), Migratory (EPBC Act) – Low likelihood of occurrence.
-	-	Spotted Bottlenose Dolphin ¹ (<i>Tursiops aduncus</i>) – Vulnerable (EPBC Act), Migratory (EPBC Act) – High likelihood of occurrence (Nearshore DE, Transshipping Navigation Route, Offshore DE).

*Included due to high conservation status, may occur in the Proposal area

¹ Arafura/Timor Sea populations only. This Dolphin has been referred to as the 'Spotted Bottlenose Dolphin' rather than 'Indo-Pacific Bottlenose Dolphin' in this report for consistency with the EPBC Act Protected Matters search results.

8.3.4 Conservation Significant Fauna

Species with the highest potential for impact are those which are of high conservation significance with a high likelihood of occurrence in waters of the DEs, or areas outside of those which could be influenced by light, underwater noise or the dredge plume. Key mammal species are the Humpback Whale, Dugong, Australian Humpback Dolphin and Indo-Pacific Bottlenose Dolphin. Key marine reptile species are the Green Turtle, Flatback Turtle and Hawksbill Turtle. The key fish species is the Green Sawfish. The Australian Fairy Tern, Bar-tailed Godwit, Curlew Sandpiper and Eastern Curlew were identified as key bird species.

The ecological windows for each of the key species within the Proposal Area is summarised in **Table 8-8**.

8.3.4.1 Mammals

Humpback Whale (BC Act: Conservation Dependant, EPBC Act: Migratory)

Humpback whales would likely to be seen 25 km Offshore DE and surrounds in waters less than <40 m deep during their annual migration around June when they head further north to breed and give birth to calves, and in closer to the shore in shallow water depths (<30 m) around October when they migrate south to feeding grounds in the Antarctic (O2 Marine 2021c). The highest numbers of Humpback Whales occur from mid-June onwards, with peak abundance being in August (Jenner et al 2010). Known threats to Humpback Whales include noise pollution and collision with vessels (DSEWPaC 2012a). The Proposal involves noise generating activities including piling, and increased vessel activity to the existing area within the Port both during construction and operation. With application of appropriate management and mitigation measures including the use of MFO's, exclusion zones, noise dampening measures and avoidance of piling during peak migration periods, indirect and direct impacts to Humpback Whales as a result of the Proposal Activities both during construction and operation is unlikely.

Dugong (BC Act: Other Specially Protected Fauna; EPBC Act Migratory)

Dugongs may be present in the Proposal area and surrounds at any time through the year, with no ecological windows having been identified. Threats relative to the Proposal on Dugongs as described in the North-west bioregional plan include marine debris, physical habitat modification, collision with vessels and invasive species (DSEWPaC 2012a). With the application of appropriate management and mitigation measures including the use of MFO's, exclusion zones, waste management procedures, the indirect and direct impacts to Dugongs as a result of the Proposal activities both during construction and operation is unlikely.

Australian Humpback Dolphin (BC Act: Priority 4, EPBC Act: Migratory and Cetacean)

Australian Humpback Dolphins are found throughout the Proposal area and are likely to be present through the area any time through the year. From studies in the area, Australian Humpback Dolphins typically inhabit shallow (depths <20m), coastal waters up to 50 km from mainland, when associated near islands (Hanf et al. 2016; Hanf et al. 2022.; Hunt et al. 2017; Hunt et al. 2020). Their distribution is likely to be associated with coral fringed islands, shoals, and reefs (Hanf et al 2022; Hunt et al., 2017). The species is likely to move through the Nearshore DE, across the Transshipping NR and through Offshore DEs. Threats relative to the Proposal on Australian Humpback Dolphins are water pollution, noise pollution and vessel disturbances. With the application of appropriate management and mitigation measures including the use of MFO's, exclusion zones and waste management procedures indirect and direct impacts to Humpback Dolphins as a result of the Proposal activities both during construction and operation is unlikely.

Indo-Pacific Bottlenose Dolphin (EPBC Act: Migratory and Cetacean)

Indo-Pacific Bottlenose Dolphin have previously been recorded throughout the Proposal area, with opportunistic data collected during Dugong aerial surveys supporting the presence of the species within the region (Hanf et al 2022). The species is likely to move through the Nearshore DE, across the Transshipping NR and through Offshore DEs. Threats relative to the Proposal on the Indo-Pacific Bottlenose Dolphin are water pollution, habitat loss and degradation, underwater noise, and vessel disturbances. With the application of appropriate management and mitigation measures including the use of MFO's, exclusion zones and waste management procedures indirect and

direct impacts to Indo-pacific Bottlenose Dolphins as a result of the Proposal activities both during construction and operation is unlikely.

8.3.4.2 Reptiles

Flatback, Green and Hawksbill Turtles (BC Vulnerable, EPBC Act: Vulnerable and Migratory)

The Flatback Turtle, Green Turtle and Hawksbill Turtle occurs in or nearby DE during all life-history phases (i.e., mating, nesting and inter-nesting) with likely year-round presence. The Proposal is located within a biologically important area for the Flatback Turtle and Hawksbill Turtle and overlaps with critical habitat for nesting and inter-nesting for the Flatback and Green Turtles (Thevenard Island) and Hawksbill Turtle (Cape Preston to mouth of Exmouth Gulf) (Pendoley Environmental 2021) (**Figure 8-6**). Green Turtles are likely to use the area during inter-nesting periods, remaining within shallow nearshore waters (<20 m). Threats relative to all species include marine debris, noise pollution, light pollution, physical habitat modification (DSEWPaC 2012a). Threats specific to the Green Turtles include changes in turbidity (DSEWPaC 2012a). Green and Flatback Turtles are also subject to human presence at sensitive sites and invasive species, whilst Green and Hawksbill Turtles are subject to collision with vessels (DSEWPaC 2012a). With application of appropriate management and mitigation measures including the use of MFO's, exclusion zones, lighting management and waste management procedures, the indirect and direct impacts to turtles as a result of the Proposal activities both during construction and operation is unlikely.

8.3.4.3 Seabirds and Shorebirds

Australian fairy tern (BC Act: Vulnerable; EPBC Act: Vulnerable), bar-tailed godwit (EPBC Act: Migratory), curlew sandpiper (BC Act: Critically Endangered; EPBC Act: Critically Endangered and Migratory) and Eastern curlew (BC Act: Critically Endangered; EPBC Act: Critically Endangered and Migratory)

The Pilbara coast and islands, provide various habitats as important refuge for shorebirds and seabirds. However, none of these habitats are found within, much less restricted to, the DEs or transshipment navigational route. Seabirds and shorebirds are likely be vulnerable to indirect impacts (e.g., light pollution or hydrocarbon spill), rather than direct impacts. With application of appropriate management and mitigation measures including best practice lighting, waste and biosecurity management procedures, the indirect impacts to birds as a result of the Proposal activities both during construction and operation is unlikely.

8.3.4.4 Sharks and Rays

Green Sawfish (BC Act: Vulnerable, EPBC Act: Threatened and Migratory)

Sawfish have been recorded in freshwater rivers, lakes and coastal marine environments, including those adjacent to the Proposal area. The key ecological window for sawfish pupping in the region occurs after the wet season, generally from late October to April. Threats relative to the Proposal on green sawfish as described in the North-west bioregional plan include marine debris. This threat is indirect and will be appropriately managed through a waste management procedure and therefore the Proposal is unlikely.

8.3.4.5 Other Species

The species considered as "other" possess similar biological and ecological characteristics to the "key" species groups and therefore the same management and mitigation measures can be applied to these "other" species groups.

Table 8-8: Key Species Ecological Windows (Dark Blue Full Duration of Presence, Light Blue Behaviour Timing)

Species Presence	D	J	F	M	A	M	J	J	A	S	O	N	Reference
Humpback Whale						Dark Blue	Irvine et al (2018), DoE(2015b), DBCA (2020)						
• Northward migration						Light Blue	Light Blue	Light Blue	Light Blue				Chevron (2010a), Chevron (2010b)
• Southward migration								Light Blue	Chevron (2010a), Chevron (2010b)				
• Southward peak calves								Light Blue	Light Blue	Light Blue	Light Blue		Irvine et al (2018)
Blue Whale					Dark Blue	Dark Blue	Dark Blue						Chevron (2010a), Chevron (2010b), Thums et al., (2022)
• Northward migration	Light Blue				Light Blue	Light Blue	Light Blue				Light Blue	Light Blue	Chevron (2010a), Chevron (2010b), Thums et al., (2022)
• Southward migration	Light Blue										Light Blue	Light Blue	Thums et al., (2022)
Southern Right Whale ¹				Dark Blue				Smith et al., (2012)					
Whale Shark					Dark Blue				Norman et al. (2016), Reynolds et al., (2017)				
• Aggregation					Dark Blue				Norman et al. (2016)				
• Non-Aggregation		Light Blue			Light Blue	Light Blue	Light Blue		Light Blue	Light Blue	Light Blue	Light Blue	Chevron (2010a) Armstrong, Armstrong, Bennett, et al., (2020)
Giant Manta Ray ²	Dark Blue	Chevron (2010a) Chevron (2010b) Armstrong, Armstrong, Bennett, et al., (2020) Armstrong, Armstrong, McGregor, et al., (2020)											
Reef Manta Ray ³	Dark Blue	Chevron (2016)											
Dugong ⁴	Dark Blue	Hanf (2015), Hanf et al (2016), Hanf et al (2017)											
Australian Humpback Dolphin	Dark Blue	Hanf (2015), Hanf et al (2016), Hanf et al (2017)											
Spotted Bottlenose Dolphin	Dark Blue	Irvine et al (2018), DoE(2015b), DBCA (2020)											
Australian Snubfin Dolphin ⁵ (based off probable sightings, vagrant individuals present)	Dark Blue	Hanf et al., (2022)											
Flatback Turtle	Light Blue	Commonwealth of Australia. (2017)											
• Foraging	Light Blue												
• Nesting and Interesting	Light Blue	Light Blue	Light Blue	Light Blue								Light Blue	
Green Turtle	Dark Blue	Commonwealth of Australia. (2017)											
• Foraging	Light Blue												
• Nesting and Interesting	Light Blue	Light Blue	Light Blue	Light Blue								Light Blue	
Hawksbill Turtle	Dark Blue	Commonwealth of Australia. (2017)											
• Foraging	Light Blue												
• Nesting and Interesting	Light Blue	Light Blue	Light Blue	Light Blue								Light Blue	
Loggerhead Turtle	Dark Blue						Dark Blue	Commonwealth of Australia. (2017)					

Species Presence	D	J	F	M	A	M	J	J	A	S	O	N	Reference
• Foraging													
• Nesting and Internesting													
Leatherback Turtle													Commonwealth of Australia. (2017)
• Foraging													
Green Sawfish													Morgan et al., (2015); Morgan et al., (2017)
• Pupping													

Indicative Timing of Construction Activities													
Dredging / Spoil disposal (2 months)													
Temporary Causeway Construction (3-4 weeks)													
Marine Piling (Floating Barge) (2 – 3 months)													
Jetty and Berth Construction (up to 9 months)													
Temporary Causeway removal (1 month)													

¹Southern Right Whale not likely to often be observed, location is at their northern most extent of their distribution. Ecological window is based off historical whaling reports that used data extracted from American whaling logbooks from 1780 to 1920 (Smith et al., 2012). Currently there is a Southern Right Whale NESP project underway, that is not yet published, that Southern Right Whales population is increasing, and they are re-occupying their historic range (includes past Exmouth Gulf). Southern Right Whales have been spotted in the Exmouth Gulf by eco-tourism pilots, as well as by Bannister (2001).

²Giant Manta Rays Manta rays were identified in Wheatstone aerial surveys (Chevron 2010a; Chevron 2010b), with occurrence in 50-150m depths, the distribution of the Giant manta ray is distribution of 10-40°S, Giant manta rays have preference for offshore (Armstrong, Armstrong, Bennett, et al., 2020), ecological window define with year-round presence of giant manta ray is probable.

³Manta rays were identified in Wheatstone aerial surveys (Chevron 2010a; Chevron 2010b), with occurrence in 50-150m depths. Tagging data between shows seasonal peak of Reef manta rays in the Exmouth gulf in the Spring (Armstrong, Armstrong, McGregor, et al., 2020). Geographical distribution found that on the Western Australian Coastline they range 26°S and 31°S with a near continuous distribution (Armstrong, Armstrong, Bennett, et al., 2020), ecological window defined with year round presence of reef manta ray is probable.

⁴Satellite tagging and aerial surveys completed for the Chevron Wheatstone project found that Dugongs were present all year round, the data is not publicly available but has been summarised in the Wheatstone Conservation Significant Marine Fauna Interaction Management Plan (Chevron 2016).

⁵Snubfin Dolphins have been spotted in this area through opportunistic studies. Occurrence to be all year round with vagrant individuals being present and scarcity within the Pilbara region. Further studies are needed to investigate the species' full extent of whether small discrete populations exist within the Pilbara region (Hanf et al., 2022).

8.3.5 Biologically Important Areas

BIAs are spatially defined zones where aggregations of individuals of a species are known to display biologically important behaviours such as breeding, foraging, resting or migration (DAWE 2021a). A summary of BIAs around the DEs is presented in **Table 8-9** below.

Table 8-9 Biologically Important Areas that Spatially Overlap with Proposal Marine Components

Species	Type	Marine Component (DE)
Humpback whale	Migration	Nearshore DE, Transshipment NR and Offshore DE
Pygmy blue	Distribution	Nearshore DE, Transshipment NR and Offshore DE
Whale shark	Foraging	Offshore, southwestern boundary of BIA
Flatback Turtle	Nesting and inter-nesting	Nearshore DE, Transshipment NR and Offshore DE
Hawksbill Turtle	Inter-nesting	Not in DE, >30km east from Nearshore
Green Turtle	Foraging	Not in DE, >40 km northeast of Offshore
Fairy Tern	Breeding	Offshore (centered around Thevenard Island) and <50 km from Nearshore
Lesser Crested Tern	Breeding	Landside, Nearshore and Offshore (centered around Thevenard Island)
Roseate Tern	Breeding	Not in DE, ~10 km northeast from Offshore
Wedge-tailed Shearwater	Breeding and foraging	Landside, Nearshore and Offshore

8.3.6 Critical Habitat Areas

The Recovery Plan for Marine Turtles in Australian 2017-2027 (DotEE 2017c) identifies habitat critical for the survival of turtle species, in relation to the various stocks (**Table 8-10**). These areas have been identified by consensus of a panel of experts in marine turtle biology. They are not on the Register of Critical Habitat under the EPBC Act, but they are relevant when applying the significant impact criteria.

Table 8-10 Critical Habitat Areas that Spatially Overlap with Proposal Port DEs

Species	Genetic Stock	Relevant/Proximal Nesting Locations	Interesting buffer	Relevant DE
Flatback Turtle	Pilbara	Coastal islands from Cape Preston to Locker Island	60 km radius	Nearshore DE, Transshipment Navigation Route (NR), Offshore DE
Green Turtle	North West Shelf	Serrurier Island, Thevenard Island, Northwest Cape	20 km radius	Nearshore DE, Transshipment NR, Offshore DE
Hawksbill Turtle	Western Australia	Cape Preston to mouth of Exmouth Gulf, Sholl Island	20 km radius	Offshore DE, Transshipment NR
Loggerhead Turtle	Western Australia	Muiron Islands	20 km radius	Offshore DE, Transshipment NR

Although not listed formally as a critical habitat, the Ashburton River estuary/delta (5 km to the west of the Proposal on the other side of the existing Port facilities) provides important breeding and foraging habitat for the green sawfish. Other creeks in the southern Pilbara, are also speculated to provide critical habitat for various species of sawfish, including the green and dwarf sawfishes, but are yet to be classified as such formally (Morgan et al. 2016).

8.3.7 Commercially and Recreationally Valued Fish

Important commercial and recreational fisheries exist in the area, however, due to Port zoning, access is prohibited to the Nearshore DE.

8.4 Potential Impacts

Potential impacts to marine fauna may occur through construction and operational activities from the Proposal.

8.4.1 Construction Phase Impacts

During the construction phase of the Proposal, the following activities and resulting impacts have the potential to adversely affect the Marine Fauna in the vicinity of the proposed DEs:

Direct Impacts

The potential direct impacts of the Proposal on marine fauna have been identified as:

- Underwater noise emissions from piling and dredging operations causing disturbance and temporary or permanent injury.
- Injury from vessel strike.
- Light pollution disrupting hatchling turtle behaviour on the beach or wedge-tailed shearwater behaviour on island beaches; and
- Loss of marine fauna habitat due to direct removal or disturbance of benthic habitat from dredging.

8.4.1.1 Underwater Noise from Piling and Dredging Activities

Construction will involve various noise generating activities and equipment. The most significant noise generating activities that have been identified are piling and dredging. The Proposal is entirely situated within WA State waters. The underwater noise modelling indicates that noise from piling and dredging will not spread into Commonwealth waters (Talis 2022, **Appendix P**). Underwater noise modelling was undertaken at the early stage of Proposal design and has considered the key species, whales, sirenians (dugongs), dolphins, turtles and sawfish as separate groups based on their sensitivities.

Underwater noise models indicate that piling has the greatest potential for impact, especially during high tide when sound can travel the furthest. The low frequency marine mammal hearing group is the group with the greatest vulnerability to noise impacts. These marine mammals may experience temporary hearing loss otherwise known as the temporary threshold shifts (TTS) in relation to piling if the noise exposure is below some critical sound energy level. If the noise exposure exceeds the critical sound energy level, tissue rupture occurs leading to hearing loss thus resulting in permanent threshold shift (PTS). **Table 8-11** and **Table 8-12** identify the distances marine fauna must be to experience impacts from piling and dredging noise.

Piling will be conducted in the Nearshore DE and is the most significant source of underwater noise identified for the construction activities of the Proposal. Noise could travel from the Nearshore DE into the Offshore DE and surrounds. The piling duration is estimated at 100 days and will be short term intermittent activity (between the hours of sunrise and sunset) associated with construction.

It is expected that dredging related operations will occur over a 24-hour period, seven days a week. The assumed maximum exposure of the marine fauna considered in the noise modelling will be one hour, as these species are transient in nature.

Table 8-11: Piling Noise Impacts to Marine Fauna (Modified from Talis 2022)

Marine Fauna Group	Tide	Distance to Piling Activities (m)		
		TTS distance limit	PTS distance limit	Behavioral response
Whales	Low	840	140	5,400
	High	1,440	225	15,000
Dolphins	Low	35	No exceedance	70
	High	40	No exceedance	1430
Dugongs	Low	15	No exceedance	70
	High	10	No exceedance	1430
Turtles and Sawfish	Low	100	<20	200
	High	215	<20	420

Table 8-12: Dredging Noise Impacts to Marine Fauna (Modified from Talis 2022)

Marine Fauna Group	Tide	Distance to Piling Activities (m)		
		TTS distance limit	PTS distance limit	Behavioral response
Whales	Low	50	No exceedance	940
	High	70	No exceedance	3,470
Dolphins	Low	No exceedance	No exceedance	<10
	High	50	No exceedance	60
Dugongs	Low	No exceedance	No exceedance	<10
	High	25	No exceedance	60
Turtles and Sawfish	Low	<20	<20	65
	High	<60	<20	130

8.4.1.2 Injury from Vessel Strike

Dredge and piling barge vessels will operate on up to a 24-hour basis. Marine fauna may be impacted by vessel strike during the construction phase due to vessel movements, with the potential impact resulting in injury or fatality. The North-west bioregional plan identifies vessel strike as a potential concern for the Australian Humpback Dolphin, Indo-Pacific Bottlenose Dolphin, Humpback Whale, Dugong, Green Turtle, Hawksbill Turtle and Flatback Turtle (DSEWPaC 2012a). Lactating Humpback Whales may be at greater risk while resting. Humpback Whales devote a significant amount of time to rest at shallow depths within reach of the hull of commercial ships, thus increasing the potential for ship strike collisions (Beider et al. 2019).

Whale Sharks may occasionally move through Offshore DE waters and could be susceptible to ship strike as they spend time on the sea surface as part of thermoregulation (i.e., warming their bodies in the sun after spending time in cold water at depth) (Thums et al. 2013).

8.4.1.3 Light Pollution during Construction

Adverse effects of artificial light on marine turtle behaviour are well recognised by a substantial body of research. Artificial lighting can impact individuals at different stages of the life cycle, including nesting adult females and hatchlings and critical nesting habitat for nesting and inter-nesting overlaps with the Proposal area. Bright lighting can disorient flying birds and subsequently cause their death through collision with infrastructure or starvation due to disruptions in the ability to forage at sea (DSEWPaC 2012a).

8.4.1.4 Loss of Marine Fauna Habitat due to Direct Removal or Disturbance Benthic Habitat from Dredging

Loss of marine fauna habitat, that has the potential to effect species or populations in any way due to direct removal or disturbance of benthic habitat from dredging is not predicted to occur. The dredge model outputs indicate that no benthic habitat significant to marine fauna will be affected because of dredging activities (**Table 8-13**). There are no predicted impacts to any habitats critical to conservation significant or commercially valued species. Any benthic infauna present within the disturbance area are well represented throughout the local (i.e., Onslow) and broader (i.e., West Pilbara) region (O2 Marine 2021a).

Table 8-13: Dredge Plume Model Outcomes Areas of BCH within high and moderate zones of influence

Zone of Influence	Certainty	Bare substrate (ha)
High	Dredge footprint – Direct impact	3.1
Moderate	Probable – Indirect Impacts	33
	Possible – Indirect impacts	35

Indirect Impacts

Indirect impacts of the Proposal on marine fauna may arise including:

- Temporary, localised turbidity increase from dredging;
- Hydrocarbon spill causing marine fauna injury or fatalities and/or impact on critical habitat;
- Entanglement/ plastic ingestion from marine debris; and
- Introduction of marine pest species from operation vessels resulting in decline in local marine fauna populations.

8.4.1.5 Temporary, localised turbidity increase from dredging

Dredge plume modelling was undertaken to predict the dredge plume's spatial extent and potential zones of impact (**Appendix J**). Models were based on two classes of potential impact zones (Zone of High Influence (ZOHI) and Zone of Moderate Influence (ZOMI) (**Figure 6-3**). **Table 8-14** below defines these two zones.

Table 8-14: Dredging Impact Zone Definitions (EPA 2021c)

Zone	Definition
Zone of High Impact (ZoHI)	The area where serious damage to benthic communities is predicted where impacts are considered irreversible. Serious damage is defined as damage that is irreversible or damage that is unlikely to be recovered for at least five years following the completion of dredging activities.
Zone of Moderate Impact (ZoMI)	The area within which predicted impacts on benthic organisms are sub-lethal, and/or the impacts are recoverable within a period of five years.

The dredge and disposal plumes will primarily be driven by tidal currents and will oscillate in response to a north easterly to south westerly pattern (O2 Metocean 2022). Over a longer period, the spatial extent of the plume is dictated by low frequency seasonally variable wind currents, which in the period of December to January create a net drift in a more north-easterly direction (O2 Metocean 2022).

The model results (**Table 8-13**) indicate that potential impacts from the dredge and disposal plume will be negligible given that they will be contained within areas of bare substrate. Waters with the potential to be influenced by the dredge plume are primarily within 2 km of the coastline and are naturally turbid. As such, increased turbidity is not expected to affect BCH that is significant to marine fauna. Marine fauna that may occur within these zones at some point in time are likely to be transiting through these relatively small areas

8.4.1.6 Hydrocarbon Spill causing Marine Fauna Injury or Fatalities and/or Impact on Critical Habitat

With the adaption of appropriate mitigation measures (**Table 8-15**) to avoid and minimise the risk of a spill occurring during the construction phase of the Proposal the risk of a hydrocarbon spill is low. Overall, the risk of a hydrocarbon spill during construction is considered low and with the appropriate planning and mitigation measures in place in the event of a spill, the threat to marine fauna is considered very low.

8.4.1.7 Entanglement/ plastic ingestion from marine debris

Sources of marine debris as a result of Proposal activities may come from direct disposal into the marine environment or wind born litter from vessels or land infrastructure.

8.4.1.8 Introduction of marine pest species from construction vessels resulting in decline in local marine fauna populations

Marine pests can be introduced during construction through ballast water discharge or dislodgment of biofouling. The dredge is considered the highest risk vector during the construction phase of the Proposal (O2 Marine 2021d). However, where appropriate mitigation measures are adopted, the risk of marine pests becoming established and affecting the biodiversity values and/or ecological integrity of the local environment is low.

8.4.2 Operational Phase Impacts

Direct Impacts

The potential direct impacts of the Proposal on marine fauna have been identified as:

- Osmotic stress from brine discharge;
- Underwater noise from operational vessels;
- Injury from vessel strike; and
- Light pollution disrupting hatchling turtle behaviour on the beach or wedge-tailed shearwater behaviour on island beaches.

8.4.2.1 *Osmotic stress from brine discharges*

The current base case is for raw seawater to be desalinated and treated, with the brine returned to the ocean. The discharge brine has the ability to change the salinity, alkalinity and the temperature averages of the seawater and can cause change on marine habitat. Nearfield brine discharge model results (O2 Metocean 2021b) (**Appendix K**) indicate two discharge options (one with an outfall flow rate of 0.29 GL/a and one with 2 GL/a) achieve the dilution required for a high LEP within a distance of 30 m (O2 Metocean 2021b). With the volumes of brine returned to the ocean, only localised impacts are expected. High salt content near the seabed could hypothetically lead to saline stratification promoting nutrient release from sediments. However, stratification does not occur near sediments and therefore does not affect any physicochemical reactions at the scale of the soil-water interface. Furthermore, existing seabed and nutrients will be removed during dredging prior to brine discharge and therefore nutrient release from the sediment as a result of stratification is not expected.

Ecotoxicity testing results were undertaken on a representative brine to determine the number of dilutions of the desalination brine required to protect 80%, 90% or 99% species to meet the different LEPs surrounding the outfall, respectively (O2 Metocean 2021b). Based on the EPA (2016c) framework for protecting the quality of WA's marine environment, a spatially defined as:

- Low LEP area has been assigned to the area that extends 70 m around the brine outfall;
- Moderate level of ecological protection assigned to the areas that extends 250 m from the Proposal infrastructure (including the berth pocket), and
- High LEP area beyond the 250m boundary).

Based on the model outputs, a reduced Low LEP boundary has been established at a 30 m distance from the discharge points to reflect the small size of the predicted mixing zone and to allow for a practical distance to accurately monitor and manage the outfall dilution requirements. Given a low level of ecological protection has been assigned 30 m around the brine outfall, it is expected that the following key elements of ecosystem integrity and their limits of acceptable change will be maintained at the level of protection for maintenance of ecosystem integrity:

- Ecosystem processes (e.g., primary production, nutrients cycles, food chains) will be maintained to the level of acceptable change being, large changes in rates, but not types of ecosystem processes (EPA 2016c);
- Biodiversity (e.g., variety and naturally occurring marine life) will be maintained to the level of acceptable change being, Biodiversity measured on a regional scale remains at natural levels although possible change in variety of biota at a local scale (EPA 2016c);
- Abundance and biomass of marine life (e.g., number or density of individual animals, the total weight of plants) will be maintained to the level of acceptable change being, Large changes in abundances and/or biomasses of marine life (EPA 2016c); and
- The quality of water, biota and sediment (e.g. Types and levels of contaminants such as heavy metals, dissolved oxygen content, water clarity), will be maintained to the level of acceptable change being, Substantial changes beyond limits of natural variation (EPA 2016c).

8.4.2.2 *Underwater Noise from Operational Vessels*

The only relevant operational noise source is TSVs. They will be used for transport of product from the marine jetty to OGVs anchored 35km from the coastline and approximately 10 km from Thevenard Island. It is estimated that four TSVs and four Tugs will operate on a 24/7 basis. A TSVs cycle time of ~8 hours have been calculated by the Proposal of which a total of ~4 hour will be spent travelling from the marine jetty to the OGVs vessel and back again. The remainder of the time will be spent loading and unloading. The TSVs are a small and slow speed vessel. As the vessel will only be spending an estimated 1.2 hours out of every 6 hours underway the noise impacts from the TSVs will not result in thresholds being exceeded (Talis 2022). In addition, the unloading and loading activities are expected to have very low levels due to the product in the holds mass loading the vessel's structure and as a result dampening any noise associated with these activities. As a result, operational noise was

not included in the noise modelling (Talis 2022). The noise levels are considered ambient given operations will be within an existing operating port and residual risk to marine fauna is considered very low.

8.4.2.3 Injury from Vessel Strike

Operational vessels will operate on a 24-hour basis, with four TSVs and four tugs operating constantly during the construction phase. Seasonal changes will not alter the frequency of TSVs operations. The TSVs will comply with PPA speed limit, of 9 knots, within the Port Boundary. Marine fauna may be impacted by vessel strike during the operation phase due to vessel movements, with the potential impact resulting in injury or fatality. The North-West bioregional plan identifies vessel strike as a potential concern for the Australian Humpback Dolphin, Indo-Pacific Bottlenose Dolphin, Humpback Whale, Dugong, Green Turtle, Hawksbill Turtle and Flatback Turtle which are key species (DSEWPac 2012a). Whale sharks may occasionally move through Offshore DE waters and could be susceptible to ship strike.

8.4.2.4 Light Pollution During Operational Activities

As described in the construction phase impacts.

Indirect Impacts

Indirect impacts may arise from:

- Hydrocarbon spill causing marine fauna injury or fatalities and/or Impact on critical habitat;
- Introduction of marine pest species from operation vessels resulting in decline in local marine fauna populations; and
- Entanglement/plastic ingestion from marine debris.

8.4.2.5 Hydrocarbon Spill Causing Marine Fauna Injury or Fatalities and/or Impact on Critical habitat.

Risks of impact to marine fauna from hydrocarbon spill are also present during the operation phase of the Proposal, particularly associated with spills during refuelling, bulk fuel storage and/or vessel collision. Diesel fuel storage consists of three 220 KL self-bunded storage tanks. This facility provides fuel for Light Vehicles, Mobile Equipment (including Front End Loaders) and TSVs. The fuel storage facility will include fuel bowsers for refuelling vehicles and a pumping system to deliver fuel to the TSVs whilst moored at the wharf.

8.4.2.6 Introduction of Marine Pest Species from Operational Vessels Resulting in Decline in Local Marine Mauna Populations

As with the construction phase, marine pests can be introduced during operations through ballast water exchange or via biofouling. Trading TSVs, barges, tugs and are among the vessels considered high-risk for the introduction of species (O2 Marine 2021d). However, where appropriate mitigation measures are adopted, the risk of marine pests becoming established and affecting the biodiversity values and/or ecological integrity of the local environment is low.

8.4.2.7 Entanglement / Plastic Ingestion from Marine Debris

Sources of marine debris as a result of Proposal activities may come from direct disposal into the marine environment or wind born litter from vessels or land infrastructure.

8.5 Mitigation

The Proponent has applied the mitigation hierarchy (avoid and minimise) to reduce the potential impacts to marine fauna during Proposal design. Potential impacts have been avoided or minimised through design of the DE and conceptual footprint, which along with specific mitigation measures are summarised in **Table 8-15** below.

A number of management plans have been prepared for the Proposal to minimise the potential impacts of project construction and operational activities on MEQ. The specific management plans that have been prepared that will assist to mitigate potential impacts on MEQ and include:

- **Marine Construction Environmental Management Plan (MCEMP).** The MCEMP has been prepared to detail how underwater noise, collision with vessels, hydrocarbon spills, invasive marine species and marine debris will be managed by the Proponent during construction of the marine components of the Proposal. The MCEMP provides the overall environmental management framework and specific management measures to address relevant environmental factors and mitigate potential impacts of the marine construction activities. Key management measures are summarised in **Table 8-15** and the MCEMP is provided in **Appendix C**.
- **Draft Underwater Noise Management Protocol (UNMP).** The UNMP has been developed for managing underwater noise associated with piling works. The UNMP has been informed by underwater noise modelling performed by Talis (2022). The UNMP outlines protocols to inform piling contractors, the obligatory requirements of Pre-Start, Soft-Start, Shut Down procedures and low visibility condition protocols. MFOs for piling will be suitably trained, dedicated crew members with demonstrated training in marine fauna observation and distance estimation. MFOs must demonstrate a knowledge of marine wildlife species in the North-West region, including threatened and migratory species listed under the EPBC Act, and WA BC Act and priority listing, and their behaviours. Key mitigation measure associated with underwater noise from dredging and piling are summarised in **Table 8-15** and the UNMP is provide in **Appendix G**.
- **Artificial Light Management Plan (ALMP).** The ALMP describes how light spill and glow from Project activities will be managed, with a focus on protecting turtles, shorebirds and seabirds and is provided in **Appendix F**. This plan includes monitoring of hatchling orientation on Ashburton Island (closest Island to the onshore/nearshore facilities) and Thevenard and Bessieres Islands (due to its area of critical marine turtle habitat, multi-species use, and proximity to the Offshore Anchorage Area and TSV navigation route). The Plan includes measures to be adopted in the event monitoring shows disorientation attributable to the Proposal. Key management measures as they relate to Marine Fauna are summarised in **Table 8-15** .and the ALMP is provided in **Appendix F**.
- **Dredging and Spoil Disposal Management Plan (DSDMP).** The DSDMP has been prepared to detail how environmental impacts will be managed during the dredging phase. Key management measures are summarised in **Table 8-15** and the DSDMP is provided in **Appendix E**.
- **Marine Operational Environmental Monitoring and Management Plan (MOEMMP).** The purpose of this MOEMMP is to establish a framework to ensure that the implementation of the Proposal does not compromise the EVs and EQOs and outlines management measures to minimise the risk of vessel strike during vessel operations. Key management measures are summarised in **Table 8-15** and the MOEMMP is provided in **Appendix D**.

Table 8-15: Mitigation Measures to Minimise Operational and Construction Impacts to Marine Fauna

Potential Impact	Proposed Mitigation			Offset required?
	Avoid	Minimise		
<p>Construction Phase Impacts</p> <p>Construction Phase impacts will be managed through development and implementation of a Marine Construction Environmental Management Plan (MCEMP), prior to commencement of construction works. The following mitigation measures will be included in the MCEMP to mitigate impacts on Marine Fauna during construction.</p>				
<p>Underwater noise impacts from piling and dredging operations</p>	<p>If possible, avoid piling during breeding, calving, calving, feeding or resting and migration periods of marine fauna (Table 8-2). Specifically:</p> <ul style="list-style-type: none"> • Sawfish pupping (October / November); • Peak Humpback Whale southern migration (August - October); and • Focus piling and dredging around low tide periods particularly during southern Humpback Whale migration. 	<p>Implementation of the UNMP (Appendix G) including:</p> <ul style="list-style-type: none"> • Dedicated marine fauna observers to be used during piling. • Maintenance of visual observation and exclusion zones during piling, as informed by underwater noise modelling (Figure 8-7, Table 8-17). • Pre-start, soft-start, dynamic piling, and shut-down procedures for piling. • Piling operations to be undertaken during daylight hours. • Pile Hammer chosen to be low noise producing. • Crew trained as marine fauna observers to be used during dredging operations. 		No
<p>Light pollution during construction</p>	<p>Only install and use lighting as required.</p>	<ul style="list-style-type: none"> • Ensure mobile light sources are not oriented towards nesting habitat or seaward (where possible) and to keep the height of these to a minimum. • Increased lighting will be minimal and uphold National Light Pollution Guidelines. • Adaptive management and continuous improvement as discussed in the Artificial Light Management Plan (Appendix F) include adopting additional engineering and/or operational solutions such as: <ul style="list-style-type: none"> ○ Changing the wavelength of light; ○ Additional shielding of light; ○ Changing the orientation and direction of the light fittings; and ○ Consideration to whether activities requiring illumination of problem lights can be undertaken during daylight hours only. 		No
<p>Injury from vessel strike</p>	<ul style="list-style-type: none"> • Vessels will adhere to PPA speed limit, 9 knots, within the Port Boundary. • All vessels to adhere to standard set in the National Whale Watching Guidelines and DBCA regulations. • If a whale approaches a vessel the motor must be in neutral or be driven at less than five knots away from the whale. • No approach zones are a zone of total vessel exclusion. Caution zones are those where speed must be no more than 6 knots. They cannot be entered by a vessel if there is an animal that is injured, stranded, entangled or distressed, or if a single calf or pod of calves are present. 	<p>Implementation of the UNMP (Appendix G) including 'Trained' MFOs will be used, at least one crew member on each vessel engaged in MinRes constructions will undergo training in marine fauna observations to undertake this task .</p> <p>Incident reporting will be undertaken in accordance with the MCEMP (Appendix C).</p>		No
<p>Temporary, localised turbidity increase from dredging</p>	<p>Minimum number of days to conduct and dredging</p>	<p>Implement DSDMP (Appendix E).</p> <p>Undertake dredging as efficiently as possible to minimise the duration of the disturbance.</p>		No

Potential Impact	Proposed Mitigation		
	Avoid	Minimise	Offset required?
		Implementation of the UNMP (Appendix G) including undertaking visual monitoring during dredging by crew trained as marine fauna observers.	
Loss of marine fauna habitat due to dredging	Avoid significant marine fauna habitat.	Implement MCEMP (Appendix C) and DSDMP (Appendix E). Ensure vessels do not exceed specified dredged areas.	No
Introduced Marine Pests/ Biosecurity	N/A	Implement MCEMP (Appendix C) and existing PPA Port procedures. Requirement for all vessels to comply with Commonwealth DAWE – Biosecurity requirements. Requirement for all vessels visiting the Port from international or interstate waters to complete the WA Department of Primary Industries and Regional Development ‘Vessel Check’ risk assessment (https://www.vessel-check.com/). Implementation of the Marine Pest State-Wide Array Surveillance Program (SWASP) at the Port.	No
Hydrocarbon spill causing marine fauna injury or fatalities and/or impact on critical habitat	<ul style="list-style-type: none"> Ensure all construction vessels are compliant with the International Maritime Organisation International Convention for the Prevention of Pollution from ships (MARPOL). Inspect and maintain all construction vessels and equipment on a daily basis. Implement existing Port refuelling procedures. Store all fuels, oils and lubricants on site to ensure that they do not pose a threat to the environment or the safety and the public. Maintain vessel speeds below 10 knots whilst within the construction zone, to limit the potential for vessel collisions. Maintain an appropriate exclusion zone around the construction site to minimise the risk of non- project related vessels entering the area. 	Implement MCEMP (Appendix C) including: <ul style="list-style-type: none"> Supply and maintain adequate hydrocarbon spill kits on site and within immediate access during refuelling; Implement procedures aligned with the Port requirements to maintain clean and tidy work areas, including the safe storage of all hydrocarbons and chemicals; and Implement water quality monitoring. 	No
Entanglement/ plastic ingestion from marine debris	<ul style="list-style-type: none"> All waste will be appropriately stored and managed to prevent marine debris from entering the marine environment. 	N/A	No
Operational Phase Impacts Operational phase impacts will be managed through development and implementation of a Marine Operational Environmental Management and Monitoring Plan (MOEMMP), prior to commencement of operations. The following mitigation measures will be included in the MOEMMP to mitigate impacts on Marine Fauna during construction.			
Light pollution during operational activities	<ul style="list-style-type: none"> All non-essential lighting to be switched off when not in use. Building and vessel window blinds to be shut during hours between sunset and sunrise. 	Implement ALMP (Appendix F) including the following mitigation measure: <ul style="list-style-type: none"> Lighting of the TSVs will be reduced to navigation lighting only when not operational; Lighting to be directed inwards and at a low vertical angle; Vehicle headlights to be dipped when operating within the port boundary; Vehicles to be parked facing away from the direction of the ocean; Light shields will be placed on large equipment; and Bird interaction procedure to be developed and implemented. Implement ALMP (Appendix F) including the following light design: <ul style="list-style-type: none"> Minimum number and intensity of lights; 	No

Potential Impact	Proposed Mitigation		
	Avoid	Minimise	Offset required?
		<ul style="list-style-type: none"> Adapt lighting for colour, intensity and timing; Light only the area intended; and Use non-reflective, dark coloured surfaces. Adaptive management and continuous improvement as discussed in the ALMP (Appendix F).	
Osmotic Stress and saline stratification from brine discharge	<ul style="list-style-type: none"> Effective diffuser design and/or location of discharge point to maximise nearfield dilution. 	Implementation of the MOEMMP (Appendix D) to ensure that the designated Levels of Ecological Protection are achieved.	No
Injury from vessel strike	<ul style="list-style-type: none"> Vessels will adhere to the PPA speed limit, 9 knots, within the Port Boundary. All vessels to adhere to standard set in the National Whale Watching Guidelines and DBCA regulations. If a whale approaches a vessel the motor must be in neutral or be driven at less than five knots away from the whale. No approach zones are a zone of total vessel exclusion. Caution zones are those where speed must be no more than 6 knots. They cannot be entered by a vessel if there is an animal that is injured, stranded, entangled or distressed, or if a single calf or pod of calves are present. 	'Trained' MFOs will be used, at least one crew member on each vessel engaged in MinRes constructions will undergo training in marine fauna observations to undertake this task. Incident reporting will be undertaken in accordance with the MOEMMP (Appendix D).	No
Introduced Marine Pests/ Biosecurity	N/A	<ul style="list-style-type: none"> Implementation of Port existing procedures. Requirement for all vessels to comply with Commonwealth DAWE – Biosecurity requirements. Requirement for all vessels visiting the Port from international or interstate waters to complete the WA Department of Primary Industries and Regional Development 'Vessel Check' risk assessment (https://www.vessel-check.com/) Implementation of the Marine Pest State-Wide Array Surveillance Program (SWASP) at the Port. 	No
Hydrocarbon spill causing marine fauna injury or fatalities and/or impact on critical habitat	<ul style="list-style-type: none"> Inspect and maintain all refuelling equipment on a daily basis or at least prior to each and every use. Implement existing Port refuelling procedures. Store all fuels, oils and lubricants on site to ensure that they do not pose a threat to the environment or the safety of staff and the public. All vessel movements are subject to the Harbourmaster's approval to ensure they are all planned, no incompatible operations co-occur, and that weather and tidal movements are factored into all vessel operations. All vessel movements subject to Port procedures, including qualified and experienced vessel operators. All shipping movements are subject to Port scheduling and Pilotage requirements to ensure the highest level of planning, which includes all vessel movements, weather and tides. Follow all reasonable directions given by the harbour master to ensure vessel collisions are avoided. 	<ul style="list-style-type: none"> The Proponent is committed to updating and reviewing the Oil Spill Response and Tactical Response Plans to accommodate the increased levels of risk posed by additional vessel movements. Operational staff shall be appropriately trained in oil spill response. The Proponent is committed to working alongside the Port to ensure oil spill response capabilities are met. 	No

Potential Impact	Proposed Mitigation		
	Avoid	Minimise	Offset required?
	<ul style="list-style-type: none"> Ensure all operational vessels are compliant with the International Maritime Organisation International Convention for the Prevention of Pollution from Ships (MARPOL). 		
Underwater noise from operational vessels	<ul style="list-style-type: none"> Vessels will adhere to the PPA speed limit, 9 knots, within the Port Boundary. 	Minimal number of vessels required for each task.	No
Entanglement/ plastic ingestion from marine debris	<ul style="list-style-type: none"> All waste will be appropriately stored and managed to prevent marine debris from entering the marine environment. 	N/A	No



Figure 8-7: Construction Piling Marine Fauna Management Zones

Table 8-16: Hierarchy of Underwater Noise Management Strategies Associated with Dredging and Piling

Strategy	Description
Avoid	<ul style="list-style-type: none"> Piling works to be undertaken outside of the Southern Humpback Whale season (when mother-calf pairs are at their greatest densities), August - October, where practicable. Piling works to be undertaken outside of the Green Sawfish pupping season, including the arrival of pregnant adult, October / November.
Minimise	<ul style="list-style-type: none"> Dedicated marine fauna observers (MFOs) to undertake mitigation for piling. Observation and Exclusion Zones have been informed by underwater noise modelling, providing confidence in distances. Further, a precautionary and practical approach to management zone distances has been made, using distances from the 'high tide' modelled scenario where noise travels the farthest. Piling operations to be undertaken during daylight hours.

**Table 8-17: Construction Piling Marine Fauna Management Zones (Talis 2021)*
Based on Permanent and Temporary Threshold Shift Distances from Piling Operations**

Marine Fauna Group	TTS Distance Limit (metres)	PTS Distance Limit (metres)	Observation Zones (Metres)	Exclusion Zone (Metres)
Whales	1,440	225	1,500	300
Dolphins	40	No exceedance	500	150
Dugongs	10	No exceedance	500	150
Turtles	215	<20	500	200

*Sawfish are not included in the marine fauna observation procedures because they are highly cryptic and unlikely to be detected by observers. Wherever possible, construction piling will be undertaken outside of sensitive life periods (i.e., pupping).

8.6 Assessment and Significance of Residual Impacts

The impact assessment has been conducted within the context of the Proposals nature and magnitude. The Proposal is being undertaken within the Port, which has been established as a precinct for further industrial activities.

The DEs overlap with a small portion of a number of BIAs. However, habitats for MNES listed species are widespread and well represented throughout the region. The movements of MNES-listed species are broader in spatial and temporal extent than the DEs themselves, or the areas affected by light, noise or turbidity. They are not restricted to the DEs, or areas which may be affected indirectly from noise, light or increased turbidity or salinity originating from within the DEs. The DEs themselves are predominantly characterised by bare sand. The Nearshore DE is characterised by highly turbid waters and bare substrate with occasional areas of limestone pavement. Benthic habitats located within the Offshore DE include low profile reef habitat with macroalgae, filter feeders and coral. The anchorage area is characterised by bare sand. No seagrass communities have been identified within the DEs. Suitable habitat will continue to be available for MNES listed species in local and regional areas.

A key aim is to avoid key ecological windows for marine fauna species. In case this cannot be achieved, further management measures will be implemented. Construction activities are planned to be undertaken from March to September (pending approvals), outside of the main seasons for turtle nesting and inter-nesting (January to March

and October to December), sawfish pupping (October to November) and the peak timing for Humpback Whale cow-calf occurrence (June to October (**Table 8-8**)).

The impact assessment has been undertaken with a high degree of confidence, based on comprehensive scientific field and desktop studies including modelling for underwater noise, light emissions, dredge and brine plumes.

In assessing potential impacts on marine fauna from the Proposal, consideration has been given to the North-west marine bioregional plan (DSWEPC 2012a). Potential impacts to key species relative to this document and that were listed within the plan were identified and considered if relevant to the potential impacts listed in **Section 8.3.5** for the Proposal. The pressures potentially affecting marine fauna species and populations as identified and characterised against a scale of concern have been considered in this assessment.

8.6.1 Construction Impacts

Direct Impacts

8.6.1.1 Underwater noise from piling and dredging activities

Hearing (physical damage)

Increased underwater noise can include reduced hearing sensitivity, through shifting the hearing threshold permanently or temporarily. Loud noises or long exposure may lead to physical damage, including permanent or temporary hearing loss (DSEWPaC 2012a).

- **Whales and Dolphins.** For whales (low frequency hearing) and Dolphins (high frequency hearing), it is assumed that the threshold levels for TTS and PTS for low and high frequency Cetaceans as defined in Southall et al (2019) and NOAA's 'Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing', are appropriate for this study.
- **Sirenians (Dugongs).** The threshold levels for TTS and PTS for Sirenians as defined in Southall et al (2019), have been used for Dugongs.
- **Turtles.** For marine turtles, the threshold levels for TTS and PTS will be adopted from study undertaken by the United States Navy . The study assesses the criteria and thresholds for sonars and other active acoustic sources.
- **Sawfish.** A study of elasmobranch fishes audiograms indicates that their hearing bandwidths range from 10 to 1000 Hz. As the very low frequencies have large wavelengths, it is expected that they will only exist as short duration evanescent waves in the water column of the study area. As a result, it has been assumed that frequencies between 100 and 100 Hz applies as a flat response for sawfish. The sawfish will then have a similar bandwidth sensitivity to that of turtles. It has therefore been assumed that the TTS and PTS levels for sawfish will be similar to that of turtles.

If the noise exposure exceeds the critical sound energy level, the hair cells become permanently damaged, tissue rupture occurs leading to hearing loss thus resulting in permanent threshold shift (PTS) (DoE 2015c and DPTI 2012). When the auditory system is exposed to a high level of sound for a specific duration, sensory hair cells begin to fatigue and change shape. If the noise exposure is below some critical sound energy level, the hair cells will eventually return to their normal shape, representing temporary threshold shift (TTS).

Marine fauna species may experience temporary hearing loss otherwise known as the temporary threshold shifts (TTS) in relation to piling if the noise exposure is below some critical sound energy level. This may cause injury such as hearing impairment, however as the injury is temporary the damaged hair cells will eventually return to their normal shape (DPTI 2012). If the noise exposure exceeds the critical sound energy level, the hair cells become permanently damaged, tissue rupture occurs leading to hearing loss and the effect is called permanent threshold shift (PTS) (DPTI 2012). The TTS will be exceeded at distances within 215 m (i.e., for turtles and sawfish) and 1,440 m (i.e., for low frequency hearing groups) of the piling activity at high tide (Talis 2022). The distances at low tide are far shorter, with 840 m for low frequency hearing groups and 100 m for turtles and sawfish, as noise will travel further at high tide than low tide (Talis 2022).

Masking (communication interference)

Noises in the low and high frequency range may mask acoustic signals that animals rely on for conspecific communication. Masking occurs when the ability to detect or recognise a sound of interest is degraded by the presence of another sound (the masker) (Erbe et al. 2016; Popper et al. 2014). Masking by anthropogenic noise is of particular concern for cetaceans when the frequency of the noise overlaps with the species' vocal frequency or hearing range (DoE 2015c). The hearing sensitivity of marine mammals varies considerably between species and between conspecifics of a species.

Erbe et al. (2016) provides one of the more comprehensive works on the effects and thresholds for masking, but unfortunately focusses on species in the high frequency hearing group. In this study, the hearing ranges for a range of families *Delphinidae*, *Monodontidae*, *Phocoenidae*, *Iniidae*, *Lipotidae* and *Ziphiidae* varied between 0.5-10 kHz to 20-160 kHz. Audiograms for Baleen Whales (family *Balaenopteridae*) which fall within the low frequency hearing group are relatively scarce and, if available, are reported based on the results of modelling (Southall et al. 2007; 2019). Southall et al (2019) for example reported that the hearing limit in Humpback Whales is between 0.018 to 15kHz, whereas DPTI (2012) and NOAA, suggest <1 kHz and 7 Hz-35 kHz, respectively. On aggregate, these sources suggest a very high potential for masking in Baleen Whales when exposed to low frequency noise between 7 Hz and 35 kHz.

Behavioural Response and Energetic Consequences

The impact of anthropogenic noise that is received at lower levels such as when further from the source but that occurs continuously can include changes in behavioural responses including. Within the North-west bioregion, noise generated by piling activities has the potential to disturb marine fauna including threatened and listed migratory species (Humpback Whale, Dugong, Indo-Pacific Bottlenose Dolphin and Australian Humpback Dolphin, Flatback Turtle, Green Turtle, Hawksbill Turtle and Green Sawfish) causing temporary or even long-term avoidance of an area that may be important for feeding, reproduction or sheltering (DSWEPaC 2012a). These impacts may affect critical behaviours and functions, such as feeding, migration, breeding and response to predators, all of which may ultimately affect an individual animal's survival. There may be potential behavioural disturbance for whales during piling (15, 000 m) and dredging (3, 470 m).

The highest potential impact from underwater noise is for Humpback Whales during the peak of the southern migration when mother and calves rest in shallow environments. Humpback whales are baleen whales with low frequency hearing and have been identified as a key species for the Proposal impact assessment and management due to their high conservation status and high likelihood of occurrence at the site. Increased underwater noise may have energetic and fitness consequences for Humpback Whales during sensitive life phases. Population IV Humpback Whales conduct a return migration from Antarctica to northern WA from late May to December. The northern migration is further offshore (median = ~50km) than the southern migration (median = ~35 km). Recent studies have revealed that Humpback Whale calving grounds extend south from Camden Sound in the Kimberley to at least North West Cape (Irvine et al 2018). At least approximately 20% of Humpback Whale calves are born near, or south of, North West Cape. Numbers increase from early June onwards, with a peak in August. Numbers steadily reduce until late October and then sporadic individuals will pass through. August represents a shift in north to southward migrating whales. Cow-calf whale pairs become abundant from this time and predominantly rest in and travel through the protected nearshore waters (i.e., inshore of 50 m bathymetric contour). This is a sensitive life phase as they are prone to killer whale predation and females expend much energy on lactation. Humpback whale cow-calf pairs rest for 35% of their time as the early phase of lactation is the most energetically demanding phase in their reproductive cycle (Bejder et al 2019). The lactating females save their energy by devoting a significant amount of time to rest and that even moderate increases of noise from vessels will decrease the communication range of Humpback Whales. A sound experiment at the same site by Sprogis et al. (2020) demonstrated that noise level from a vessel drives the short-term behavioural response of Humpback Whales to disturbance through an increase in respiration rate and movements which could reduce the amount of energy available for other activities including predator avoidance and completion of their migration.

Implementation of appropriate underwater noise management strategies (**Table 8-16**), as informed by the modelling, will ensure that impacts from underwater noise will **not** cause population level consequences. The impacts associated with noise (particularly piling, during the construction phase) are manageable and temporary, with a **low risk** of cumulative impact. Further mitigation will be adopted where avoidance cannot be achieved. The

use of MFOs will facilitate the protection of other marine fauna (i.e., dolphins, dugongs, turtles, and occasional pelagic visitors such as whale sharks and other whales) as well as Humpback Whales. Timing presented is based on data collected by Centre for Whale Research for the Wheatstone Project, at the same location as the Proposal.

8.6.1.2 *Light Pollution During Construction*

Adverse effects of artificial light on marine turtle behaviour are well recognised by a substantial body of research (see Withington & Martin 2003; Lohmann et al. 1997; Salmon 2003 for reviews). Artificial lighting can impact individuals at different stages of the life cycle, including nesting adult females and hatchlings and critical nesting habitat for nesting and inter-nesting overlaps with the Proposal area.

Bright lighting can disorient flying birds and subsequently cause their death through collision with infrastructure or starvation due to disruptions in the ability to forage at sea (DSWEPaC, 2012a). The Proposal related light sources are associated with the following Proposal facilities and vessel lighting during construction and operation:

- Landside DE:
 - Storage and loading infrastructure;
 - Desalination plant;
 - Power station;
 - Administration building; and
 - Sewage treatment facility.
- Nearshore DE:
 - Dedicated berth;
 - Jetty Wharf; and
 - Ship loader, including 2 TSVs.
- Offshore Development Envelope:
 - Two OGVs (at Anchorage A and B); and
 - Two TSVs unloading at one OGV (Anchorage A).

Light modelling (**Appendix F**) has been undertaken to inform the development of mitigation for the key marine species at risk included marine turtles. Based on the outcomes of the impact assessment, light pollution was assessed as a high-risk threat to the Flatback Turtle, Green Turtle and Hawksbill Turtle (Pendoley Environmental 2021). Lighting design has been managed in line with the (DotEE, 2020), the WA EPA Environmental Assessment Guideline: Marine Fauna (EPA 2016b) and the WA Environmental Protection Authority Environmental Assessment Guideline No. 5 Protecting Marine Turtles from Light Impacts (EPA 2010).

Based on the outcomes of the Artificial Light Impact Assessment (**Appendix F**), onshore hatchling marine turtles were most at risk of negative impact from Proposal lighting, with little to no impact on nesting adult turtles (Pendoley Environmental 2021). Management measures to reduce potential impacts of artificial light will **prevent** adverse effects to nesting island habitat critical for the survival of flatback, hawksbill and green turtle species (DotEE 2017).

In regard to seabirds, all residual risk was **low** (Pendoley Environmental 2021). In the event operations (post-construction) monitoring identified an impact additional engineering and/or operational solutions will be implemented where practicable to control the problem light(s) as detailed in the Artificial Light Impact Assessment and Management Plan (Pendoley Environmental 2021; **Appendix F**). Considering the information provided in the Artificial Light Impact Assessment (Pendoley Environmental 2021), and the implementation of control measures outlined in **Table 8-15**, significant impacts to marine turtles, seabirds and shorebirds are **unlikely**.

The ALMP (**Appendix F**) will be implemented to mitigate impacts, which includes monitoring of hatchling orientation on Thevenard and other Islands. Based on light modelling impacts are expected to be **low**.

8.6.1.3 Injury from Vessel Strike

Shipping activities within and surrounding the Proposal are considered low compared to shipping activities within the greater North West, WA region. The consequence of vessel strike on marine fauna may result in injury or mortality, however potential impacts from Proposal activities are **unlikely** to result in significant declines in the local or regional populations of species and their distribution, or reductions in the diversity of species. Additional shipping activities within and surrounding the Proposal area in the construction and operation phases are considered low compared to shipping activities within the greater Northwest, WA region. The Proposal will not significantly increase the risk of cumulative impacts from vessel strikes on marine fauna.

Indirect Impacts

8.6.1.4 Hydrocarbon Spills Causing Marine Fauna Injury or Fatalities and/or Impact on Critical Habitat

With the adaption of appropriate mitigation measures (**Table 8-15**) to avoid and minimise the risk of a spill occurring during the construction phase of the Proposal the risk of a hydrocarbon spill is low. Overall, the risk of a hydrocarbon spill during construction is considered low and with the appropriate planning and mitigation measures in place in the event of a spill, the threat to marine fauna is considered **very low**.

8.6.1.5 Introduction of Marine Pest Species from Construction Vessels Resulting in Decline in Local Marine Fauna Populations

Mitigation measures consistent with the National System for the prevention and Management of Marine Pest Incursions, the Australian Ballast Water management requirements, the National biofouling management guidelines for commercial vessels reduce the risk that Proposal activities will result in the introduction of marine pests in the Port (Nearshore DE) and Anchorage Area (Offshore DE). Management measures to mitigate the risk of invasive marine species are outlined in **Table 8-15**. Provided that these mitigation measures are implemented, the risk of marine pest incursion during operations is considered to be **negligible**.

8.6.1.6 Entanglement / Plastic Ingestion from Marine Debris

The consequence of debris entering the marine environment may result in injury or mortality, through entanglement or plastic ingestion. General waste is expected in any construction and operation phase of any Port and Harbour. However, if all waste is appropriately disposed of, stored and managed, this can prevent marine debris from entering the marine environment and subsequently **unlikely** to result in declines in the local or regional populations of species and their distribution, or reductions in the diversity of species.

8.6.2 Operational Impacts

Direct Impacts

8.6.2.1 Osmotic Stress from Brine Discharge

Based on modelling results, brine discharge impacts are not expected to extend into the moderate or high ecological protection area (O2 Metocean 2021b; **Appendix K**). Furthermore, results from ecotoxicity testing indicate that a brine dilution of 1:8 would achieve an 80% SPL appropriate for a Low LEP Area (O2 Metocean 2021b). For the Moderate (90%) and High (99%) SPL, the Seawater Desalination Plant required dilutions would be 1:10 within 70 m of the outfall and 1:23 within 250 m of the outfall (O2 Metocean 2021b). Due to the proposed brine having slightly higher predicted salinity than the brine used for ecotoxicity testing, O2 Metocean 2021b) applied a factor of two for each dilution requirement to ensure conservatism and demonstrate that the EPA guidance for Marine Environmental Quality is achieved within each LEP Area (i.e. 1:20 and 1:46 for Moderate and High SPL, respectively). Based on the model outputs, a reduced Low LEP boundary has been established at a 30 m distance from the discharge points (rather than EPA's recommended 70m) to reflect the small size of the predicted mixing zone and to allow for a practical distance to accurately monitor and manage the outfall dilution requirements. If the LEPs are achieved, then any impacts would be limited to possible periods of short-term stress

or discomfort associated through the Low LEP. No impacts would be expected in the Moderate LEP. Mobile marine fauna such as marine mammals may move through the low, moderate or high LEP zone at any point, however the risk is considered low giving species ability to leave the zone if deemed unfavourable. Less mobile marine fauna species would have greater susceptibility to osmotic stress. However, given that the LEP zone is small, without recognised important habitat, it is **unlikely** that marine fauna species would be restricted to that location.

Figure 7-2 displays the modelled dilution contours where the 90% and 99% SPLs are met as required to satisfy the moderate and high LEP areas, respectively. As can be seen, these are typically met within the designated low LEP area, thus indicating the **extremely low** level of predicted impact from brine discharge.

8.6.2.2 Injury from Vessel Strike

Potential impact to marine fauna as a result of vessel strikes can be avoided by limiting vessel speeds, which will allow vessels more time to slow down if marine fauna are observed. Laist (2006) found significant increase in the risk of vessel collision between marine megafauna and vessels at speeds above 10 knots and more severe and lethal injuries were found to be caused by vessels travelling at speeds above 14 knots. The likelihood of a vessel strike during operation from proposed vessel movements is considered **low** due to the small scale (i.e., spatial movements) of the operation and piling (i.e., slow-moving and small support vessels). The risk is further reduced by limited vessel speeds in the navigational channel to no more than 9 knots. At a minimum, all vessels will comply with PPA speed limit, 9 knots, within the Port.

The consequence of vessel strike on marine fauna may result in injury or mortality, although potential impacts from Proposal activities are **unlikely** to result in significant declines in the local or regional populations of species and their distribution, or reductions in the diversity of species.

Indirect Impacts

8.6.2.3 Introduction of Marine Pest Species from Operations Vessel

As with the construction phase, marine pests can be introduced during operations through ballast water exchange or via biofouling. However, mitigation measures consistent with the National System for the prevention and Management of Marine Pest Incursions, the Australian Ballast Water management requirements, the National biofouling management guidelines for commercial vessels reduce the risk that Proposal activities will result in the introduction of marine pests in the Port (Nearshore DE) and Anchorage Area (Offshore DE). Management measures to mitigate the risk of invasive marine species are outlined in **Table 8-16**. Provided that these mitigation measures are implemented, the risk of marine pest incursion during operations is considered to be **negligible**.

8.6.2.4 Hydrocarbon Spills Causing Marine Fauna Injury or Fatalities and/or Impact on Critical Habitat

The risks to marine fauna from hydrocarbon spill associated with operational activities can be effectively mitigated through industry standard controls. Through implementation of these controls (outlined in **Table 8-16**) the residual risk to marine fauna is considered to be **very low**.

8.6.3 Cumulative Impact

The majority of the BCH in the Proposal Nearshore DE was historically predicted to be impacted from dredging and construction in relation to the Wheatstone Project. The filter feeder communities were largely unaffected by the Wheatstone dredging beyond the ZOHI and this was likely due to the natural resilience of these communities to naturally turbid waters and low light conditions that are common in the Ashburton region. However, the accuracy of predicted impacts to coral and seagrass communities is not publicly available, although it is noted, that given the time since capital dredging (i.e., eight years), Coral, Seagrass and Macroalgal BCH within the predicted ZOMI may have now recovered. It is likely that ongoing frequent (i.e., ~ biannually) maintenance dredging would have impacted the ability for BCH within the predicted ZOHI to recover.

The Proposal is located in the Port and represents a small addition to existing activities. The Port was constructed in 2014 as part of the development of Chevron's Wheatstone Liquefied Natural Gas processing facility.

Since implementation, Chevron has submitted several Project Compliance Assessment Reports to the WA DWER. Chevron has complied with all conditions set by the State's Environmental Protection Authority during the reporting period and has fully implemented the proposal in accordance with MS 873. The implemented proposal is not considered to have had any detrimental environmental effects that were not assessed as part of the original proposal.

The direct impacts to marine fauna during the construction phase of this Proposal, from lighting, noise and vessels, are like those assessed for the original Wheatstone Project but much smaller in extent, severity and duration. As the Wheatstone construction phase has been completed there will be **no** cumulative impacts on marine fauna from these potential stressors.

Potential loss of habitat that supports marine fauna from the Proposal will be captured in the assessment of impacts to benthic communities and habitats, which will be consistent with the EPA's Technical Guidance for the Protection of Benthic Communities and Habitats (EPA 2016d). This guidance sets out a framework for considering cumulative loss of benthic communities and habitats and the potential consequences for marine ecological integrity and biological diversity. The approach is consistent with the assessment of the Wheatstone Project to ensure consistency and provide confidence in the assessment of cumulative loss of critical fauna habitat.

The Proposal is also expected to have potential operational impacts on marine fauna that are similar to the existing port, although it will only be a minor additional contributor to these. Ore will be loaded from TSVs onto Capesize OGVs at a maximum of two of the five anchorage points at any one time. The PPA has operational and regulatory oversight of the Port and associated waters and lands in accordance with the powers vested to the PPA under the *Port Authorities Act 1999*.

The PPA's application of an environmental quality management framework, which all Port users need to comply with, will also ensure an appropriate level of environmental quality is maintained across the Port waters so that cumulative impacts to marine fauna are managed to an **acceptable level**.

8.7 Environmental Outcomes

Based on the assessment of potential impacts and proposed mitigation measures (**Table 8-16**) to protect environmental values associated with marine fauna, the Proponent considers that the EPA objective for this factor can be met. The predicted outcomes for marine fauna are summarised below:

- **No** impacts to important habitats (i.e., nesting, nursery, foraging or breeding areas), for any conservation significant marine fauna species.
- The number of individuals affected is expected to be low and **not significant** in terms of local populations.
- **No** reduction in populations of species of local and regional importance.
- **No** reduction in the biodiversity of marine fauna in the DEs or surrounds; and
- Suitable habitat for all other identified threatened, and migratory MNES species will **continue to be available** in the DE, local and regional areas.

Table 8-18: Summary of Nature and/or Magnitude of the Proposal and Potential Impacts on Marine Fauna

Significant Impact Criteria	Assessment of Significance
Lead to a long-term decrease in the size of a population	Long term decreases in population size are unlikely for any marine fauna populations in the area due to the limited potential for impact as described in the preceding sections. However, with appropriate control measures including monitoring and adaptive management of light emissions, the risk of this potential impact will be further reduced.
Reduce the area of occupancy of the species	Individuals or populations are unlikely to be displaced from existing habitat and therefore the area of occupancy is unlikely to be reduced.
Fragment an existing population into two or more populations	No aspects of the Proposal are expected to create a barrier to movement of individuals, or displace individuals or populations, which could cause population fragmentation.
Adversely affect habitat critical to the survival of a species	<p>No habitats on the Register of Critical Habitat under the EPBC Act, are located within the Proposal DEs or adjacent areas.</p> <p>Management measures to reduce potential impacts of artificial light will prevent adverse effects to nesting island habitat critical for the survival of Flatback, Hawksbill and Green Turtle species (DotEE 2017c).</p>
Disrupt the breeding cycle of a population	Disruption to the breeding cycle of a population unlikely for any marine fauna. However, with appropriate control measures including monitoring and adaptive management, light spill will be minimised, reducing this potential impact.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Although light may be visible from foraging habitat for both seabirds and shorebirds, and nesting habitat for turtles, the presence of light is unlikely to adversely impact this habitat. Nocturnal roost sites are unlikely to be impacted by light to the extent that species populations will decline.</p> <p>In addition, dredging resulting in benthic habitat removal and increased turbidity within the Nearshore DE is expected, however critical habitat does not exist within the Nearshore DE and is mostly comprised of both bare substrate with occasional areas of limestone pavement. Turbidity is only expected to be localised and temporary.</p> <p>Appropriate dilution of brine discharge based on ecotoxicity testing and brine modelling would result in a low risk to benthic habitat within the low ecological protection area that has been applied around the diffuser outfall.</p>
Result in invasive species that are harmful to a species becoming established in the endangered or vulnerable species' habitat	Although marine pests can be introduced during operations through ballast water exchange or bio fouling, with appropriate mitigation measures the risk of marine pest incursion during operations is considered to be negligible .
Introduce disease that may cause the species to decline	No vectors for introduced disease have been identified.
Interfere with the recovery of the species	The impact assessment determined that the potential for residual impacts to marine fauna is low, and the potential for significant impacts in the above criteria are unlikely . Therefore, the Proposal is unlikely to interfere with the recovery of the species present.

8.7.1 Summary of the Predicted Outcome

The key predicted outcomes for the Marine Fauna values outlined above are:

- **No** impacts to important habitats (i.e., nesting, nursery, foraging or breeding areas), for any conservation significant marine fauna species.
- The number of individuals affected is expected to be low and **not significant** in terms of local populations.
- **No** reduction in populations of species of local and regional importance.
- **No** reduction in the biodiversity of marine fauna in the DEs or surrounds; and
- Suitable habitat for all other identified threatened, and migratory MNES species will continue to be available in the Development Envelope, local and regional areas.

After the mitigation hierarchy has been applied (**Table 8-15**), the Proponent considers that the Proposal can be managed to meet the EPA's objective for Marine Fauna.

Based on the negligible potential impact on Marine Fauna habitat and the implementation of all mitigation measures to limit the impact of the Proposal on the environment, the EPA objective for Marine Fauna will be met.

9. FLORA AND VEGETATION

9.1 EPA Objective

The EPA's objective for flora and vegetation is to protect *flora and vegetation so that biological diversity and integrity is maintained* (EPA 2020e).

9.2 Policy and Guidance

The Proponent has considered published policy and guidance relevant to this factor as summarised in **Table 9-1**.

Table 9-1: Policy and Guidance for Flora and Vegetation

Policy/Guidance	Consideration
Instructions on how to prepare an Environmental Review Document (EPA 2020)	The RSD has been prepared in accordance with the Instructions.
Statement of Environmental Principles, Factors and Objectives (EPA 2020e)	Impacts of the Proposal have been assessed against the EPA objective for all relevant factors.
Instructions on how to prepare <i>Environmental Protection Act 1986</i> Part IV Environmental Management Plans (EPA 2020c)	The attached CEMP has been prepared in accordance with this guidance.
Environmental Factor Guideline: Flora and Vegetation (EPA 2016e)	The information provided in this chapter addresses the 'considerations for environmental impact assessment' listed in this document.
Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016f)	This document guides the appropriate obtainment and collation of flora and vegetation data to be used in EIA. All studies conducted for the Proposal are in accordance with this guidance document.
Government of Western Australia (2011) WA <i>Environmental Offsets Policy</i>	The offset policy and guidelines have been considered in relation to the definition of significant residual impacts and the proposed offset strategy.
Government of Western Australia (2014) WA <i>Environmental Offsets Policy</i>	

9.3 Receiving Environment

9.3.1 Environmental Studies

A summary of studies undertaken in relation to the flora and vegetation factor, and the assessment of potential impacts primarily draws on information included in the reports provided in **Table 9-2**. 360 Environmental Proprietary Limited (herein referred to as '360 Environmental') undertook baseline surveys covering the Haul Road DE in 2020 and 2021. The 360 Environmental (2022b) survey is the key baseline survey for the haul road, with the Terrestrial Survey Area used to provide further context on the Proposal's impact on a regional scale. The Terrestrial Survey Area covers 26,999 ha, which covers the whole of the Proposal's Haul Road DE (16,209.1 ha) in addition to surrounding areas (the Terrestrial Survey Area; **Figure 9-1**).

The spatial extent of studies and surveys completed for the flora and vegetation factor is shown in **Table 9-2** and **Figure 9-1**.

In addition, numerous flora and vegetation studies have been conducted within the vicinity of the Haul Road DE, providing a greater understanding of the flora and vegetation values within the broader region. These include:

- Onslow Material Pits Environmental Impact Assessment and Environmental Management Plan (GHD 2011);
- Level 1 flora and vegetation survey of the Ashburton North Gas Pipeline (ANGP) project area (Mattiske Consulting 2014);
- Targeted Flora Survey – Onslow Utilities Infrastructure Upgrade Project (GHD 2017);
- Flora and vegetation survey and terrestrial fauna survey for the proposed Pilbara Regional Waste Management Facility (Phoenix Environmental Services 2017);
- Detailed flora and vegetation survey for the Pilbara Regional Waste Management Facility (Phoenix Environmental Sciences 2018);
- Onslow Road Phase 2 Reconnaissance Survey (Main Roads 2018);
- Pilbara Ports Authority – Port of Ashburton – Eastern Port Precinct – Additional Clearing Areas Flora Survey (Vicki Long & Associates 2020); and
- Warrirda Road Detailed & Targeted Flora and Basic Fauna Assessment (Spectrum 2021).

Table 9-2: Studies for Flora and Vegetation

Studies and Surveys	Area	Scope and Timing	Survey / Study Effort	Consistency with Guidance and Limitations
<p>360 Environmental (2021a) Ashburton Infrastructure Project Flora and Vegetation Assessment (Appendix Q)</p>	<p>Ashburton Infrastructure Project Terrestrial Survey Area: Approximately 30,238 ha (includes the haul road alignment, buffer and associated borrow pit areas). Includes 3,875.2 ha extrapolation area.</p>	<p>The field surveys were undertaken across seven field trips to collect data from the Survey Area from June 2020 to May 2021.</p> <p>Phase 1 (dry season) flora and vegetation survey were undertaken to:</p> <ul style="list-style-type: none"> Establishment of flora sites within the proposed Haul Road alignment on Peedamulla Station, the proposed Haul Road alignment on Red Hill Station (eastern portion only), proposed borrow pit areas occurring between Onslow Road and the North West Coastal Highway (NWCH) and proposed borrow pit areas adjacent east of NWCH. Establishment of infill flora sites on Peedamulla Station. Targeted Searching on Peedamulla Station and eastern portion of Red Hill Station. Establishment of flora sites within proposed borrow pit areas occurring east of NWCH, on Peedamulla Station. <p>The field surveys were undertaken across three field trips, totally 76 field days:</p> <ul style="list-style-type: none"> 5 – 15 June 2020; 22 Sep - 2 Oct 2020; and 27 -30 Oct 2020. <p>Phase 2 (wet season) flora and vegetation survey to support the development of the Proposal and provide further clarification from the Phase 1 survey (360 Environmental 2020). The field surveys were undertaken across four field trips:</p> <ul style="list-style-type: none"> 17 – 24 March 2021; 9 – 16 April 2021; 27 April – 4 May 2021; and 19 – 24 May 2021. <p>The report included:</p> <ul style="list-style-type: none"> Desktop assessment of available literature and databases to identify previously recorded environmental values. Field surveys to establish flora sites across the Terrestrial Survey Area; and Mapping of desktop assessment results, Priority flora and fauna points within the Terrestrial Survey Area. 	<p>The field survey built upon the 180 flora sites established in the 360 Environmental 2020 report (360 Environmental 2020), providing an additional 48 flora sites and bringing the total to 228 sites overall (132 quadrats and 96 relevés in 50 m x 50 m configurations).</p>	<p>This report was conducted in accordance with appropriate technical guidance including:</p> <ul style="list-style-type: none"> Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016f); and Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DoE 2013). <p>The following limitations and constraints associated with this field survey are detailed below:</p> <ul style="list-style-type: none"> Site access – one section of the Terrestrial Survey Area could not be accessed due to landowner restrictions; and Life forms sampled – this was a partial constraint as a total of 92 taxa were not able to be identified to species level. None of the unconfirmed flora were considered likely to be analogous to any of the conservation significant flora species identified with a medium, high, or confirmed likelihood of occurrence by the database searches. <p>This report has been independently reviewed by Mattiske Consulting Proprietary Limited (herein referred to as 'Mattiske'). All comments received from Mattiske have been included and updated within this report.</p>
<p>360 Environmental (2022b) Ashburton Infrastructure Project: Flora and Vegetation Assessment (Appendix S)</p>	<p>Terrestrial Survey Area: Approximately 26,999 ha (includes the haul road alignment, buffer and associated borrow pit areas).</p>	<p>The field surveys were undertaken across nine field trips to collect data from the Survey Area from June 2020 to March 2022.</p> <p>Phase 1 (dry season) flora and vegetation survey were undertaken to:</p>	<p>The field survey included a total of 270 sites overall (157 quadrats and 113 relevés in 50 m x 50 m configurations).</p>	<p>This report was conducted in accordance with appropriate technical guidance including:</p> <ul style="list-style-type: none"> Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016f); and

Studies and Surveys	Area	Scope and Timing	Survey / Study Effort	Consistency with Guidance and Limitations
		<ul style="list-style-type: none"> • Establishment of flora sites within the proposed Haul Road alignment on Peedamulla Station, the proposed Haul Road alignment on Red Hill Station (eastern portion only), proposed borrow pit areas occurring between Onslow Road and the North West Coastal Highway (NWCH) and proposed borrow pit areas adjacent east of NWCH; • Establishment of infill flora sites on Peedamulla Station; and • Targeted Searching on Peedamulla Station and eastern portion of Red Hill Station. Establishment of flora sites within proposed borrow pit areas occurring east of NWCH, on Peedamulla Station. <p>The field surveys were undertaken across four field trips, totally 108 field days:</p> <ul style="list-style-type: none"> • 5 – 15 June 2020; • 22 Sep - 2 Oct 2020; • 27 -30 Oct 2020; and • 14-21 September 2021. <p>Phase 2 (wet season) flora and vegetation survey to support the development of the Proposal and provide further clarification from the Phase 1 survey (360 Environmental 2020). The field surveys were undertaken across five field trips:</p> <ul style="list-style-type: none"> • 17 – 24 March 2021; • 9 – 16 April 2021; • 27 April – 4 May 2021; • 19 – 24 May 2021; and • 21 – 25 March 2022. <p>The report included:</p> <ul style="list-style-type: none"> • Desktop assessment of available literature and databases to identify previously recorded environmental values. • Field surveys to establish flora sites across the Terrestrial Survey Area; and • Mapping of desktop assessment results, Priority flora and fauna points within the Terrestrial Survey Area. 		<ul style="list-style-type: none"> • Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DoE 2013). <p>The following limitations and constraints associated with this field survey are detailed below:</p> <ul style="list-style-type: none"> • Site access – this was a minor limitation as some quadrats near the Red Hill station homestead were installed using a helicopters and could not be resampled due to the helicopter being unavailable. These sites were still sampled once, and species counts in the sites were not restricted by season.

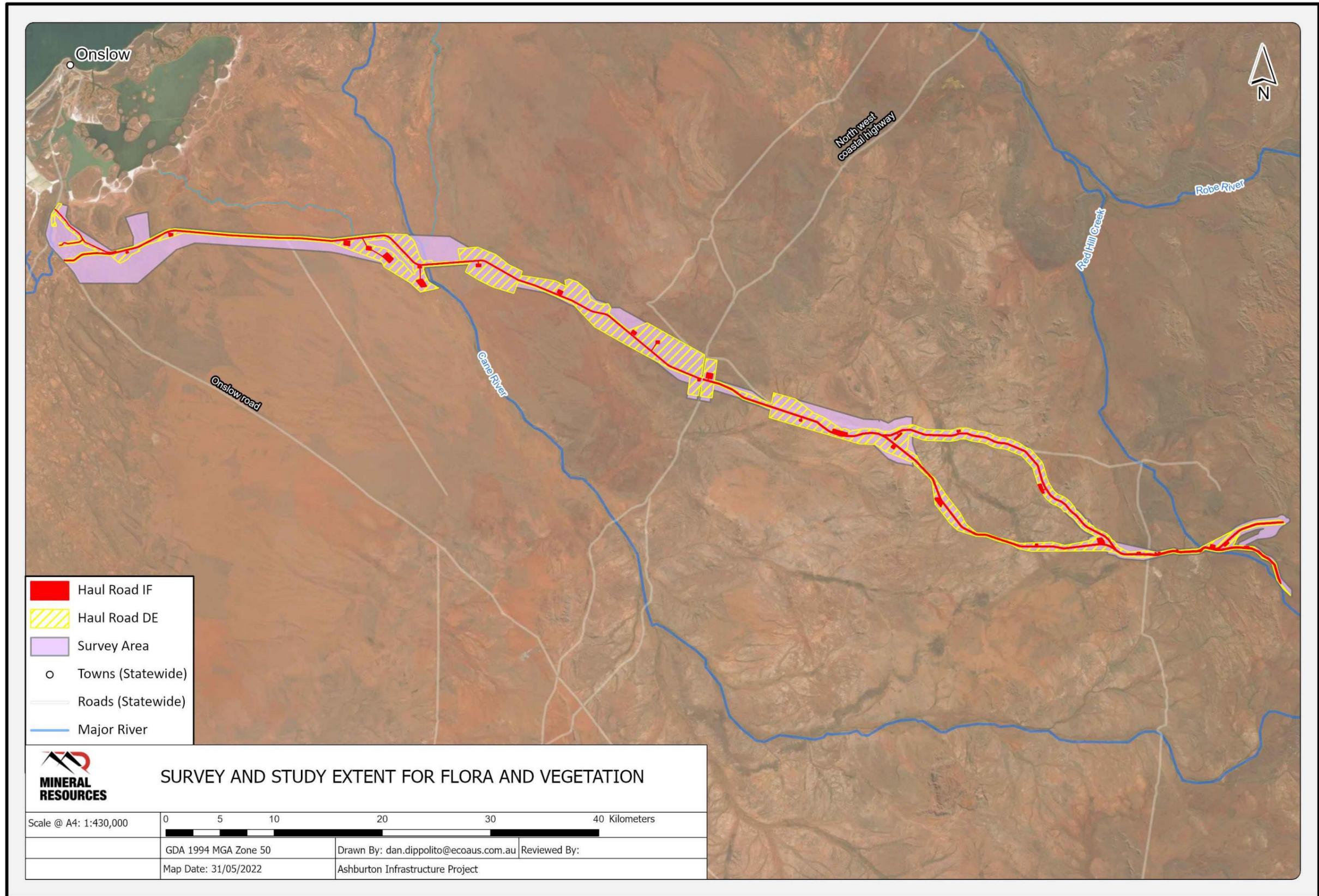


Figure 9-1: Survey and Study Extent for Flora and Vegetation

9.3.2 Vegetation

9.3.2.1 Vegetation Associations

Mapping of pre-European broad vegetation within Western Australia was completed on a broad scale (1:1,000,000) by Beard (1975). These vegetation types were later re-assessed by Shepherd et al. (2002), resulting in 819 vegetation associations within Western Australia. 13 pre-European vegetation association units are represented by the vegetation in the Proposal DE (360 Environmental 2022b). **Table 9-3** summarises the current and pre-European extent of these vegetation associations within the Pilbara and Carnarvon Bioregions and the DE. More than 97% of the pre-European extent of each of these associations remain across the Pilbara Bioregion.

Table 9-3: Vegetation Associations within the Proposal DE

Vegetation Associations	Pre-European Extent (ha)	Current Extent Remaining (ha)	% of Pre-European Extent Remaining	Extent in Proposal DE (ha)
Cape Range (CAR01) sub region				
Cape Yannare Coastal Plain 117	919,517	886,005.8	96.4	1.9
Cape Yannare Coastal Plain 127	97,585.5	95,939.9	98.3	82.5
Cape Yannare Coastal Plain 670	147,897.1	147,794.6	99.9	879.3
Cape Yannare Coastal Plain 98	184,351.0	184,341.2	100.0	148.0
Cape Yannare Coastal Plain 676	24,120.2	23,659.9	98.1	19.9
Hamersley (PIL03) sub-region				
Stuart Hills 103	614,596.5	614,463.8	100.0	1629.3
Stuart Hills 583	242,394.5	242,394.5	100.0	6013.6
Stuart Hills 612	476.2	476.2	100.0	72.5
Roebourne (PIL04) sub-region				
Onslow Coastal Plain 29	5,235.6	5,235.6	100.0	405.1
Onslow Coastal Plain 585	144,781.5	144,769.9	100.0	2,918.6
Onslow Coastal Plain 606	32,103.7	32,103.7	100.0	165.5
Onslow Coastal Plain 641	2,117.9	2,117.8	100.00	18.8
Onslow Coastal Plain 605	88374.6	88374.6	100.0	3197.1

9.3.2.2 Landside Development Envelope vegetation types

A total of four vegetation types (excluding cleared and other areas have been delineated within Landside DE (360 Environmental 2020, 360 Environmental 2022b). These vegetation types CT01, CT05, CT06 and DS04 as described in **Table 9-4**.

There will be no clearing of vegetation within the Landside DE as part of this Proposal, however, there is potential for the construction and operation of the Port to lead to increased dust deposition to surrounding vegetation.

Matsuki (2016) conducted a study examining the impacts of dust on plant health in semi-arid environments. The study found no evidence of negative impacts on plant health for dust deposition in semi-arid environments. Plants

in semi-arid environments are exposed to dust naturally and may be less likely to suffer from short—term impacts of dust. These plants often have morphological adaptations that capture and retain moisture (Matsuki 2016).

Nevertheless, as discussion in **Section 12.5**, the Proposal has been specifically designed to maximise the suppression and capture of emissions. At the Port, the Proposal will minimise emissions through ensuring ore is stockpiled and conveyed in covered infrastructure. As such, the Proponent considers that emissions can be managed in accordance with management procedures and the EPA's objective for Air Quality can be met.

Based on this the Proposal is unlikely to significantly impact flora and vegetation values within and surrounding the Port, and therefore these values have not been discussed further in this section.

Table 9-4: Vegetation Types Mapped in the Landside Development Envelope

Vegetation Type	Description	Extent in Landside DE (ha)	% of Landside DE
Claypans / tidal flats and channels			
CT01	<i>Avicennia marina</i> tall shrubland over <i>Tecticornia halocnemoides</i> (<i>Tecticornia auriculata</i>) low open shrubland.	0.4	0.7
CT05	<i>Tecticornia auriculata</i> or <i>Tecticornia halocnemoides subsp. tenuis</i> low chenopod shrubland.	14.2	26.8
CT06	<i>Tecticornia auriculata</i> low shrubland over <i>Eragrostis falcata</i> low isolated tussock grasses.	0.6	1.1
Dunes and Swales			
DS04	* <i>Cenchrus ciliaris</i> (<i>Eragrostis falcata</i>) low grassland (with <i>Triodia epactia</i> low isolated hummock grasses) over mixed low sparse herbs.	6.4	12.1
Other			
Not Assessed`		31.4	59.3

9.3.2.3 *Haul Road Development Envelope vegetation types*

A total of 48 vegetation types (excluding cleared have been delineated within the Haul Road DE (360 Environmental 2022b). Vegetation types are described in **Table 9-5** and depicted in **Figure 9-2** to **Figure 9-11**.

Table 9-5: Vegetation Types Mapped in the Haul Road Development Envelope

Vegetation Types	Description	Extent in Haul Road DE (ha)	% of Haul Road DE
Claypans / tidal flats and channels			
CT02	<i>Tecticornia auriculata</i> and <i>Tecticornia halocnemoides</i> low open chenopod shrubland with <i>Triodia epactia</i> low open hummock grassland.	61.7	0.4
CT03	<i>Tecticornia auriculata</i> (<i>Tecticornia halocnemoides</i> subsp. <i>tenuis</i>) low open chenopod shrubland to isolated chenopod shrubs (+/- * <i>Cenchrus ciliaris</i> low isolated tussock grasses).	224.4	1.4
CT04	Tidal flats/open clay pans with low isolated herbs and chenopod shrubs.	26.1	0.2
CT05	<i>Tecticornia auriculata</i> or <i>Tecticornia halocnemoides</i> subsp. <i>tenuis</i> low chenopod shrubland.	9.9	0.1
CT07	<i>Acacia tetragonophylla</i> and <i>Acacia synchronicia</i> (and/or * <i>Vachellia farnesiana</i>) tall to mid open shrubland over <i>Eriachne flaccida</i> and <i>Sporobolus mitchellii</i> open tussock grassland to isolated tussock grasses.	14.6	0.1
Dunes and swales			
DS01	<i>Grevillea stenobotrya</i> and <i>Hakea stenophylla</i> subsp. <i>stenophylla</i> (+/- <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>) tall to mid open to sparse shrubland over <i>Acacia stellaticeps</i> low sparse shrubland to isolated shrubs over <i>Triodia avenoides</i> and <i>Triodia epactia</i> low open hummock grassland.	224.1	1.4
DS02	<i>Acacia stellaticeps</i> (+/- <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>) mid to low open shrubland over <i>Triodia epactia</i> (+/- <i>Triodia avenoides</i> , <i>Triodia glabra</i>) low hummock grassland.	141.2	0.9
DS03	(+/- <i>Acacia tetragonophylla</i> , <i>Acacia tetragonophylla</i> x <i>trachycarpa</i> and/or <i>Acacia synchronicia</i> mid to low sparse shrubland over) <i>Triodia epactia</i> low hummock grassland.	162.8	1.0
Plains			
PL01	<i>Acacia xiphophylla</i> tall open shrubland over <i>Triodia wiseana</i> and/or <i>Triodia longiceps</i> (<i>Triodia epactia</i>) low open hummock grassland.	1816.9	11.2
PL02	<i>Corymbia hamersleyana</i> (+/- <i>Corymbia candida</i> subsp. <i>candida</i>) low isolated trees over <i>Acacia ancistrocarpa</i> tall open shrubland to isolated shrubs over <i>Triodia glabra</i> low hummock grassland to open hummock grassland.	321.1	2.0
PL03	<i>Acacia atkinsiana</i> (+/- <i>Acacia ancistrocarpa</i> , <i>Acacia bivenosa</i> and <i>Acacia inaequilatera</i>) tall to mid open shrubland over <i>Triodia glabra</i> and/or <i>Triodia epactia</i> low open hummock grassland.	1698.7	10.5
PL04	<i>Acacia stellaticeps</i> (<i>Acacia bivenosa</i>) low open shrubland over <i>Triodia glabra</i> low hummock grassland to open hummock grassland.	76.2	0.5
PL05	<i>Acacia xiphophylla</i> (<i>Acacia synchronicia</i>) tall to mid open shrubland over <i>Triodia epactia</i> (+/- <i>Triodia glabra</i>) low hummock grassland to open hummock grassland.	1045.9	6.5
PL06	<i>Acacia bivenosa</i> tall to mid open shrubland over <i>Senna</i> spp. (+/- <i>Eremophila cuneifolia</i>) mid to low isolated shrubs over <i>Triodia wiseana</i> (+/- <i>Triodia longiceps</i>) low hummock grassland to sparse hummock grassland.	1856.4	11.5
PL08	<i>Acacia synchronicia</i> (<i>Acacia bivenosa</i> and <i>Acacia inaequilatera</i>) mid isolated shrubs over <i>Triodia glabra</i> low hummock grassland to open hummock grassland.	393.0	2.4
PL09	<i>Acacia bivenosa</i> mid sparse shrubland over <i>Scaevola spinescens</i> low sparse shrubland over <i>Triodia epactia</i> low hummock grassland with <i>Maireana georgei</i> and <i>Trianthema turgidifolium</i> low sparse chenopod shrubland.	14.2	0.1
PL10	<i>Acacia atkinsiana</i> and <i>Acacia bivenosa</i> tall open to sparse shrubland over <i>Triodia epactia</i> and <i>Triodia wiseana</i> low hummock grassland.	111.3	0.7
PL11	<i>Corymbia hamersleyana</i> low open woodland to isolated trees over <i>Acacia ancistrocarpa</i> (+/- <i>Acacia bivenosa</i> and <i>Acacia inaequilatera</i>) mid sparse shrubland over <i>Triodia epactia</i> low hummock grassland to open hummock grassland.	407.6	2.5
PL13	<i>Acacia synchronicia</i> and <i>Acacia bivenosa</i> mid sparse shrubland over <i>Triodia epactia</i> low hummock grassland.	281.9	1.7
PL14	<i>Acacia synchronicia</i> low sparse shrubland over <i>Triodia epactia</i> low hummock grassland.	148.5	0.9
PL15	<i>Acacia xiphophylla</i> tall sparse shrubland over <i>Acacia bivenosa</i> and <i>Acacia synchronicia</i> mid to low sparse shrubland over <i>Triodia wiseana</i> low open hummock grassland.	148.8	0.9
PL16	<i>Acacia xiphophylla</i> (<i>Acacia synchronicia</i>) tall to mid shrubland over <i>Triodia glabra</i> (+/- <i>Triodia epactia</i>) low open to sparse hummock grassland.	278.9	1.7

Vegetation Types	Description	Extent in Haul Road DE (ha)	% of Haul Road DE
PL17	<i>Acacia xiphophylla</i> tall shrubland over <i>Enchylaena tomentosa</i> var. <i>tomentosa</i> and <i>Rhagodia eremaea</i> low sparse chenopod shrubland over <i>Eragrostis xerophila</i> and <i>Sporobolus australasicus</i> low sparse grassland over <i>Salsola australis</i> low isolated herbs.	107.6	0.7
PL18	<i>Corymbia hamersleyana</i> low isolated trees over <i>Acacia ancistrocarpa</i> (<i>Acacia inaequilatera</i>) mid to sparse shrubland over <i>Triodia epactia</i> low hummock grassland to open hummock grassland.	7.2	0.0
PL19	(<i>Corymbia candida</i> subsp. <i>candida</i> low isolated trees over) <i>Acacia ancistrocarpa</i> and <i>Acacia inaequilatera</i> tall open shrubland to isolated shrubs over <i>Triodia glabra</i> (<i>Triodia epactia</i>) low hummock grassland to open hummock grassland.	2077.9	12.8
PL20	<i>Acacia aptaneura</i> tall shrubland (over <i>Triodia epactia</i> low sparse hummock grassland).	68.7	0.4
PL21	(+/- <i>Eucalyptus victrix</i> and <i>Corymbia hamersleyana</i> low isolated trees over) <i>Acacia ancistrocarpa</i> tall shrubland to open shrubland over <i>Triodia epactia</i> low open hummock grassland over * <i>Cenchrus ciliaris</i> low open tussock grassland.	266.4	1.6
PL22	<i>Acacia aptaneura</i> , <i>Acacia synchronicia</i> and <i>Acacia xiphophylla</i> tall to mid open to sparse shrubland over <i>Triodia epactia</i> low closed to sparse hummock grassland.	126.0	0.8
PL23	Intermittent patches of <i>Acacia xiphophylla</i> (or <i>Acacia ancistrocarpa</i> and <i>Acacia bivenosa</i> in lower patches) over low mixed herbs and grasses with large open patches of <i>Triodia glabra</i> (<i>Triodia epactia</i>) hummock grassland.	292.3	1.8
PL24	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> low sparse shrubland over <i>Triodia glabra</i> and <i>Triodia epactia</i> low hummock grassland.	45.8	0.3
Drainage			
DR01	(+/- <i>Corymbia candida</i> subsp. <i>candida</i> low isolated trees over) <i>Acacia ancistrocarpa</i> and <i>Acacia bivenosa</i> tall to mid open shrubland to isolated shrubs over <i>Triodia epactia</i> (+/- <i>Triodia longiceps</i>) low to tall open hummock grassland (+/- <i>Chrysopogon fallax</i> low to tall sparse tussock grassland).	1483.6	9.2
DR02	<i>Acacia atkinsiana</i> and <i>Acacia ancistrocarpa</i> tall shrubland to open shrubland over <i>Triodia epactia</i> low closed to open hummock grassland.	624.6	3.9
DR03	<i>Eucalyptus victrix</i> and <i>Corymbia hamersleyana</i> low open woodland over <i>Acacia trachycarpa</i> (<i>Melaleuca glomerata</i>) tall to mid open shrubland over <i>Triodia epactia</i> low hummock grassland to open hummock grassland with <i>Enteropogon ramosus</i> low open to sparse tussock grassland.	16.1	0.1
DR04	<i>Eucalyptus camaldulensis</i> and <i>Melaleuca argentea</i> low woodland over <i>Melaleuca glomerata</i> , <i>Acacia trachycarpa</i> and <i>Acacia coriacea</i> subsp. <i>coriacea</i> tall open shrubland over <i>Triodia epactia</i> low sparse hummock grassland with * <i>Cenchrus ciliaris</i> low to tall sparse tussock grassland and <i>Cyperus vaginatus</i> low sparse sedgeland.	3.3	0.0
DR05	<i>Corymbia hamersleyana</i> low open woodland over <i>Acacia ancistrocarpa</i> (and <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>) tall shrubland over <i>Triodia glabra</i> and <i>Triodia epactia</i> low hummock grassland.	10.1	0.1
DR06	<i>Eucalyptus victrix</i> (+/- <i>Eucalyptus camaldulensis</i>) mid woodland over mixed <i>Acacia</i> spp. (+/- <i>Melaleuca glomerata</i>) mid shrubland over <i>Triodia epactia</i> low open hummock grassland.	50.1	0.3
DR07	<i>Corymbia hamersleyana</i> low open woodland over <i>Acacia colei</i> var. <i>colei</i> (or <i>Acacia tumida</i> var. <i>pilbarensis</i>) tall to mid closed to sparse shrubland over <i>Triodia epactia</i> (<i>Triodia wiseana</i>) hummock grassland.	168.5	1.0
DR08	<i>Eucalyptus victrix</i> and <i>Corymbia candida</i> subsp. <i>candida</i> low open woodland over <i>Triodia epactia</i> low open hummock grassland.	59.9	0.4
DR09	<i>Corymbia hamersleyana</i> low open woodland over <i>Acacia ligulata</i> , <i>Acacia synchronicia</i> and <i>Acacia bivenosa</i> closed to open shrubland over <i>Triodia epactia</i> low open hummock grassland.	32.3	0.2
DR10	<i>Corymbia candida</i> low woodland over <i>Acacia colei</i> var. <i>colei</i> , <i>A. elachantha</i> , and <i>A. tumida</i> var. <i>pilbarensis</i> tall shrubland over <i>Sida</i> sp. L (A.M. Ashby 4202) and <i>Walthera indica</i> low open shrubland over <i>Eriachne flaccida</i> and <i>Eriachne tenuiculmis</i> low tussock grassland.	126.2	0.8
DR11	<i>Acacia adsurgens</i> and <i>Grevillea wickhamii</i> (<i>A. inaequilatera</i>) tall shrubland over <i>Triodia epactia</i> (<i>T. wiseana</i>) low hummock grassland.	6.4	0.0
Low Hills and Mesas			
HM01	Tall to mid isolated shrubs over <i>Triodia wiseana</i> low open hummock grassland to hummock grassland	9.5	0.1
HM02	<i>Acacia inaequilatera</i> tall, isolated shrubs over <i>Triodia wiseana</i> low open hummock grassland	457.2	2.8
HM03	<i>Eremophila fraseri</i> subsp. <i>fraseri</i> and <i>Acacia bivenosa</i> low open to sparse shrubland over <i>Triodia wiseana</i> low hummock grassland to open hummock grassland	21.9	0.1

Vegetation Types	Description	Extent in Haul Road DE (ha)	% of Haul Road DE
HM05	<i>Acacia bivenosa</i> (<i>Acacia arida</i>) mid sparse shrubland over <i>Triodia wiseana</i> (<i>Triodia epactia</i>) low open hummock grassland	15.4	0.1
HM06	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low open woodland to isolated trees over <i>Acacia ancistrocarpa</i> , <i>Acacia bivenosa</i> and <i>Acacia synchronicia</i> low sparse shrubland over <i>Triodia wiseana</i> low hummock grassland to open hummock grassland	0.3	0.0
HM08	<i>Acacia ancistrocarpa</i> (with mixed <i>Acacia</i> and <i>Senna</i> spp.) mid to low isolated shrubs over <i>Triodia wiseana</i> low hummock grassland to sparse hummock grassland	60.9	0.4
HM09	<i>Acacia atkinsiana</i> and/or <i>Acacia ancistrocarpa</i> (<i>Acacia bivenosa</i> , <i>Codonocarpus cotinifolius</i>) tall to mid open shrubland over <i>Triodia wiseana</i> low hummock grassland	485.9	3.0
Other			
Cleared		118.0	0.7
No Access		0.4	0.0
TOTAL		16,209.2	100.00

*Note: this total includes areas other than vegetation types (i.e., cleared) which affects the total. Discrepancies in total extent in Haul Road DE are due to rounding.

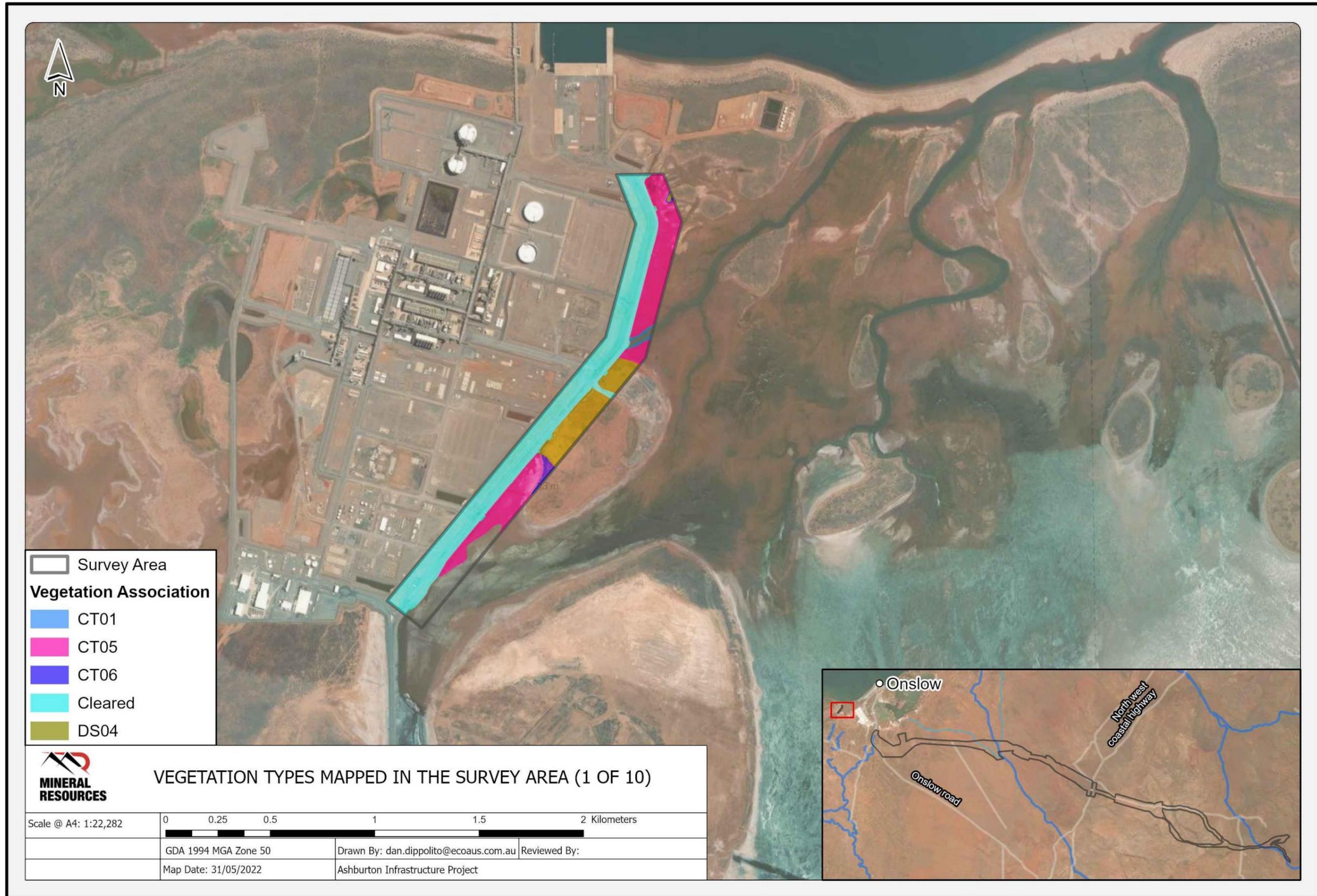


Figure 9-2: Vegetation Types Mapped in the Terrestrial Survey Area (1 of 10)

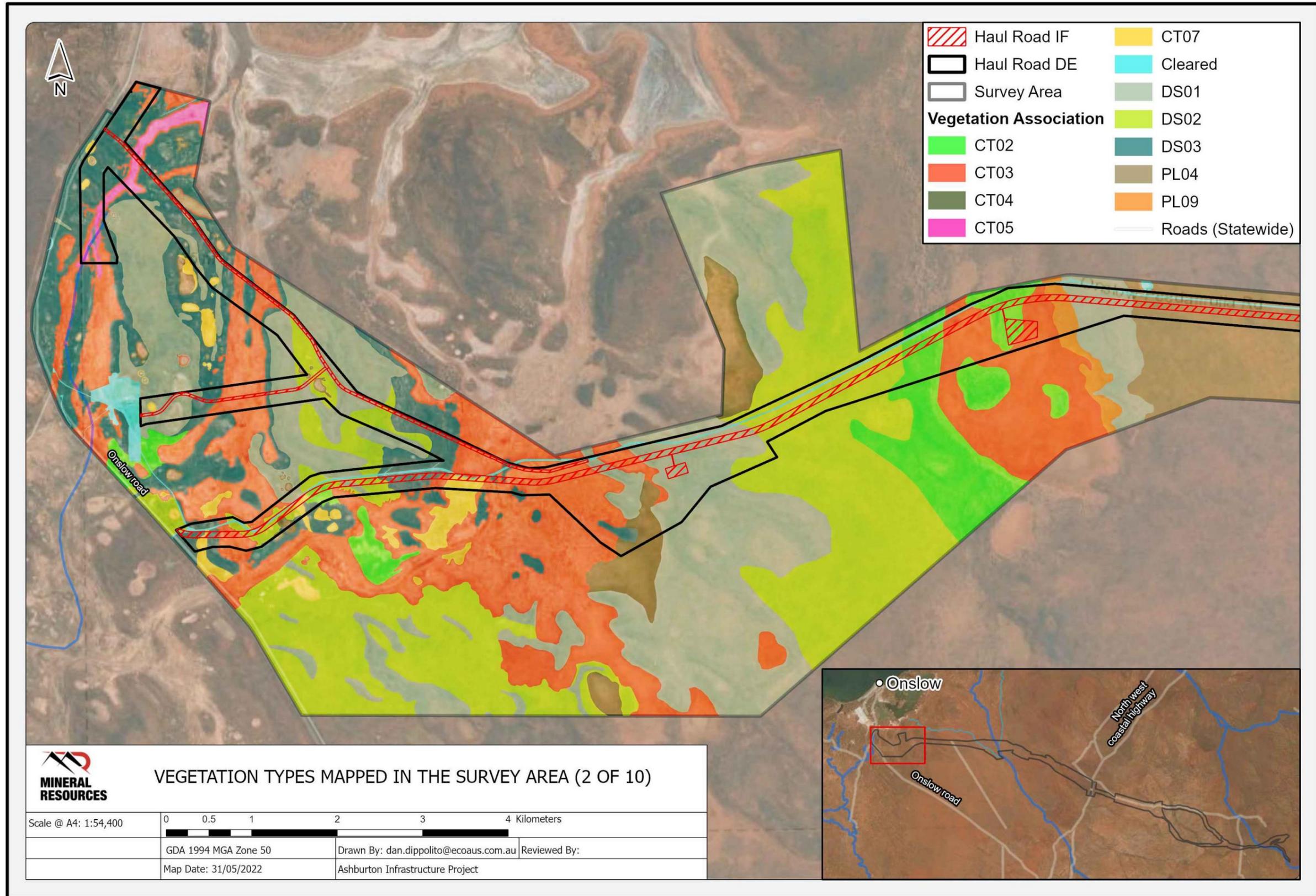


Figure 9-3: Vegetation Types Mapped in the Terrestrial Survey Area (2 of 10)

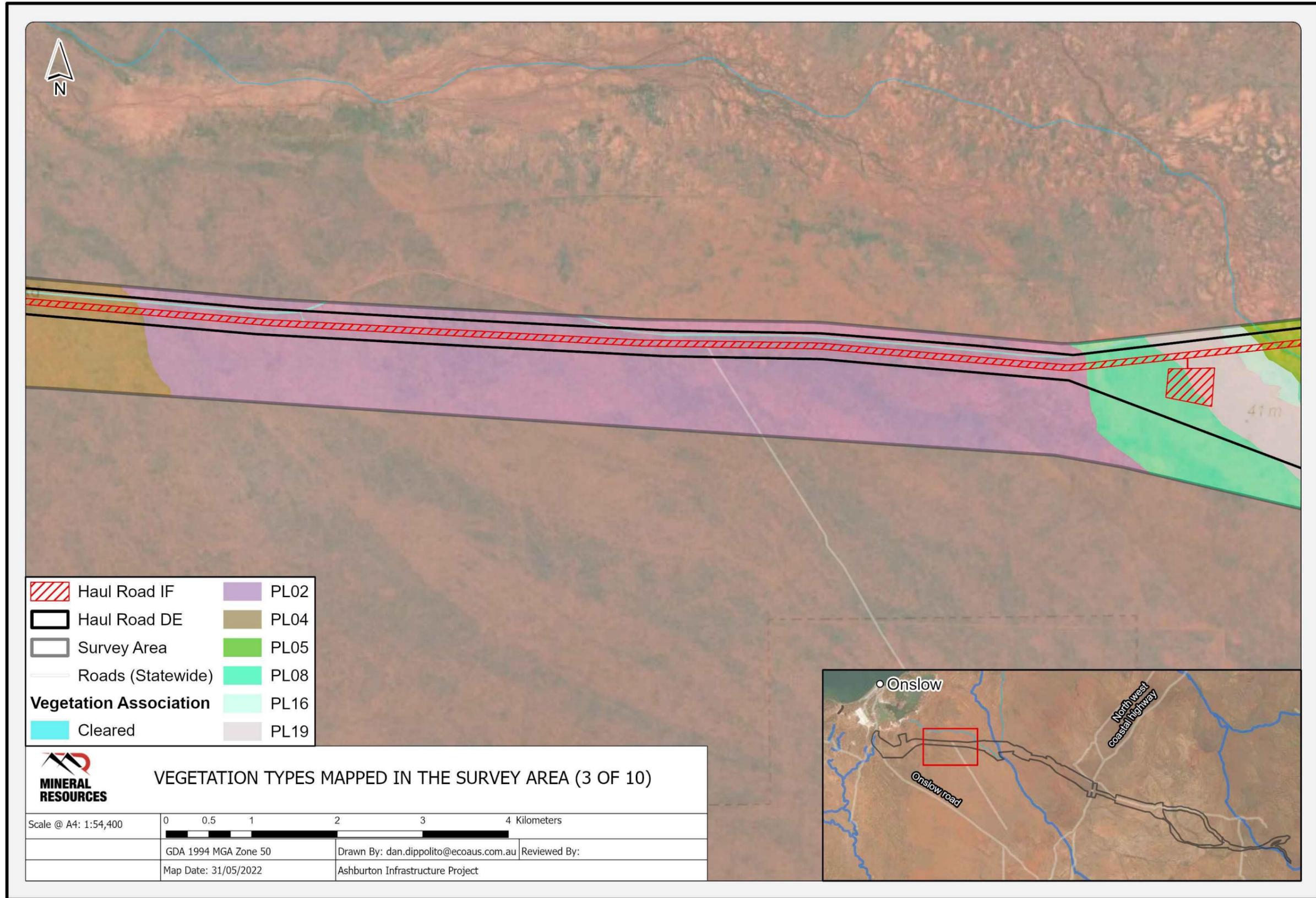


Figure 9-4: Vegetation Types Mapped in the Terrestrial Survey Area (3 of 10)

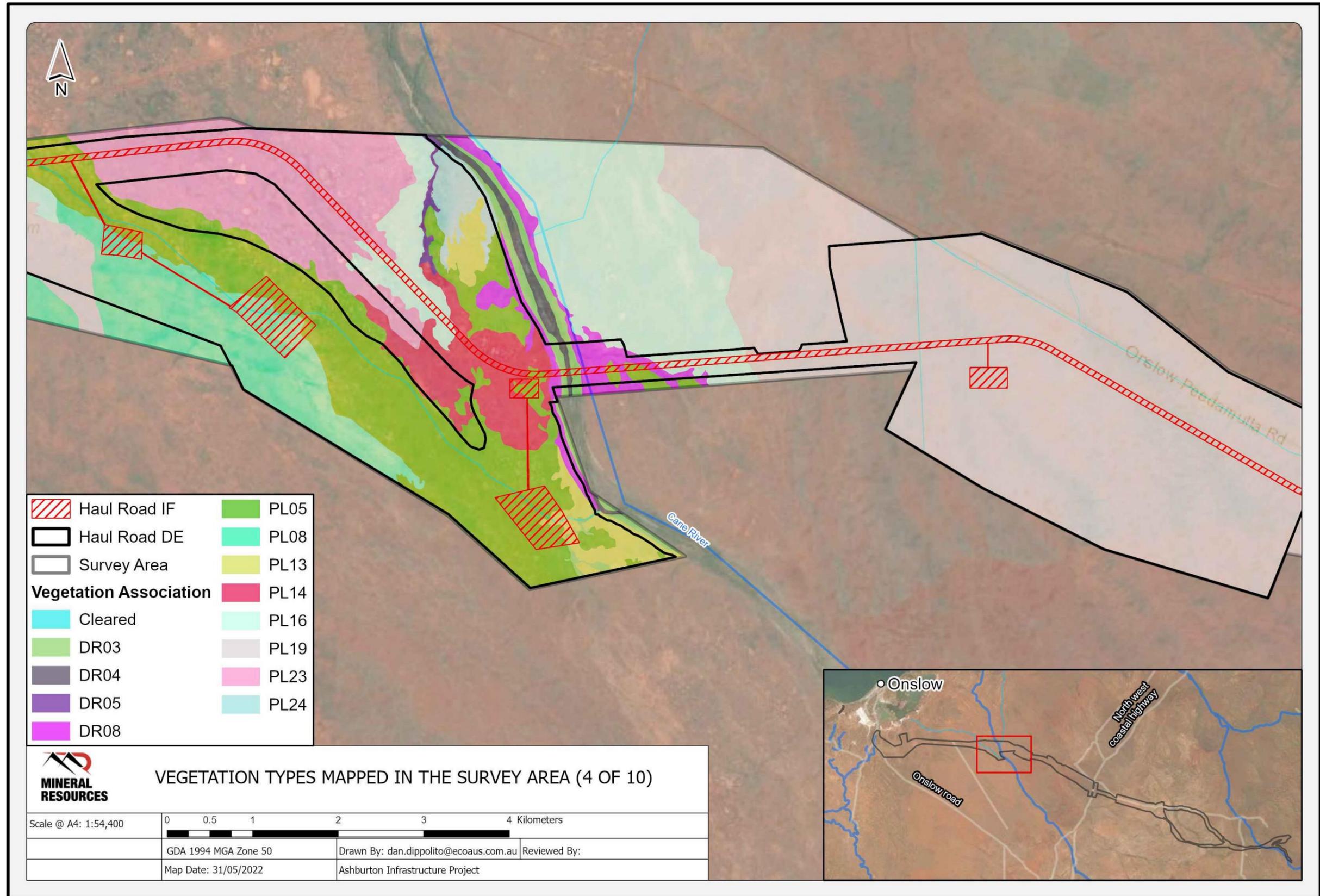


Figure 9-5: Vegetation Types Mapped in the Terrestrial Survey Area (4 of 10)

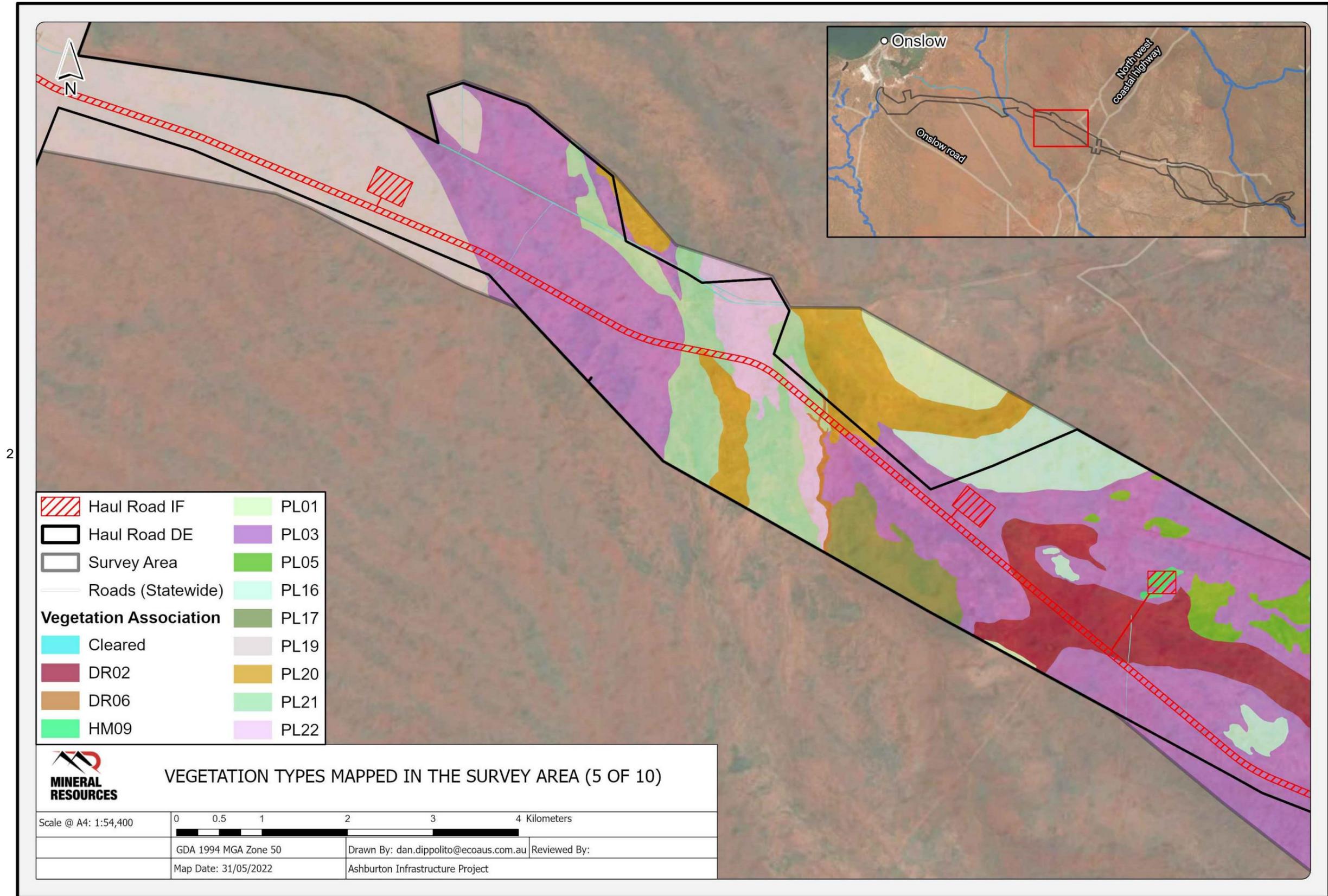


Figure 9-6: Vegetation Types Mapped in the Terrestrial Survey Area (5 of 10)

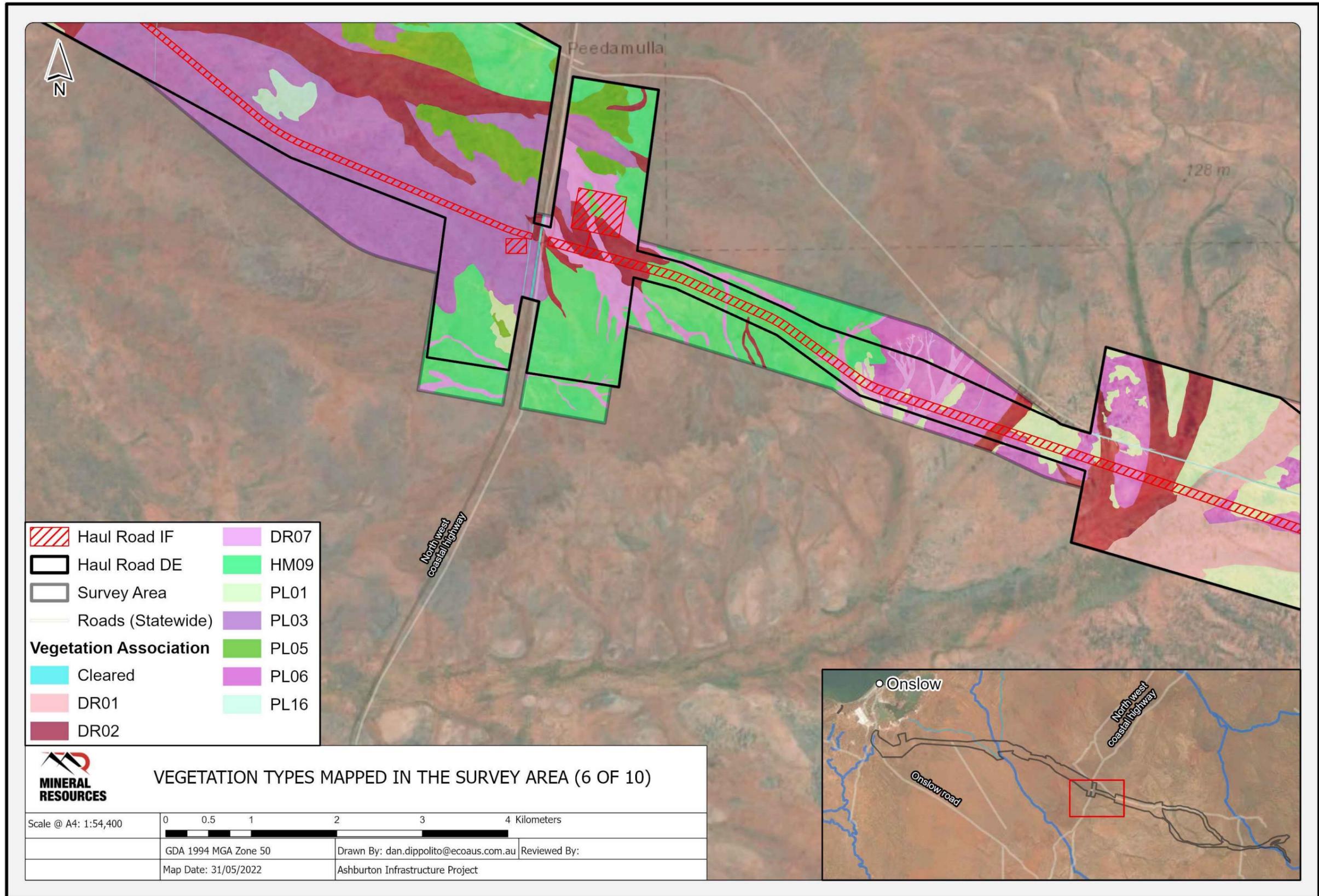


Figure 9-7: Vegetation Types Mapped in the Terrestrial Survey Area (6 of 10)

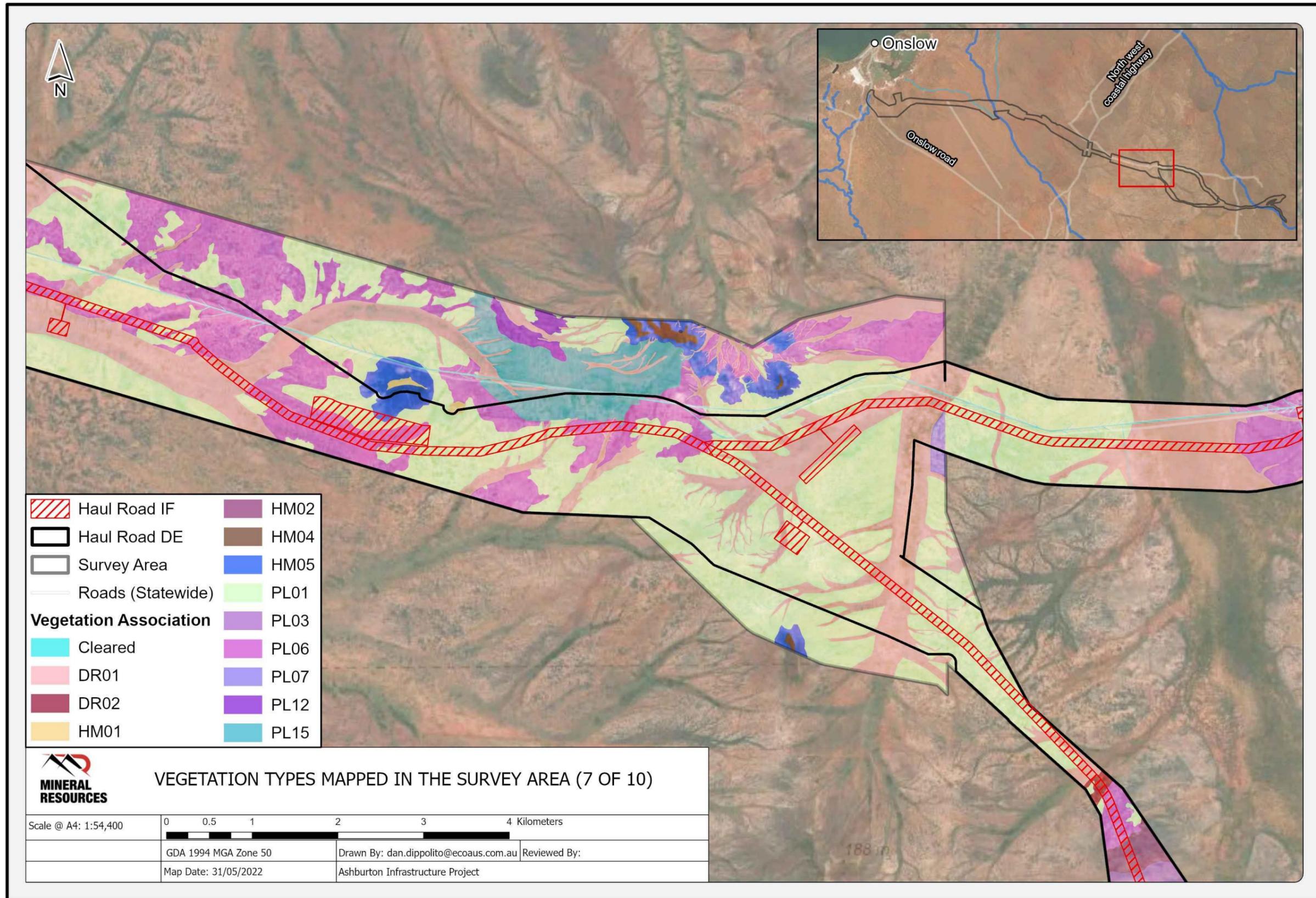


Figure 9-8: Vegetation Types Mapped in the Terrestrial Survey Area (7 of 10)

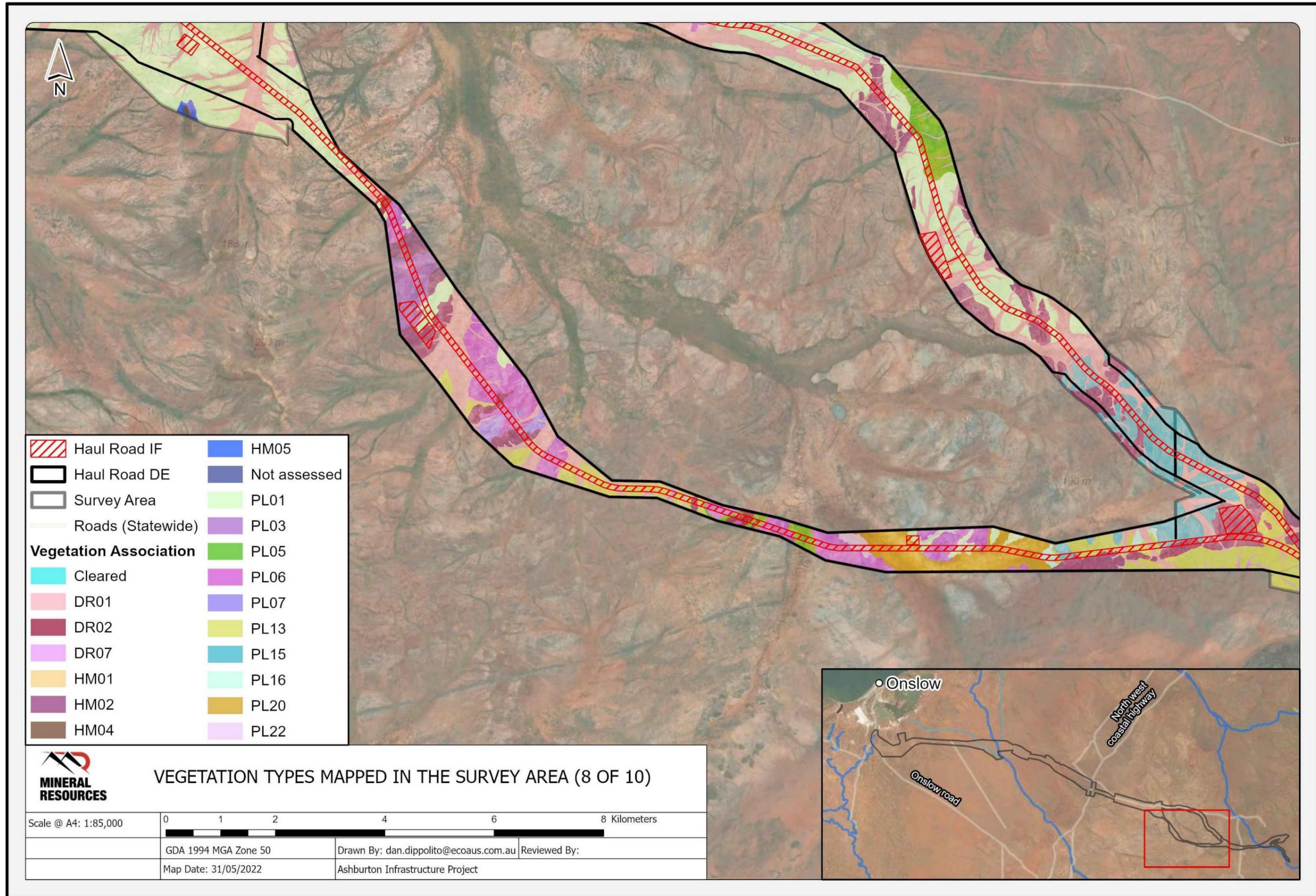


Figure 9-9: Vegetation Types Mapped in the Terrestrial Survey Area (8 of 10)

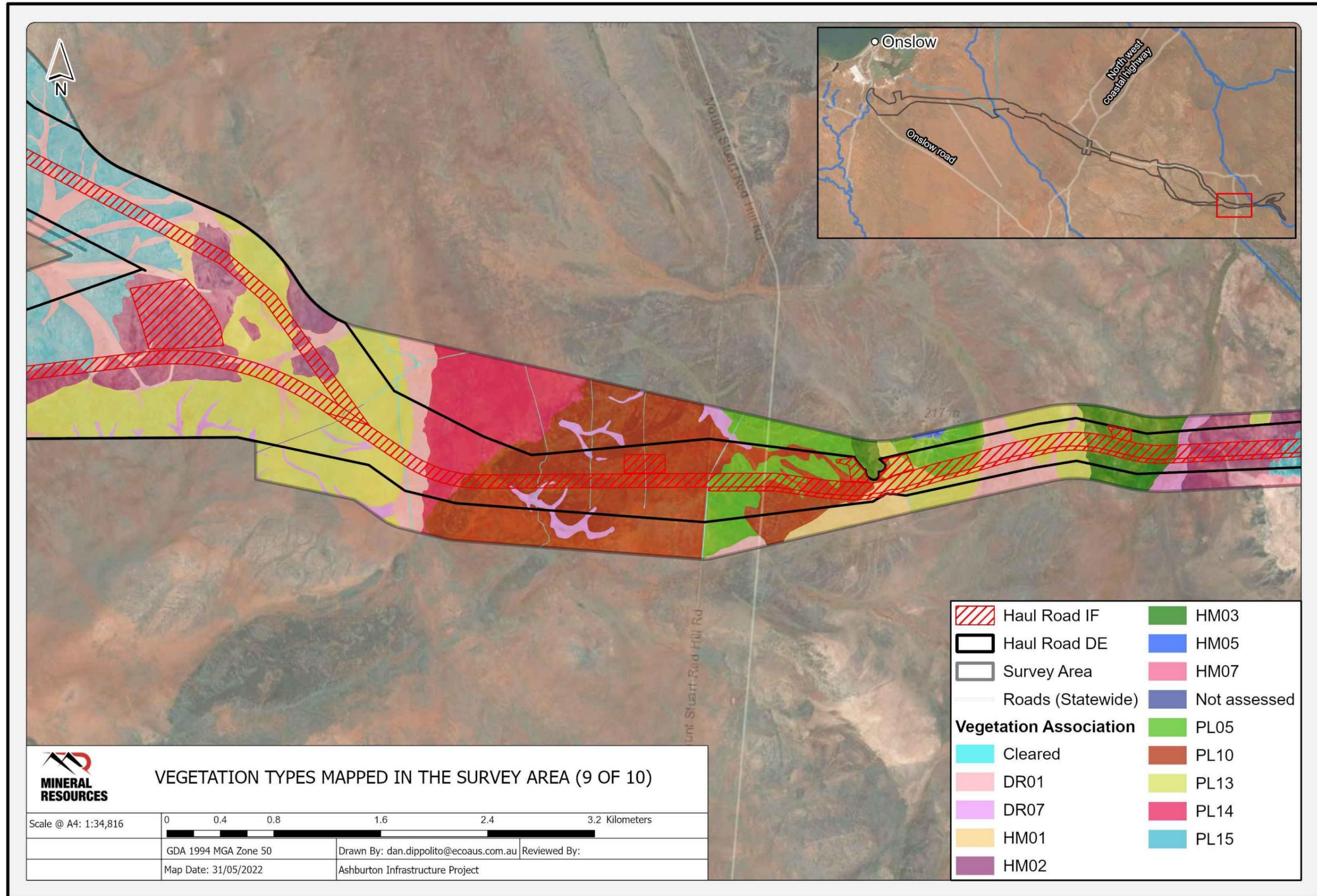


Figure 9-10: Vegetation Types Mapped in the Terrestrial Survey Area (9 of 10)

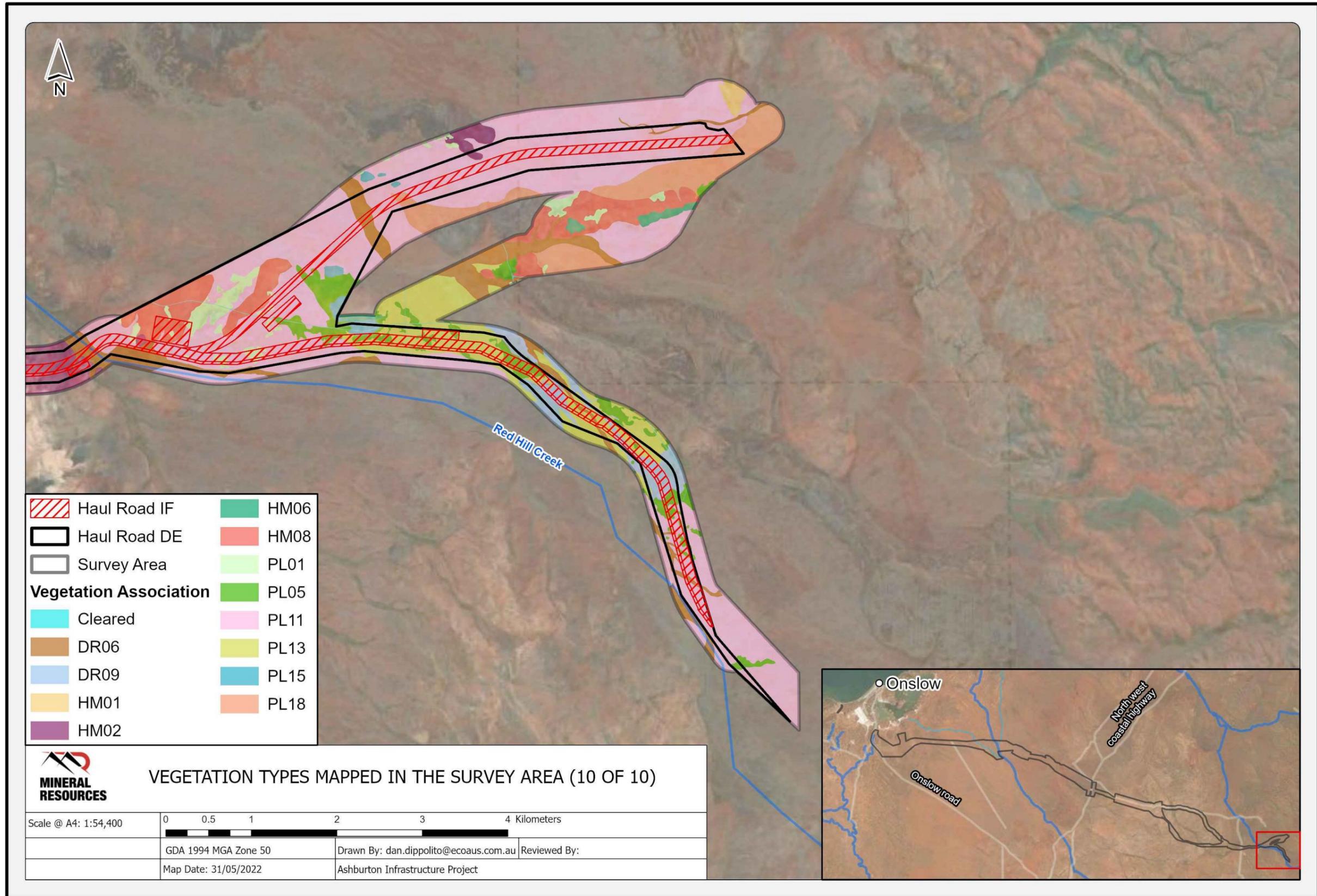


Figure 9-11: Vegetation Types Mapped in the Terrestrial Survey Area (10 of 10)

9.3.2.4 Vegetation Condition

The majority of vegetation (approximately 97%) in the Haul Road DE is considered to be in Very Good and Good condition based on the Keighery (1994) vegetation scale provided in the EPA *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016f) (Table 9-6, Figure 9-12 to Figure 9-21)

Table 9-6: Vegetation Condition across the Haul Road DE

Vegetation Conditions	Extent in Haul Road DE (ha)	% of Haul Road DE
Excellent	20.3	0.1
Very Good	11,165.6	68.9
Good	4572.3	28.2
Poor	330.4	2.0
Cleared	118.1	0.7
Not Assessed	2.4	0.0
Total	16,209*	100.0

*Discrepancies in total extent in Haul Road DE due to rounding

For the purposes of impact assessment present in the **Section 9.6** the 2.4 ha area labelled as 'Not Assessed' above, have been assumed to be in Very Good condition based on a conservative assessment of the condition's ratings assigned in the remainder of the Haul Road DE.

9.3.2.5 Vegetation Significance

None of the vegetation communities delineated within the Haul Road DE represent any current or potential conservation significant ecological communities under the EPBC Act, the BC Act or by the DBCA. Areas of riparian vegetation have a higher species richness than other vegetation; however, these vegetation types are considered well represented in the local area.

One Priority Ecological Community (PEC), the Tanpool Land System PEC, currently listed as Priority 1 (P1) by DBCA (DBCA 2021) is a raised landform that occurs approximately 640 m north of the Haul Road DE (see **Figure 9-26**). This PEC is represented by the PL01 vegetation type, described as *Acacia xiphophylla* tall open shrubland over *Triodia wiseana* and / or *Triodia longiceps* (*Triodia epactia*) low open hummock grassland (360 Environmental 2021a). As this PEC, and associated vegetation type, occurs outside of the Haul Road DE, it is not considered further in this assessment.

Vegetation types PL03, PL16 and PL20 all occur within the PEC's 500 m buffer as mapped by DBCA. However, the structure and composition of these vegetation types is not considered to be analogous to the PEC, as they do not occur within the Tanpool Land System, and hence are not considered further.

31 of the vegetation types in the Haul Road DE have been considered as potential vegetation types of local significance as they support Priority flora species or potential range extensions (360 Environmental 2022b). However, it is noted that due to the linear nature of the proposed haul road, and based on field observations and aerial imagery, these vegetation types are well represented in areas surrounding the Haul Road DE. Vegetation of significance are shown in **Figure 9-22** to **Figure 9-31**.

9.3.2.6 Potential Water Dependent Vegetation

Vegetation types associated with surface water (sheet flow) and groundwater can be locally restricted in the landscape and are therefore described below as potentially significant vegetation.

Two vegetation units (PL20 and PL22) described in the Haul Road DE may represent potential sheet flow dependent vegetation types due to their presence within existing drainage landforms such as the Cane River, as well as the dominant presence of Mulga species such as *Acacia aptaneura* (360 Environmental 2021a). However, these do not overlap areas mapped as potential sheetflow in the Ashburton Haul Road Surface Water Flow Assessment (Water Technology 2020).

In addition, eight vegetation types within the Haul Road DE may represent groundwater dependent vegetation (GDV), due to the presence of *Eucalyptus camaldulensis* and *Eucalyptus victrix*, which are facultative phreatophytes (meaning they are deeply rooted and tap into groundwater opportunistically), and the presence of *Melaleuca argentea*, which is an obligative phreatophyte (meaning species which are dependent on groundwater availability (360 Environmental 2020)). In particular, drainage vegetation types (DR03, DR04, DR06, DR07 and DR08) contain riparian trees and shrubs that are typical of the region including *Eucalyptus victrix*, *Eucalyptus camaldulensis*, *Acacia colei* and *Gossypium robinsonii*, as well as *Melaleuca argentea* and *Melaleuca glomerata* which were recorded in DR03 and DR04 vegetation communities (intersecting and associated with Cane River).

These vegetation types are displayed in **Table 9-7** and shown in **Figure 9-22** to **Figure 9-31**.

Table 9-7: Potential Groundwater Dependent Vegetation in the Haul Road DE

Vegetation Type	Indicator Species	Extent in Haul Road DE (ha)
DR03	<i>Eucalyptus camaldulensis</i> , <i>Eucalyptus victrix</i> and <i>Melaleuca argentea</i>	16.1
DR04	<i>Eucalyptus camaldulensis</i> , <i>Eucalyptus victrix</i> and <i>Melaleuca argentea</i>	3.3
DR06	<i>Eucalyptus camaldulensis</i> and <i>Eucalyptus victrix</i>	50.1
DR07	<i>Eucalyptus victrix</i>	168.5
DR08	<i>Eucalyptus victrix</i>	59.9
PL03	<i>Eucalyptus victrix</i>	1698.7
PL20	<i>Eucalyptus victrix</i>	68.7
PL21	<i>Eucalyptus victrix</i>	266.4



Figure 9-12: Vegetation Condition within the Terrestrial Survey Area (1 of 10)

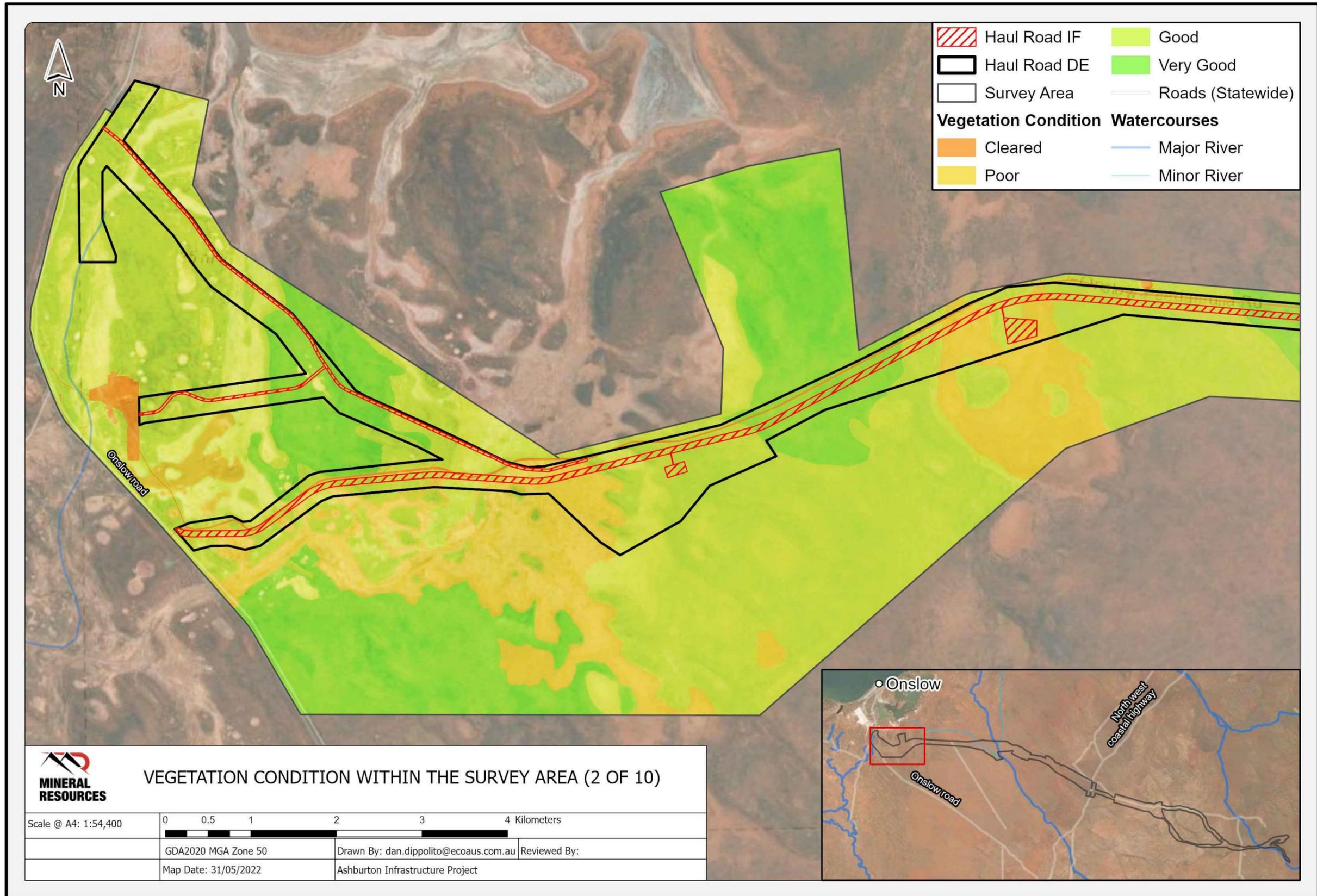


Figure 9-13: Vegetation Condition within the Terrestrial Survey Area (2 of 10)

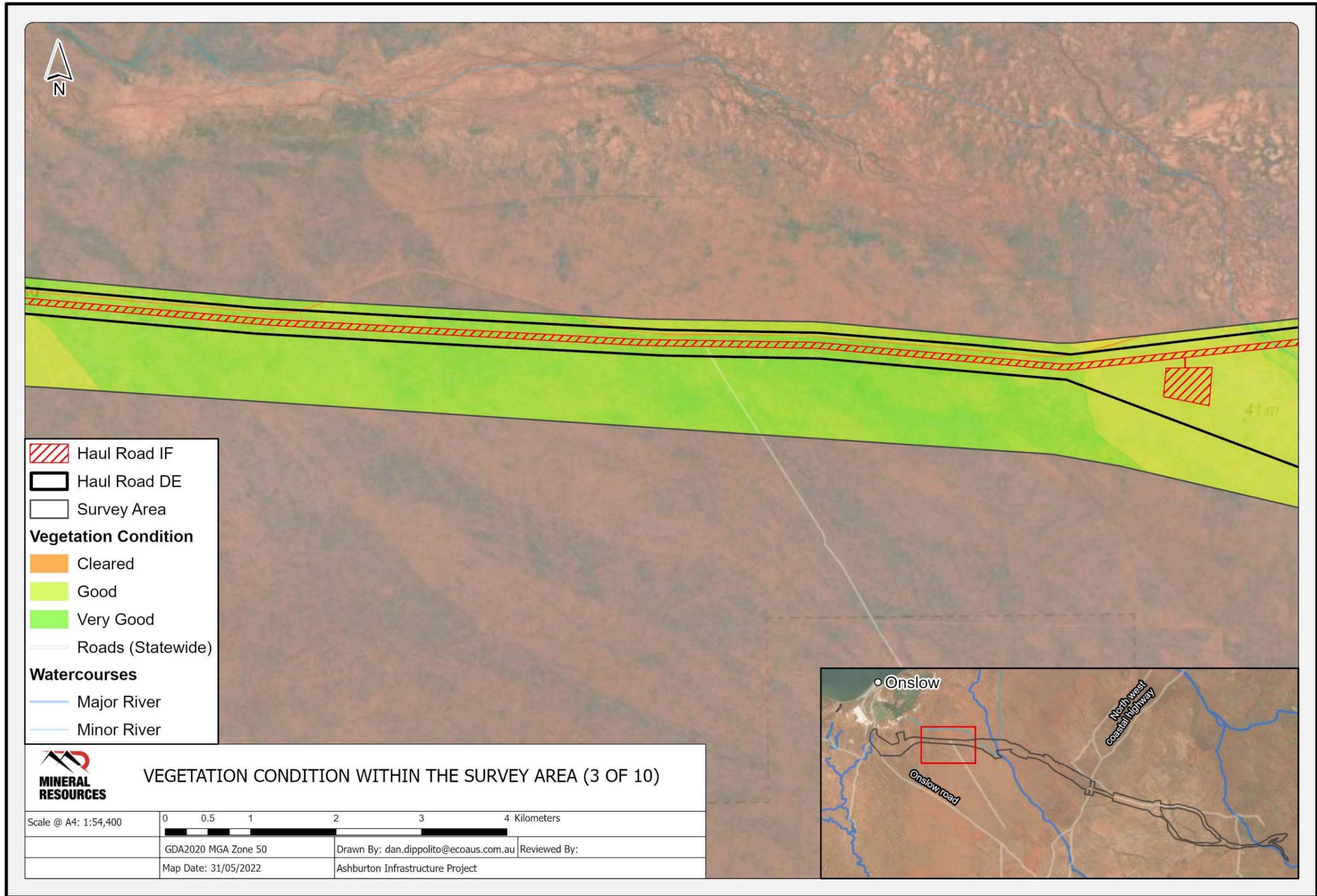


Figure 9-14: Vegetation Condition within the Terrestrial Survey Area (3 of 10)

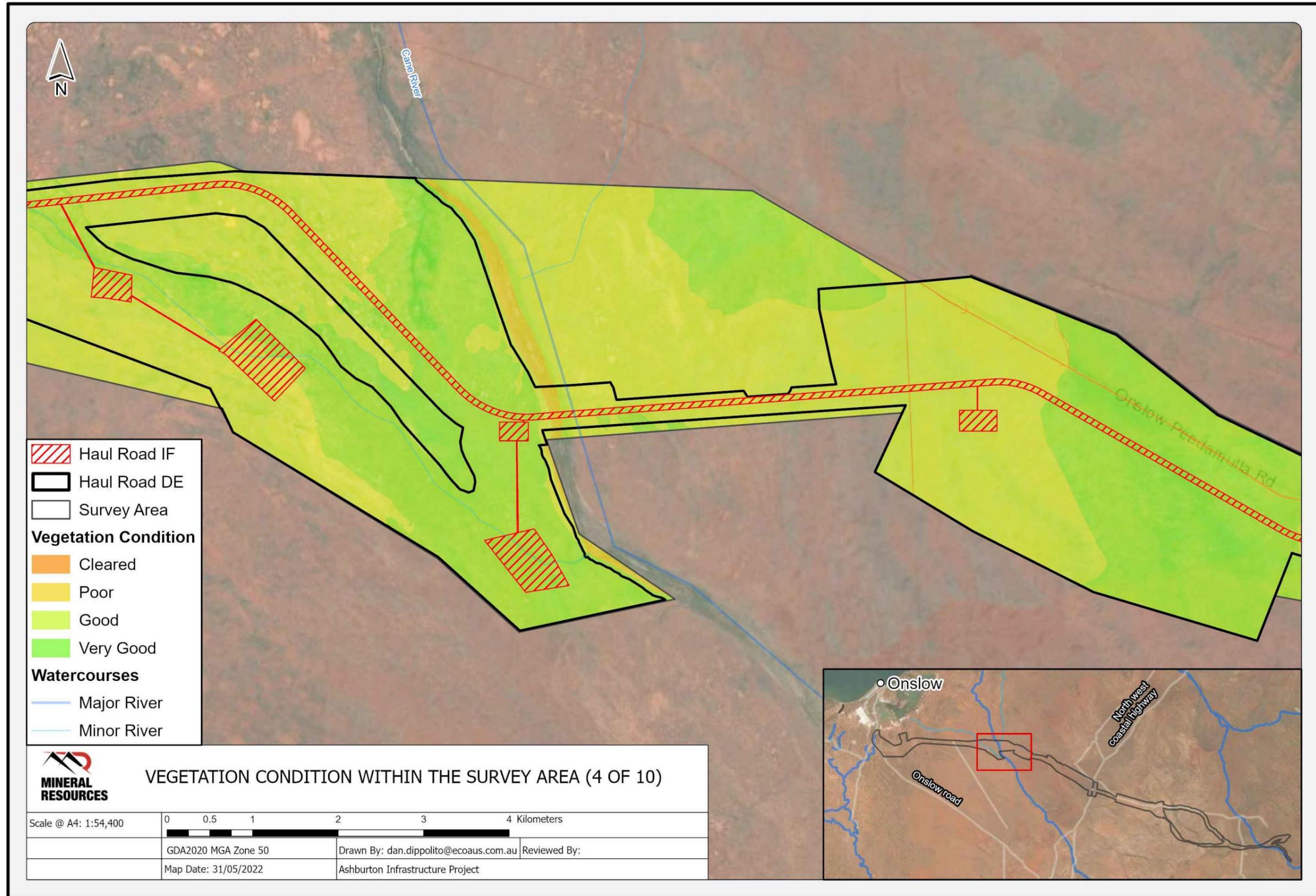


Figure 9-15: Vegetation Condition within the Terrestrial Survey Area (4 of 10)

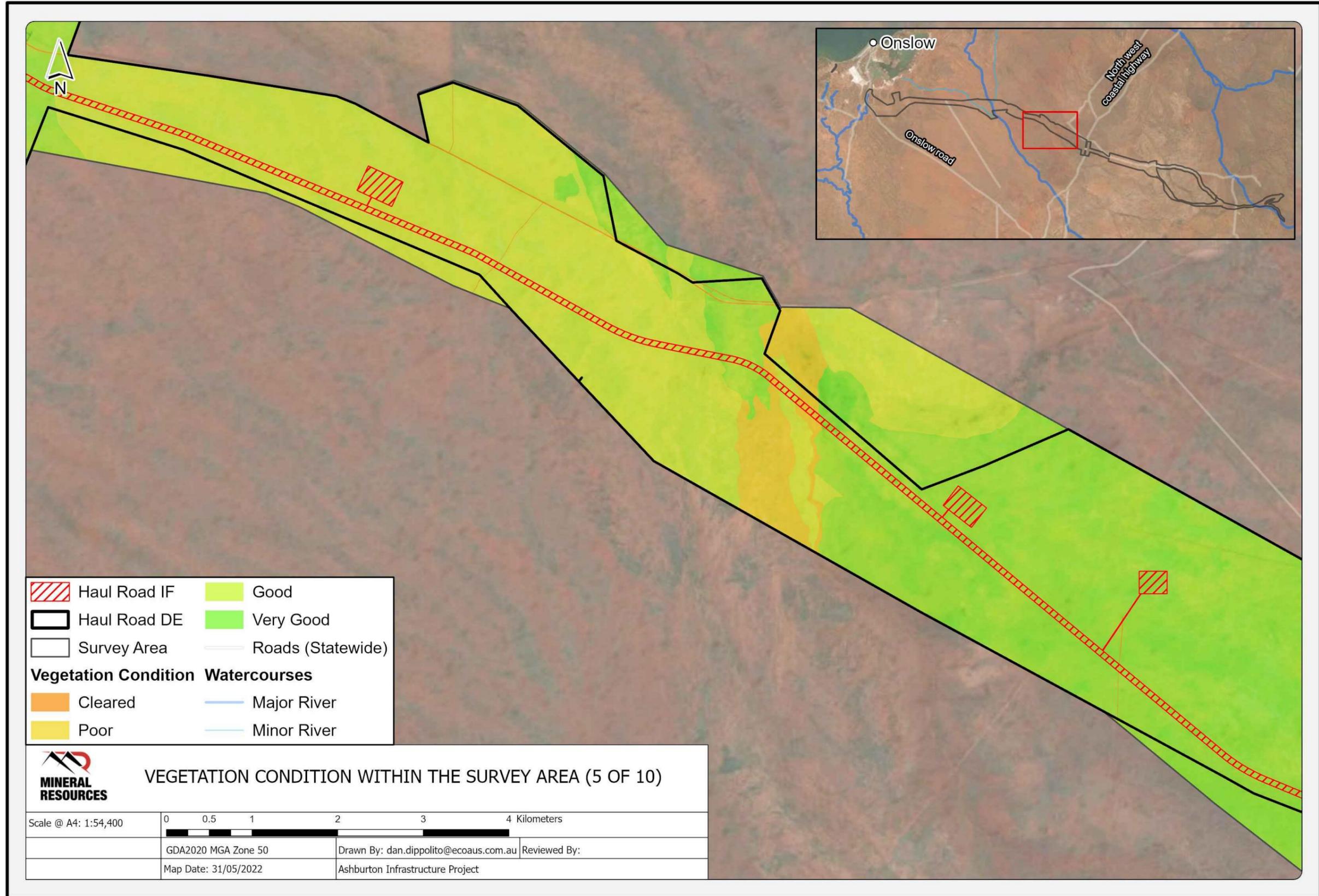


Figure 9-16: Vegetation Condition within the Terrestrial Survey Area (5 of 10)

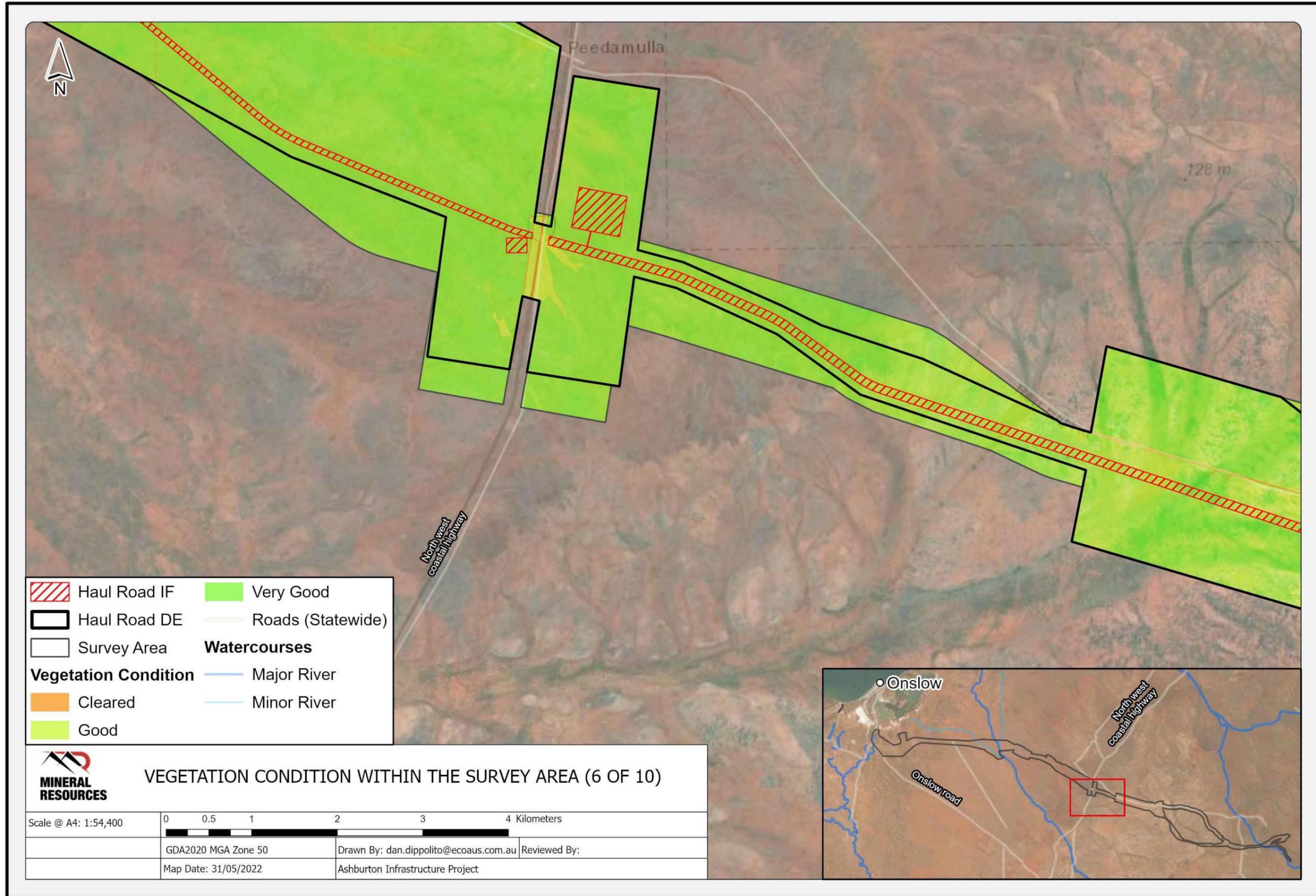


Figure 9-17: Vegetation Condition within the Terrestrial Survey Area (6 of 10)

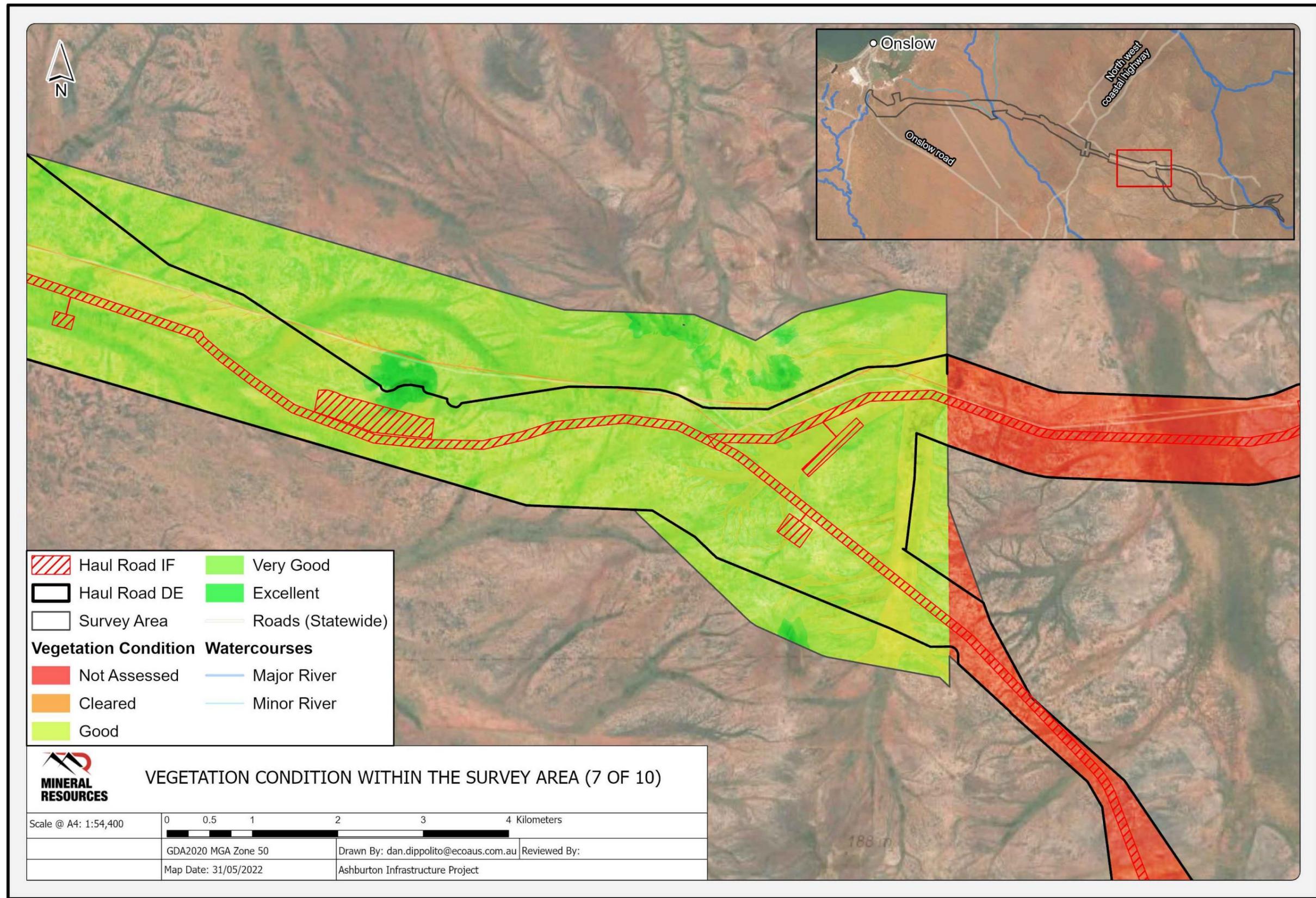


Figure 9-18: Vegetation Condition within the Terrestrial Survey Area (7 of 10)

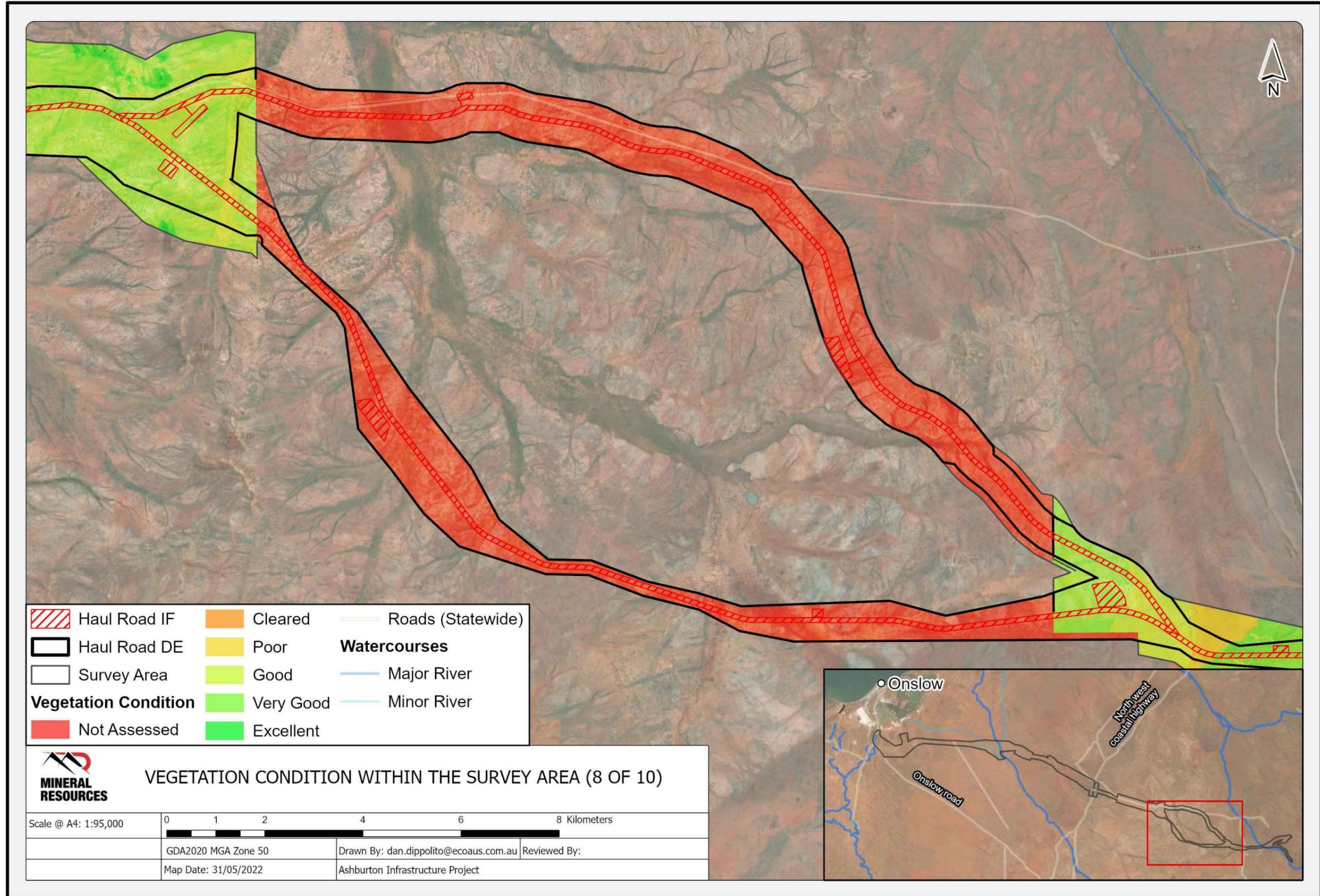


Figure 9-19: Vegetation Condition within the Terrestrial Survey Area (8 of 10)

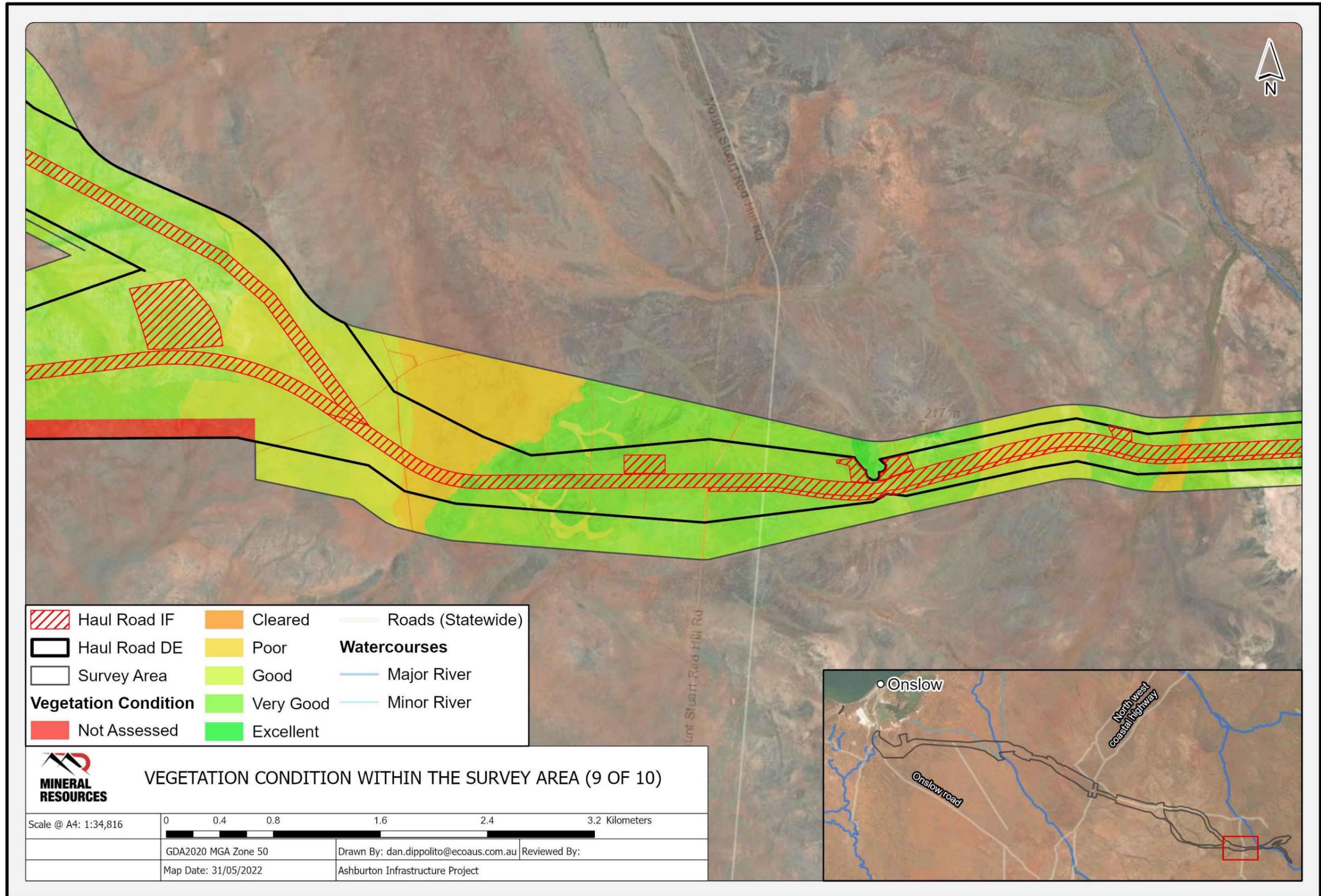


Figure 9-20: Vegetation Condition within the Terrestrial Survey Area (9 of 10)

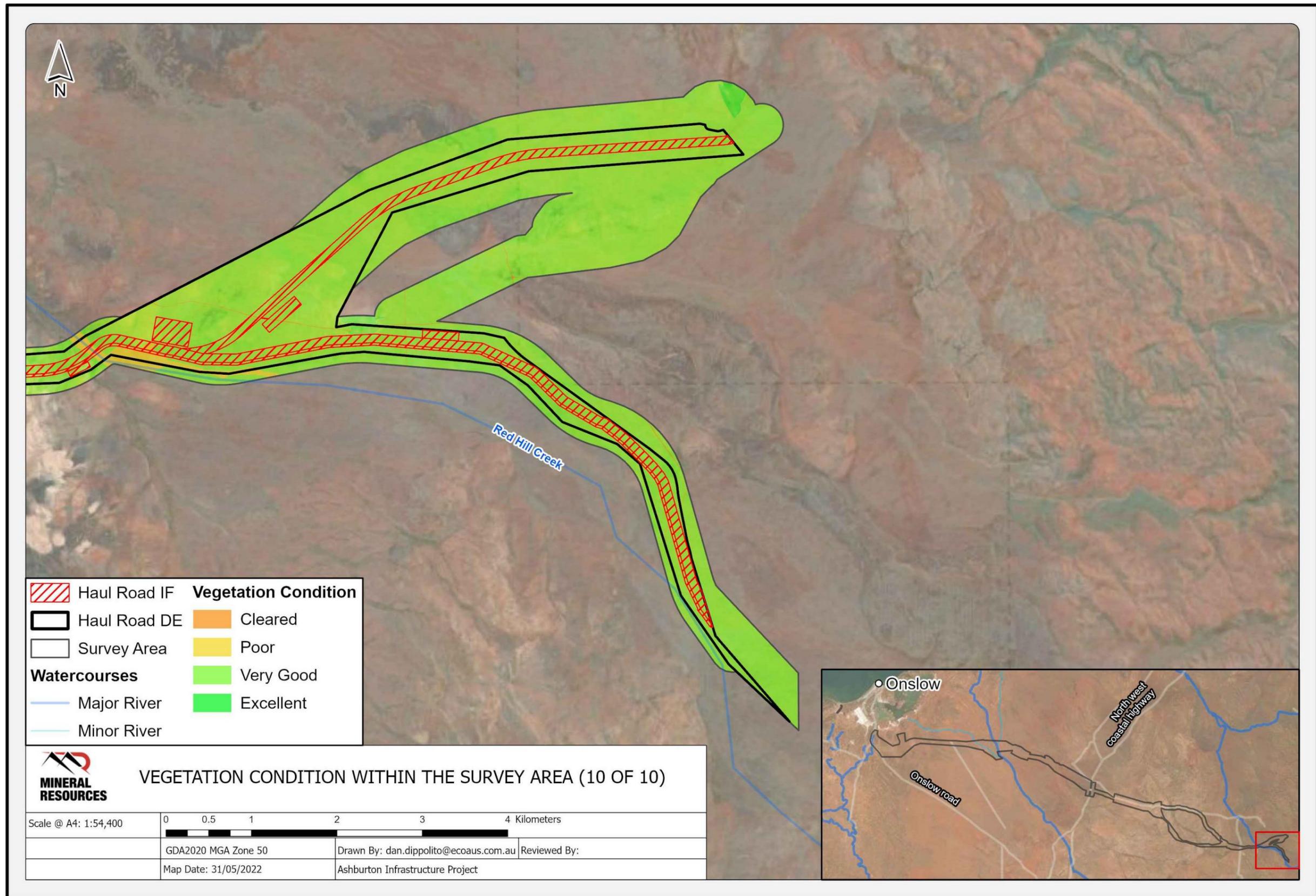


Figure 9-21: Vegetation Condition within the Terrestrial Survey Area (10 of 10)



Figure 9-22: Vegetation of Significance within the Terrestrial Survey Area (1 of 10)

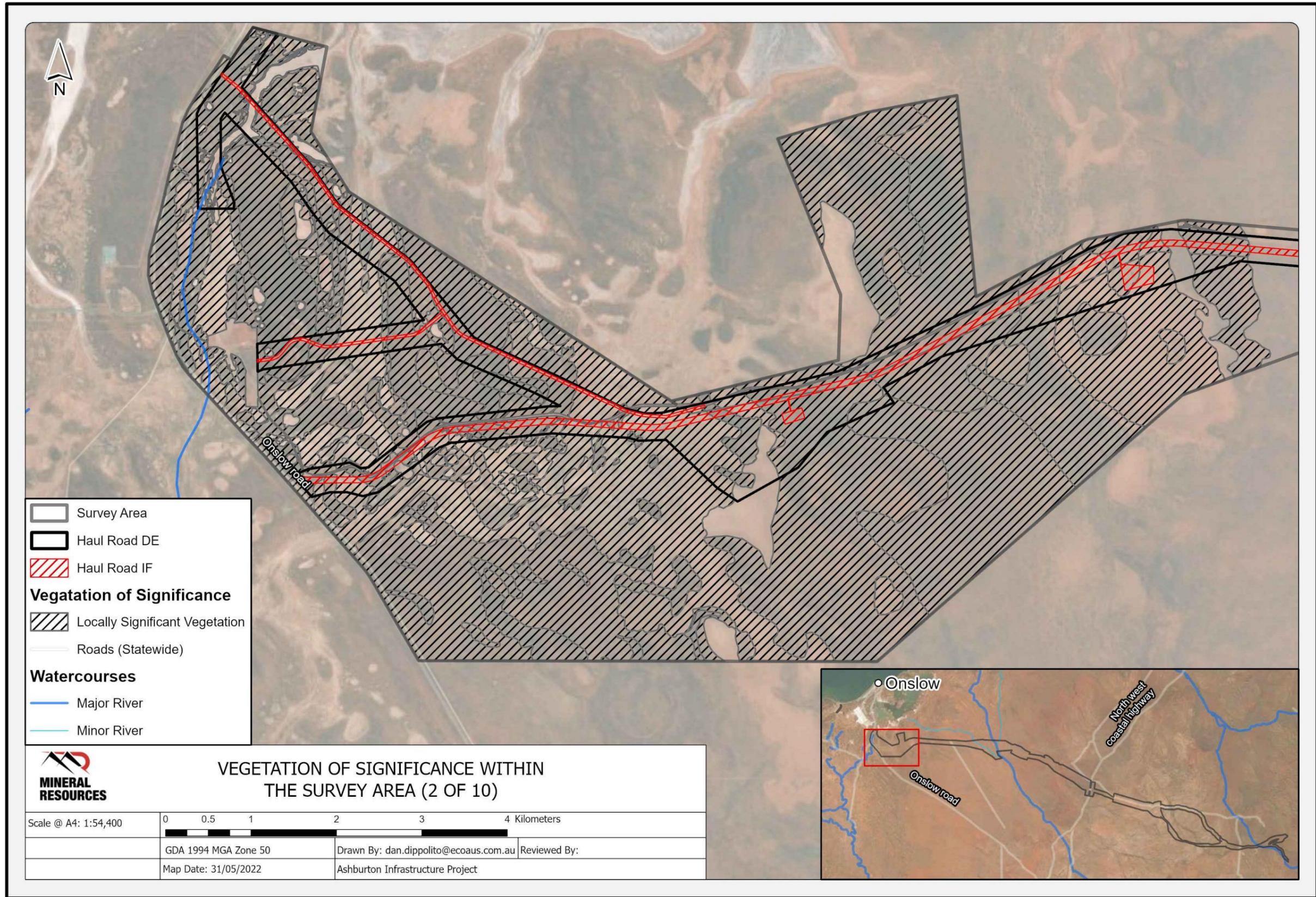


Figure 9-23: Vegetation of Significance within the Terrestrial Survey Area (2 of 10)

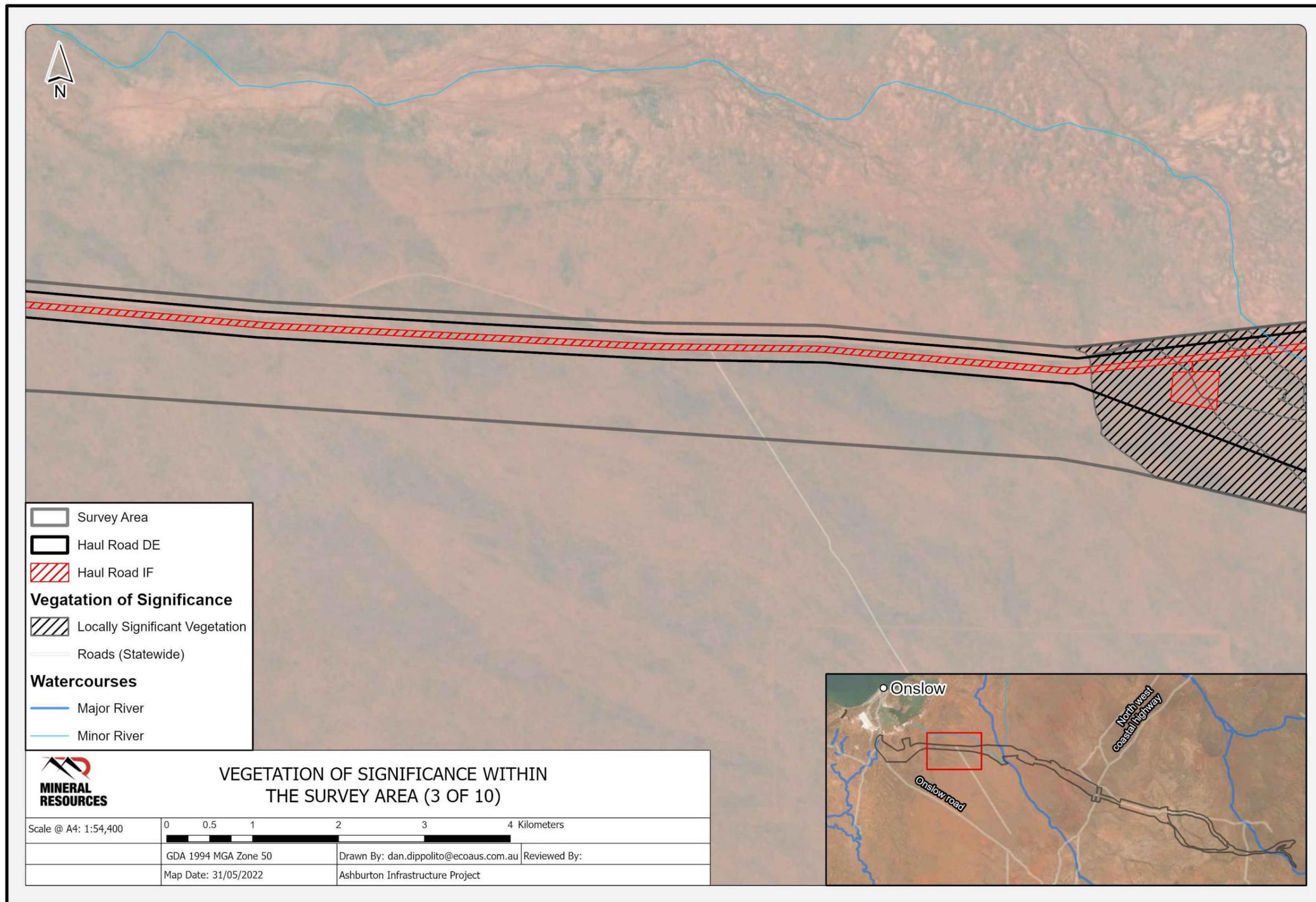


Figure 9-24: Vegetation of Significance within the Terrestrial Survey Area (3 of 10)

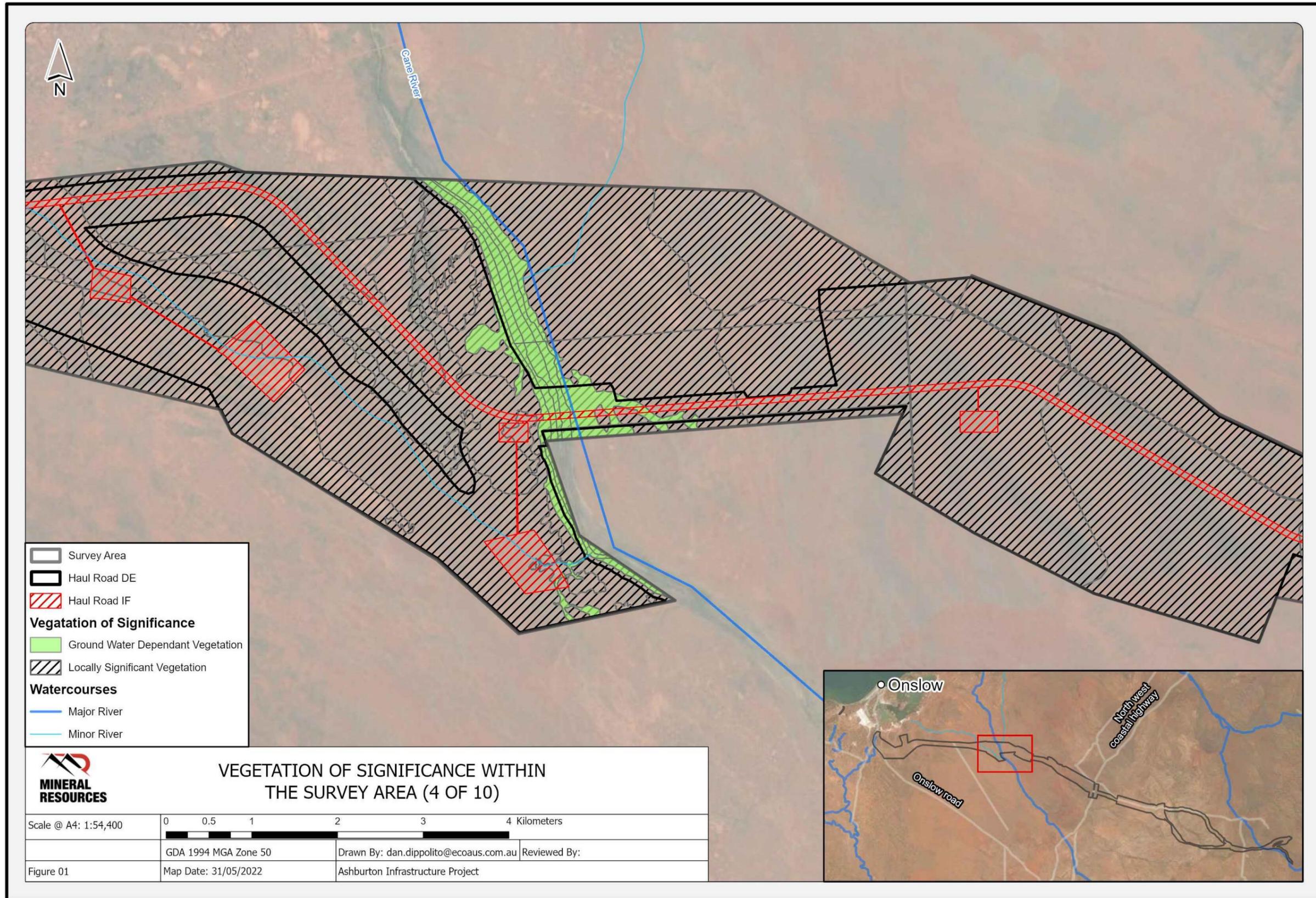


Figure 9-25: Vegetation of Significance within the Terrestrial Survey Area (4 of 10)

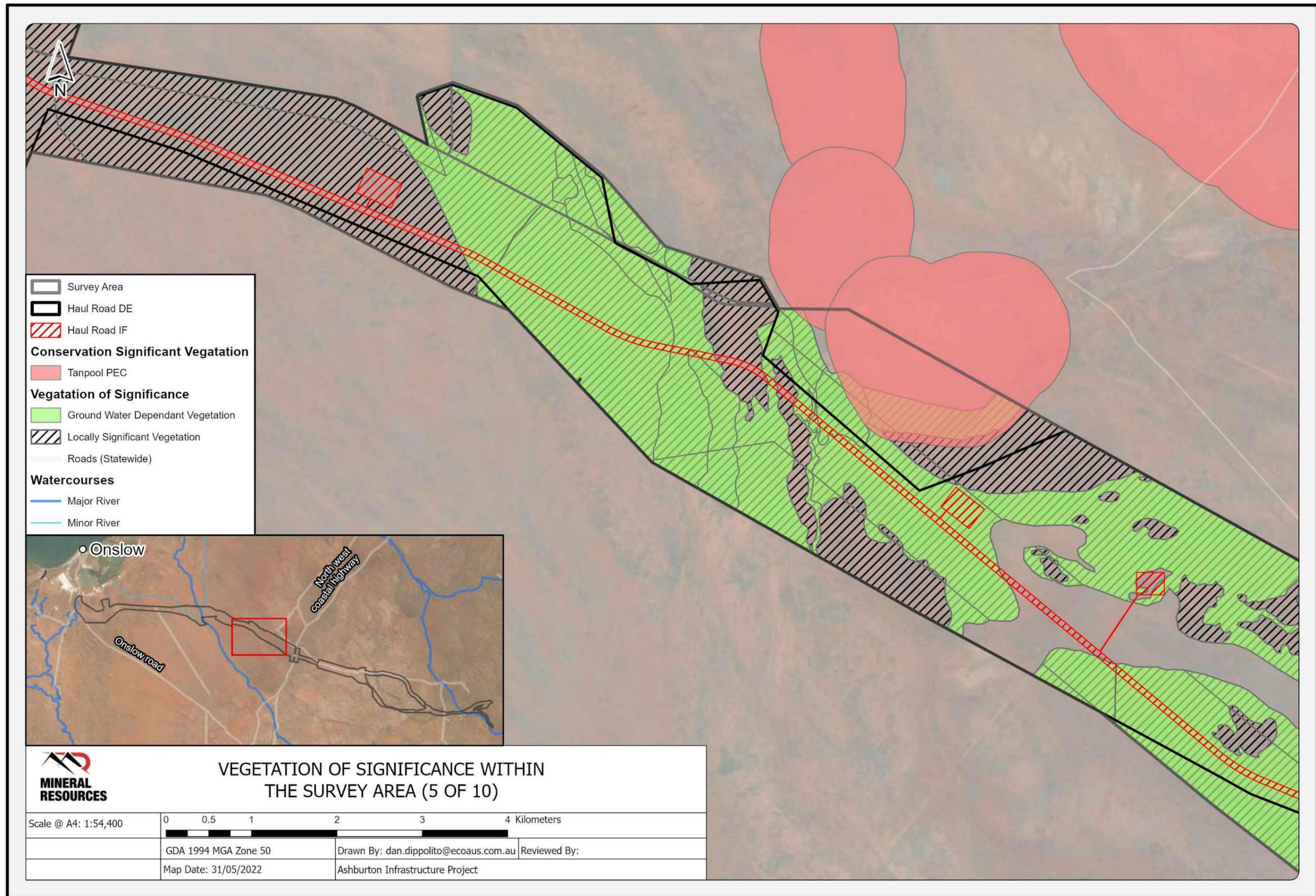


Figure 9-26: Vegetation of Significance within the Terrestrial Survey Area (5 of 10)

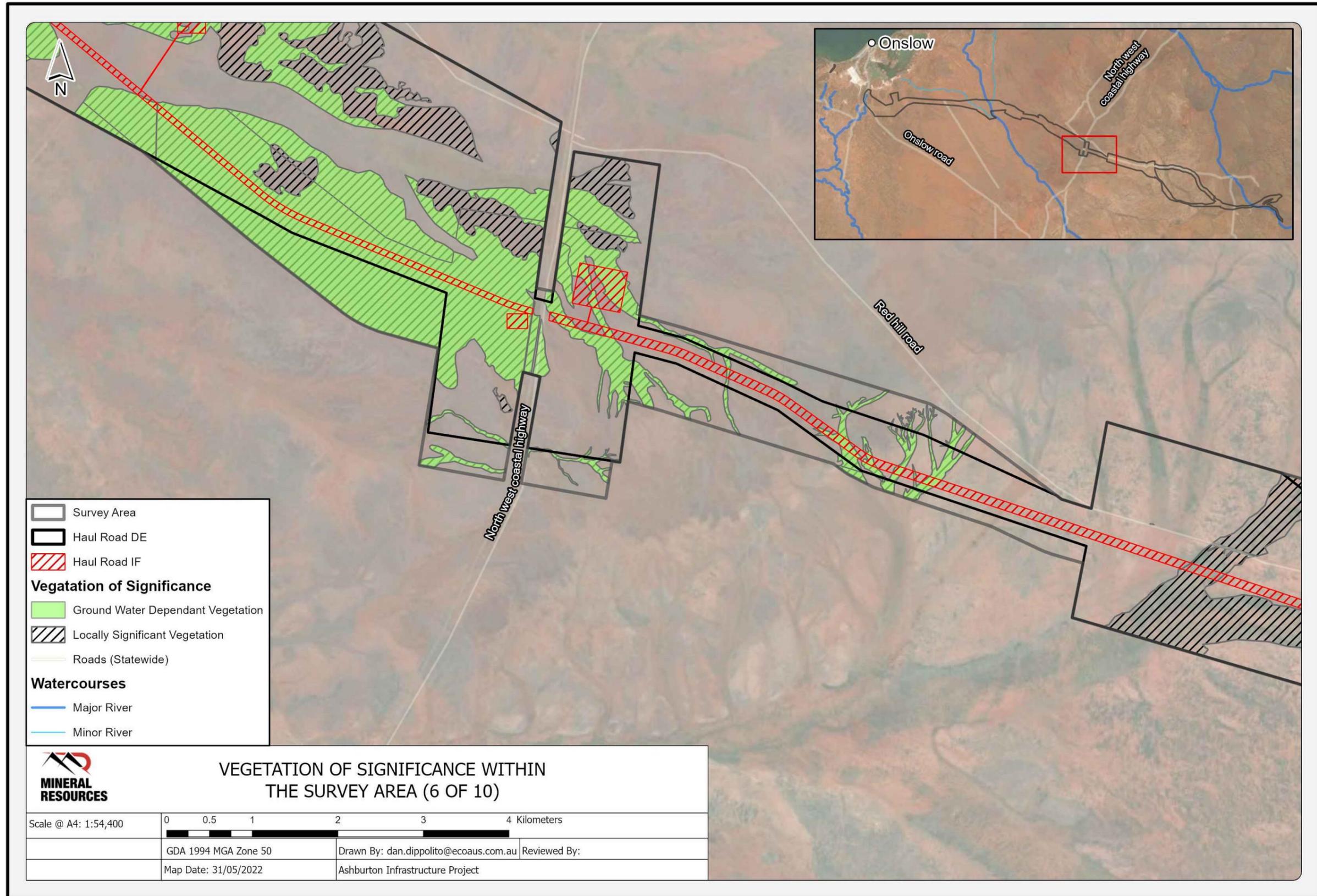


Figure 9-27: Vegetation of Significance within the Terrestrial Survey Area (6 of 10)

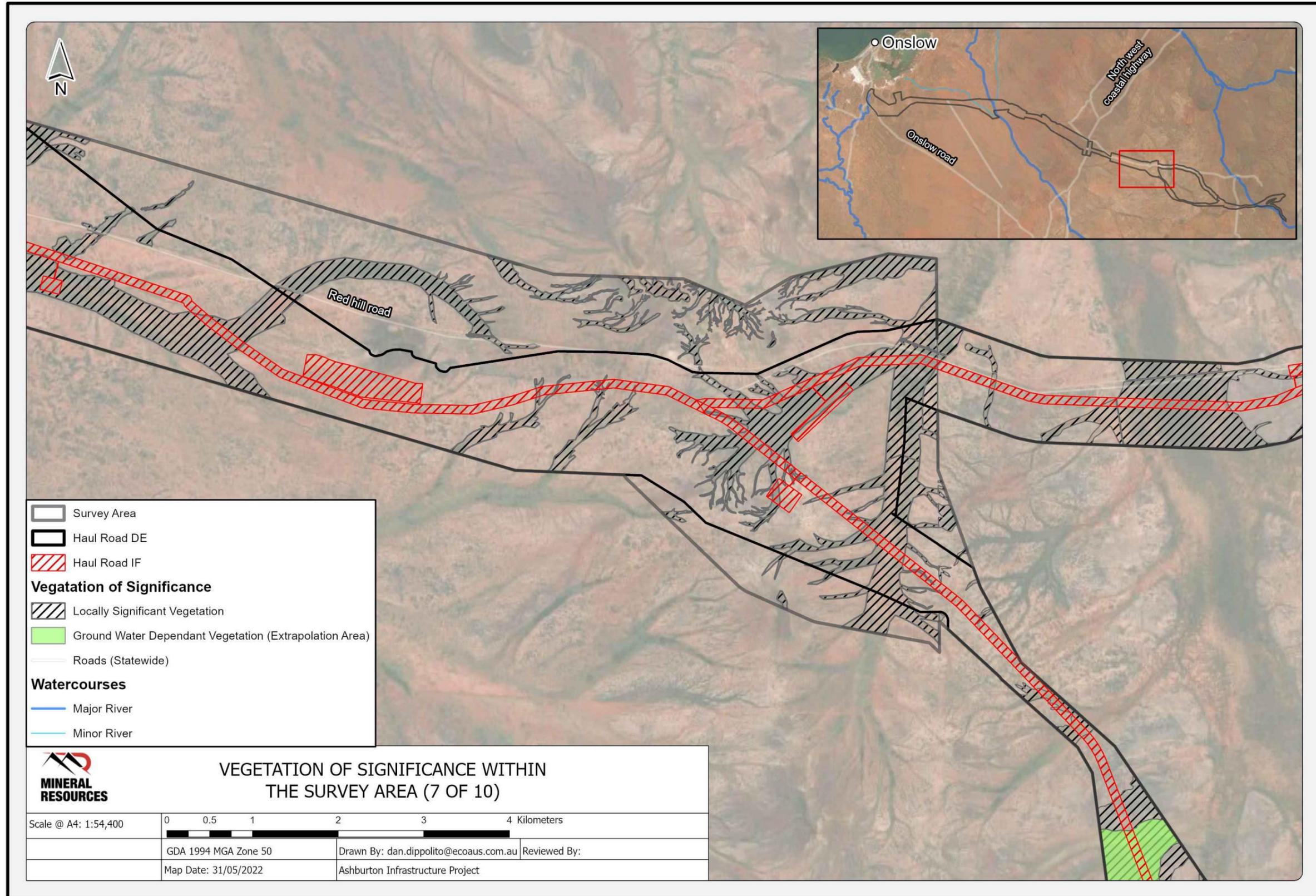


Figure 9-28: Vegetation of Significance within the Terrestrial Survey Area (7 of 10)

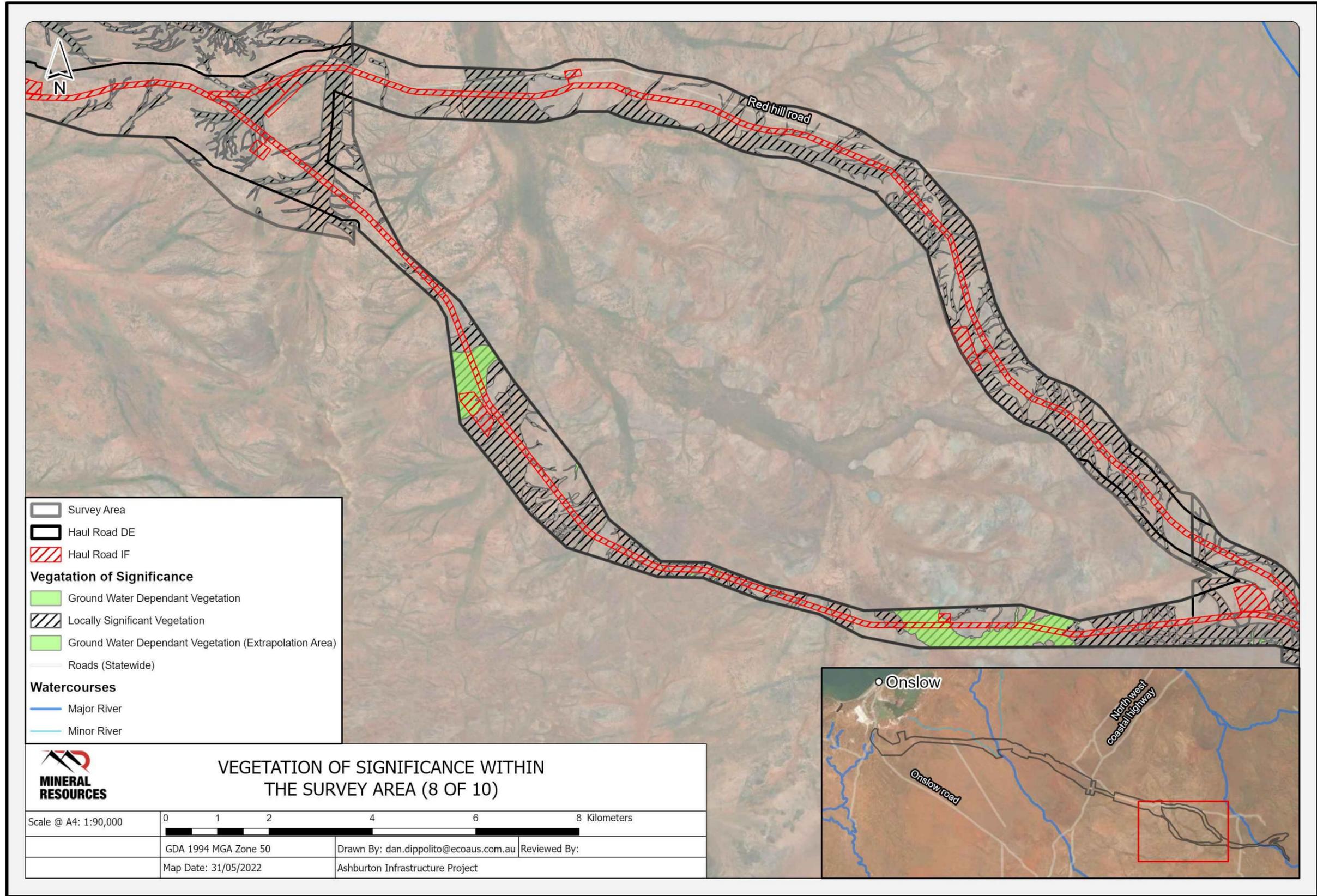


Figure 9-29: Vegetation of Significance within the Terrestrial Survey Area (8 of 10)

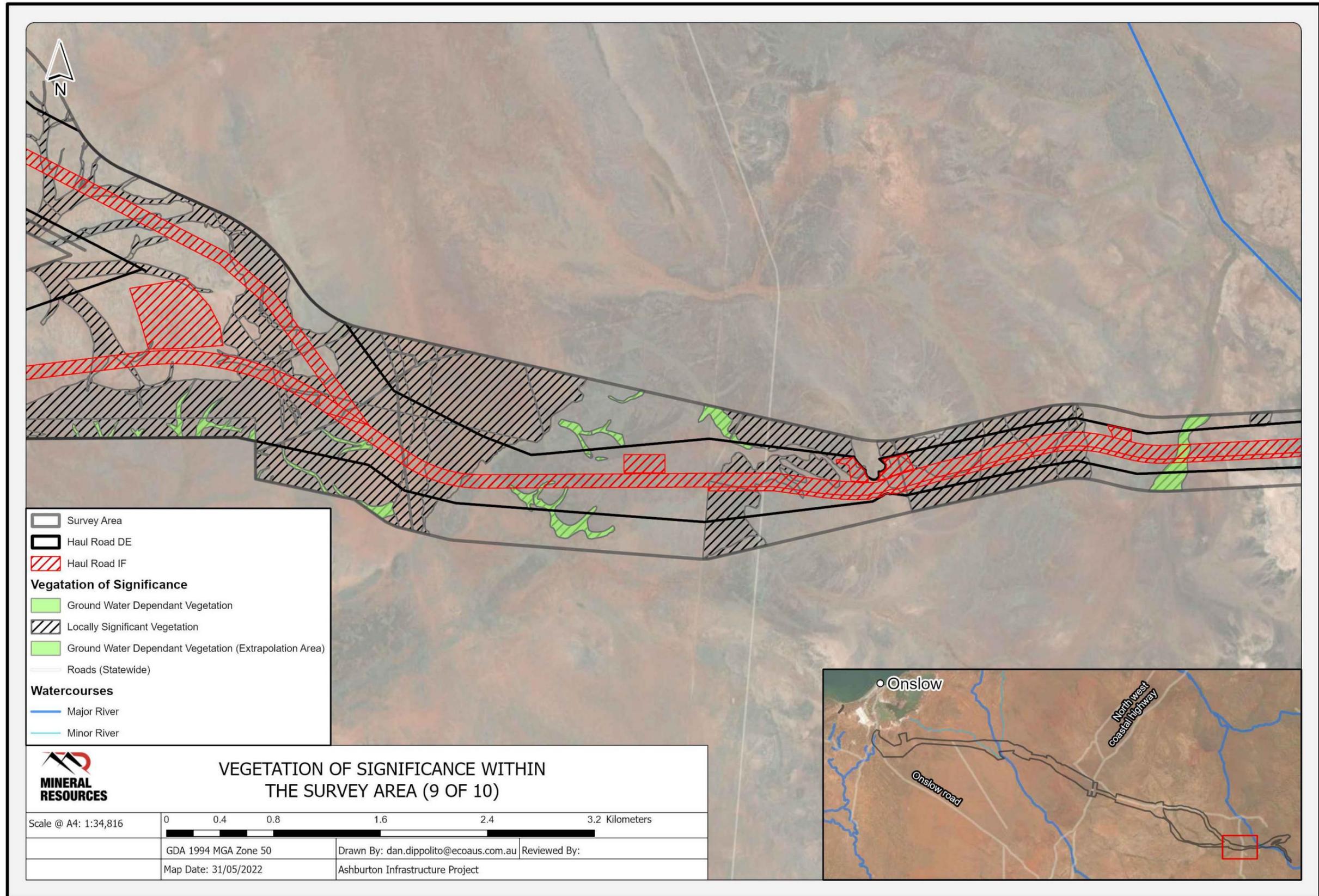


Figure 9-30: Vegetation of Significance within the Terrestrial Survey Area (9 of 10)

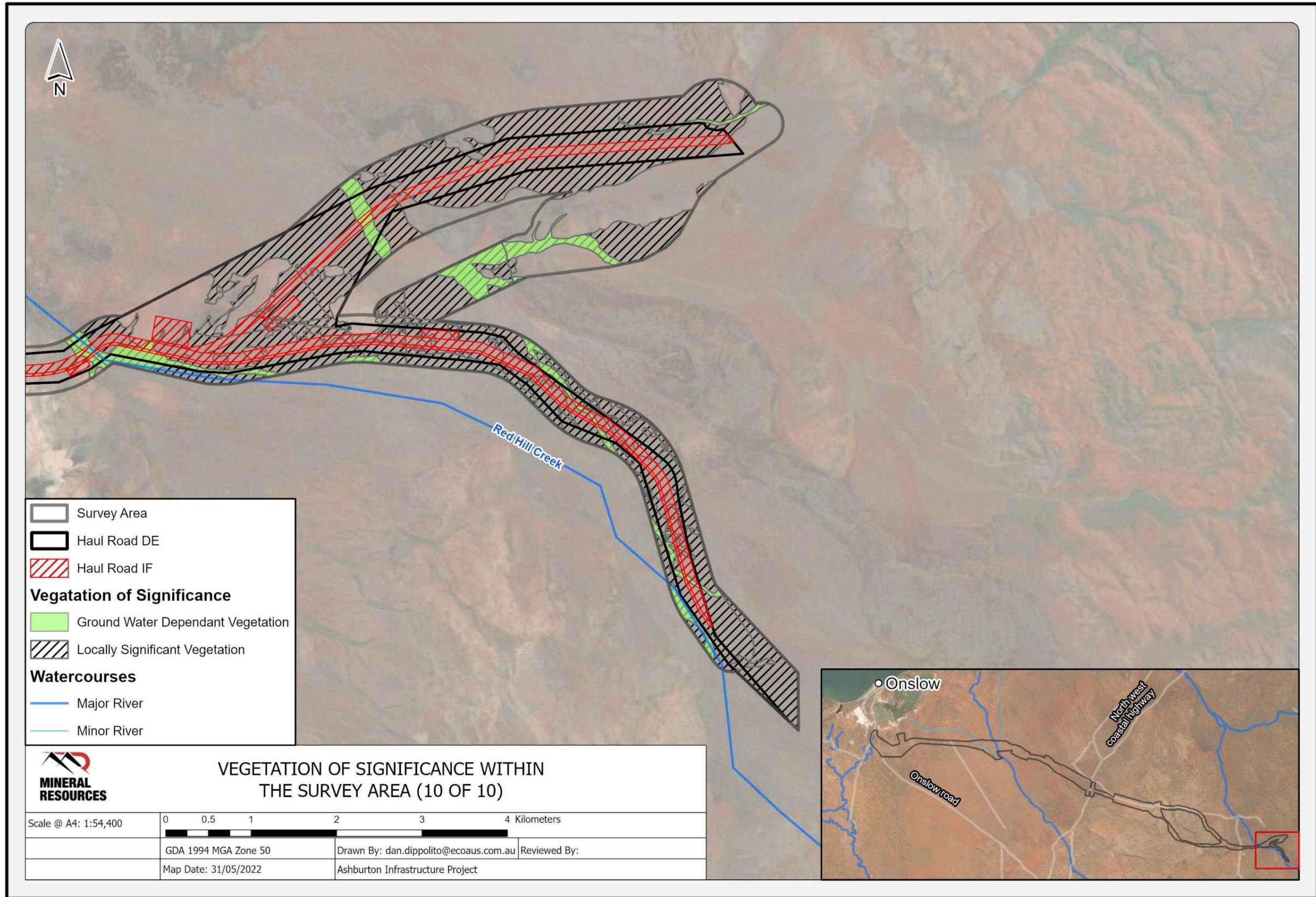


Figure 9-31: Vegetation of Significance within the Terrestrial Survey Area (10 of 10)

9.3.3 Flora

The surveys undertaken across the Haul Road DE and Terrestrial Survey Area have recorded a combined total of 583 flora taxa (360 Environmental 2022b). The most represented families were *Fabaceae* (98 taxa), *Poaceae* (89 taxa) and *Malvaceae* (78 taxa). The most represented genera were *Acacia* with 35 taxa, *Ptilotus* with 20 taxa and *Corchorus* with 18 taxa.

9.3.3.1 Conservation Significant Flora

Conservation significant flora are species listed under the EPBC Act, the BC Act, or Priority species identified by DBCA as requiring further protection. No Threatened flora species listed under the EPBC Act, or the BC Act have been recorded within the Haul Road DE during the most recent surveys (360 Environmental 2022b); or from any previous surveys conducted.

Seven Priority flora species have been recorded in the Haul Road DE and are identified in the **Table 9-8** and **Figure 9-32** to **Figure 9-41**.

Table 9-8: Conservation Significant Flora Recorded in the Haul Road DE

Species	Habitat	Vegetation Type	No Individual in Haul Road DE	No of Individuals within the Terrestrial Survey Area	Other Precious Records of Species
<i>Abutilon sp. Onslow (F. Smith s.n. 10/9/61) (P1)</i>	Flat stony plains in the Shire of Ashburton	PL05 PL08 PL13 PL14 PL16 PL19 PL23 DR03 DR04 DR05	4,260	9092 [^] This species was noted to occur beyond the Terrestrial Survey Area and therefore a further targeted survey was undertaken. This portion is termed the <i>Abutilon sp. Onslow</i> Survey Area. Following the targeted searches and aerial estimates, an estimated map of the density of individuals was produced within the <i>Abutilon sp. Onslow</i> Survey Area utilising targeted searches and aerial estimates (Figure 9-42).	The large number of this species were recorded in the Terrestrial Survey Area, as well as the continuation of the Cane River suggests this species extends north and south along Cane River (360 Environmental 2022b). The WAH has 12 specimens lodged with records limited to a small area on the border of the Pilbara and Carnarvon regions (WAH 2021). Database searches for this taxon returned 12 locations, dating back to 1996, noting that the abundance was sometimes very high, with 'in excess of 1,000 plants recorded with numerous juveniles and seedlings noted following the above average rainfall', mirroring the results of this survey (360 Environmental 2022b).
<i>Euphorbia inappendiculata var. inappendiculata (P2)</i>	Cracking clay and clay loam plains	PL21 DR06	2	2	The WAH has 11 specimens lodged with records from the Pilbara and Gascoyne regions. The nearest known population occurs approximately 11.4 km east-northeast of the nearest record within the Terrestrial Survey Area (360 Environmental 2022b).
<i>Eremophila forrestii subsp. viridis (P3)</i>	Red sand and rocky gullies	DS01 DR01 DR03 PL13 PL19 PL24	875	1067	The WAH has 5 specimens lodged with records distributed in the Pilbara, Carnarvon and Great Sandy Desert regions. An additional 176 individuals were recorded and tentatively identified based on sterile material (360 Environmental 2022b). A total of 3,928* individuals were recorded outside of the Haul Road DE in addition to the 1067 recorded in the Terrestrial Survey Area (Spectrum 2021; 360 Environmental 2022b; ELA 2021).
<i>Indigofera rivularis (previously known as Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)) (P3)</i>	Drainage lines in association with red-brown sandy clay loam soils	DR06	12	13	The WAH has 50 specimens lodged with records restricted to the Pilbara region and records in excess of 1000+ individuals. The nearest known population occurs approximately 56 km east of the nearest record within the Terrestrial Survey Area (360 Environmental 2022b).
<i>Owenia acidula (P3)</i>	Low-lying dense thicket drainage (opportunistic). Recorded within Warrambo Creek.	DR01	17	17	The WAH has seven specimens lodged, with records restricted to the northwestern area of the Pilbara and eastern area of the Kimberley (360 Environmental 2022b). An additional 100 individuals were recorded outside of the Haul Road DE and Terrestrial Survey Area
<i>Solanum sp. Red Hill (S. van Leeuwen et al. PBS 5415) (P3)</i>	Within low lying drainage plains.	PL11	1	1	The WAH has nine specimens lodged with records restricted to the northern Pilbara (360 Environmental 2022b).
<i>Goodenia nuda (P4)</i>	Seasonally inundated clay soils and drainage lines, and sand scoured riverbeds and hill sides	PL03 PL23 DR01 DR05 Cleared	48	166	The WAH has 107 specimens lodged with records widely distributed throughout the Pilbara region, including conservation tenure. The species is known to be a disturbance opportunist, with records on Florabase referencing the species within degraded areas such as along roadsides (360 Environmental 2022b).

[^] Including individuals recorded outside of the Terrestrial Survey Area during targeted searches for local contextual occurrences.

*This total is an amalgamation of data from Spectrum 2021 and ELA 2021 with areas overlapping in the Warrirda Road Corridor utilising the most recent survey information from Spectrum 2021

106 flora taxa encountered and/or collected by 360 Environmental (2022b) were sterile and unable to be confidently identified to species level. However, none of the unconfirmed flora taxa were considered to be analogous to Priority flora taxa identified by the database searches.

30 flora taxa recorded from the field survey (360 Environmental 2021a, 2022b) were considered to represent potential range extensions (**Table 9-9**).

Table 9-9: Flora That Represent Potential Range Extensions in the Haul Road DE

Flora taxon	Habitat within Haul Road DE	Nearest known population outside of the Haul Road DE
<i>Abutilon macrum</i>	DR01	Approx. 60 km southwest of the nearest record within the Terrestrial Survey Area.
<i>Acacia cowleana</i>	DR09	Approx. 98 km northeast of the nearest record within the Terrestrial Survey Area.
<i>Acacia cuthbertsonii</i> subsp. <i>cuthbertsonii</i>	PL06	Approx. 84 km north of the Terrestrial Survey Area.
<i>Acacia marramamba</i>	PL19	Approx. 140 km southeast of the nearest record within the Terrestrial Survey Area.
<i>Amphipogon sericeus</i>	HM04	Approx. 120 km east of the nearest recorded within the Terrestrial Survey Area.
<i>Aristida inaequiglumis</i>	PL03 DR06	Approx. 162 km east of the nearest record within the Terrestrial Survey Area.
<i>Aristida ingrata</i>	DR01	Approx. 59 km east.northeast of the Terrestrial Survey Area.
<i>Bulbostylis turbinata</i>	PL20 PL05 PL22 PL23	Approx. 117 km east-northeast of the nearest record within the Terrestrial Survey Area.
<i>Cucumis? picrocarpus</i>	PL20 DR03 DR04	Approx. 146 km east-northeast of the nearest record within the Terrestrial Survey Area.
<i>Euphorbia ferdinandi</i> var. <i>ferinandi</i>	Recorded opportunistically	Approx. 154 east of the Terrestrial Survey Area.
<i>Euphorbia inappendiculata</i> var. <i>inappendiculata</i> (P2)	PL21 DR06	Approx. 114 km east-northeast of the nearest record within the Terrestrial Survey Area.
<i>Fimbristylis littoralis</i>	Recorded opportunistically	Approx. 53 km southeast of the nearest recorded within the Terrestrial Survey Area
<i>Goodenia triodiophila</i>	PL21 DR01	Approx. 87 km east of the Terrestrial Survey Area.

Flora taxon	Habitat within Haul Road DE	Nearest known population outside of the Haul Road DE
	DR07	
<i>Hibiscus verdcourtii</i>	PL17 DR06	Approx. 119 km northeast of the nearest record within the Terrestrial Survey Area.
<i>Indigofera rivularis</i> (previously known as <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)) (P3)	PL23 DR07	Approx. 56 km east of the nearest record within the Terrestrial Survey Area.
<i>Ipomoea captica</i>	CT03 CT07	Approx. 84 km north-northwest of the nearest record within the Terrestrial Survey Area.
<i>Lepidium pholidogynum</i>	CT03 CT02 DR01 HM01 HM05 PL01 PL05 PL06	Approx. 61 km east of the nearest record within the Terrestrial Survey Area.
<i>Maireana platycarpa</i>	PL16	Approx. 207 km southeast of the nearest record within the Terrestrial Survey Area.
<i>Minuria integerrima</i>	CT07	Approx. 139 km east of the nearest record within the Terrestrial Survey Area.
<i>Paranotis pterospora</i>	DS01	Approx. 530 km east of the nearest record within the Terrestrial Survey Area.
<i>Peripleura hispidula</i> var. <i>setosa</i>	DR02	Approx. 106 km west of the Terrestrial Survey Area.
<i>Phyllanthus exilis</i>	DR10	Approx. 124 km east of the Terrestrial Survey Area.
* <i>Portulaca pilosa</i>	PL01 PL06 PL12	Approx. 137 km northeast of the Terrestrial Survey Area.
<i>Pterocaulon serrulatum</i> var. <i>velutinum</i>	PL11 DR06	Approx. 126 km southeast of the Terrestrial Survey Area.
<i>Sclerolaeana beaugleholei</i>	PL05	Approx. 99 km south of the Terrestrial Survey Area.

Flora taxon	Habitat within Haul Road DE	Nearest known population outside of the Haul Road DE
<i>Sclerolaena recurvicauspis</i>	CT03	Approx. 115 km southwest of the nearest record within the Terrestrial Survey Area.
<i>Senna sericea</i>	PL10	Approx. 280 km east of the Terrestrial Survey Area.
<i>Sida arenicola</i>	PL05	Approx. 108 km west of the Terrestrial Survey Area.
<i>Sida spinosa</i>	PL03 PL05 PL11 PL14 DR01 DR03 DR04 DR05 DR06 DR07 DR09 HM02 HM03	Approx. 53 km southwest of the nearest record within the Terrestrial Survey Area.
<i>Tephrosia aff. remotiflora</i>	DR01 PL20	Approx. 180 km east of the nearest record within the Terrestrial Survey Area.

9.3.3.2 Introduced Flora

A total of 16 introduced flora species (weeds) were recorded in the Haul Road DE (360 Environmental 2020 and 2022b), including:

- *Aerva javanica* (Kapok Bush);
- *Bidens binpinnata* (Bipinnate Beggartick);
- *Cenchrus ciliaris* (Buffel Grass);
- *Cenchrus setiger* (Birdwood Grass);
- *Citrullus amarus*;
- *Echinochloa colona* (Awnless Barnyard Grass)
- *Euphorbia hirta* (Asthma Plant);

- *Flaveria trinervia* (Speedy Weed);
- *Malvastrum americanum* (Spiked Malvastrum);
- *Passiflora foetida* var. *hispida* (Stinking Passion Flower);
- *Portulaca pilosa* (Djanggara);
- *Prosopis pallida* (Mesquite);
- *Setaria verticillata* (Whorled Pigeon Grass);
- *Sonchus oleraceus* (Common Sowthistle);
- *Tribulus terrestris* (Caltrop); and
- *Vachellia farnesiana* (Mimosa Bush).

One introduced flora species: *Prosopis pallida* is listed as a Declared Pest under the State *Biosecurity and Agriculture Management Act 2007* (BAM Act 2007), and as a Weed of National Significance (WoNS) on the Western Australian Organism List database.



Figure 9-32: Priority Flora recorded within the Terrestrial Survey Area (1 of 10)

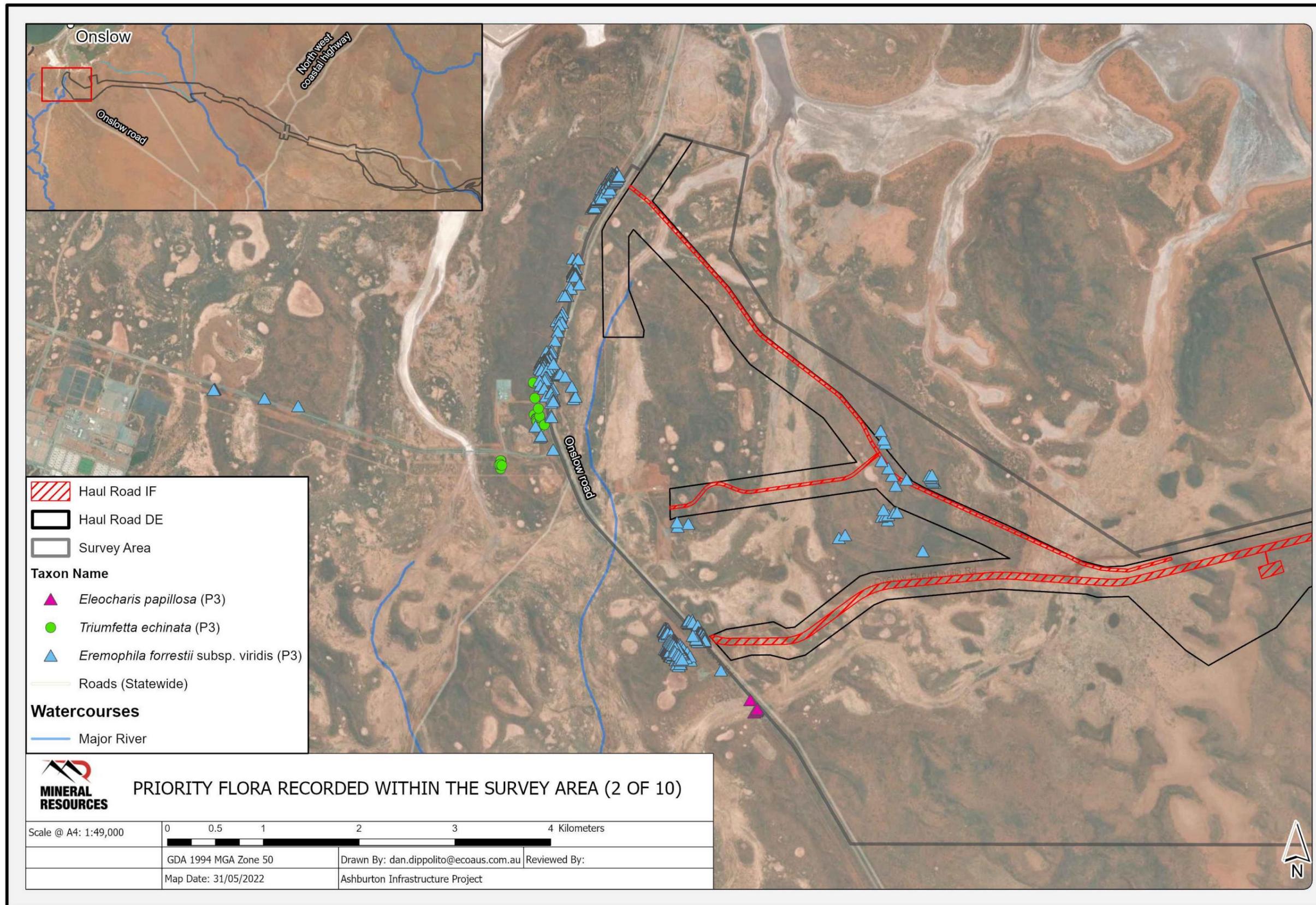


Figure 9-33: Priority Flora recorded within the Terrestrial Survey Area (2 of 10)

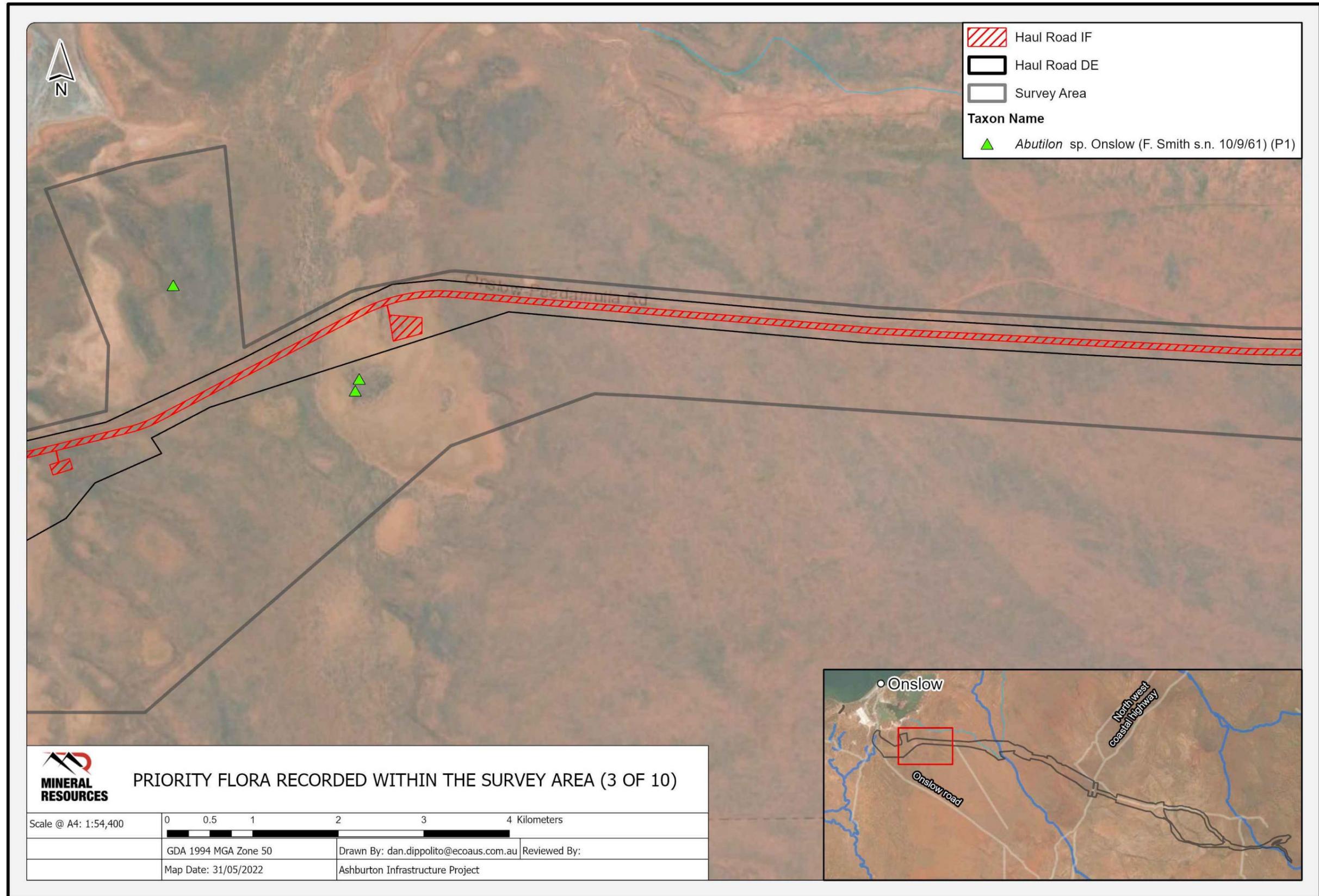


Figure 9-34: Priority Flora recorded within the Terrestrial Survey Area (3 of 10)

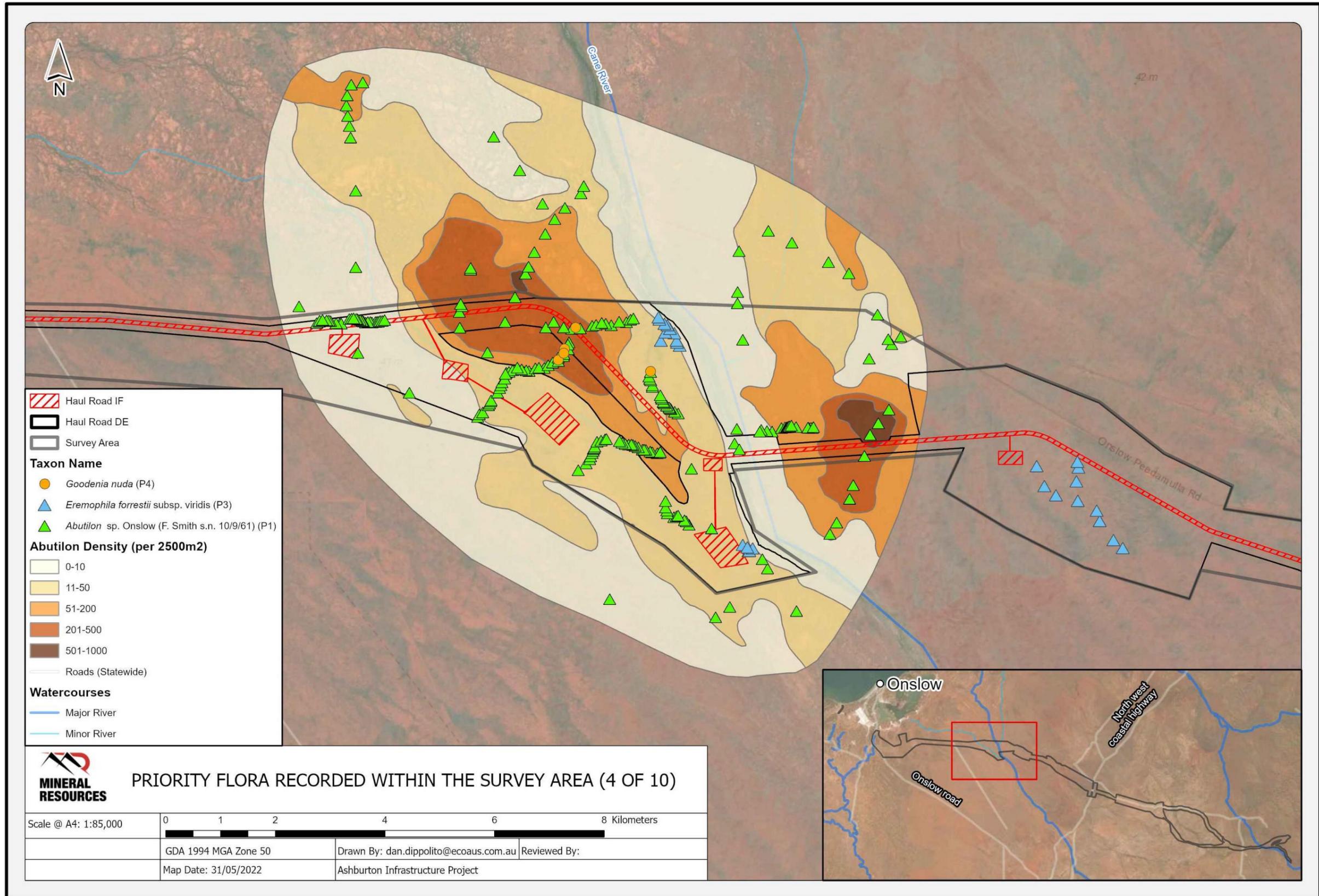


Figure 9-35: Priority Flora recorded within the Terrestrial Survey Area (4 of 10)

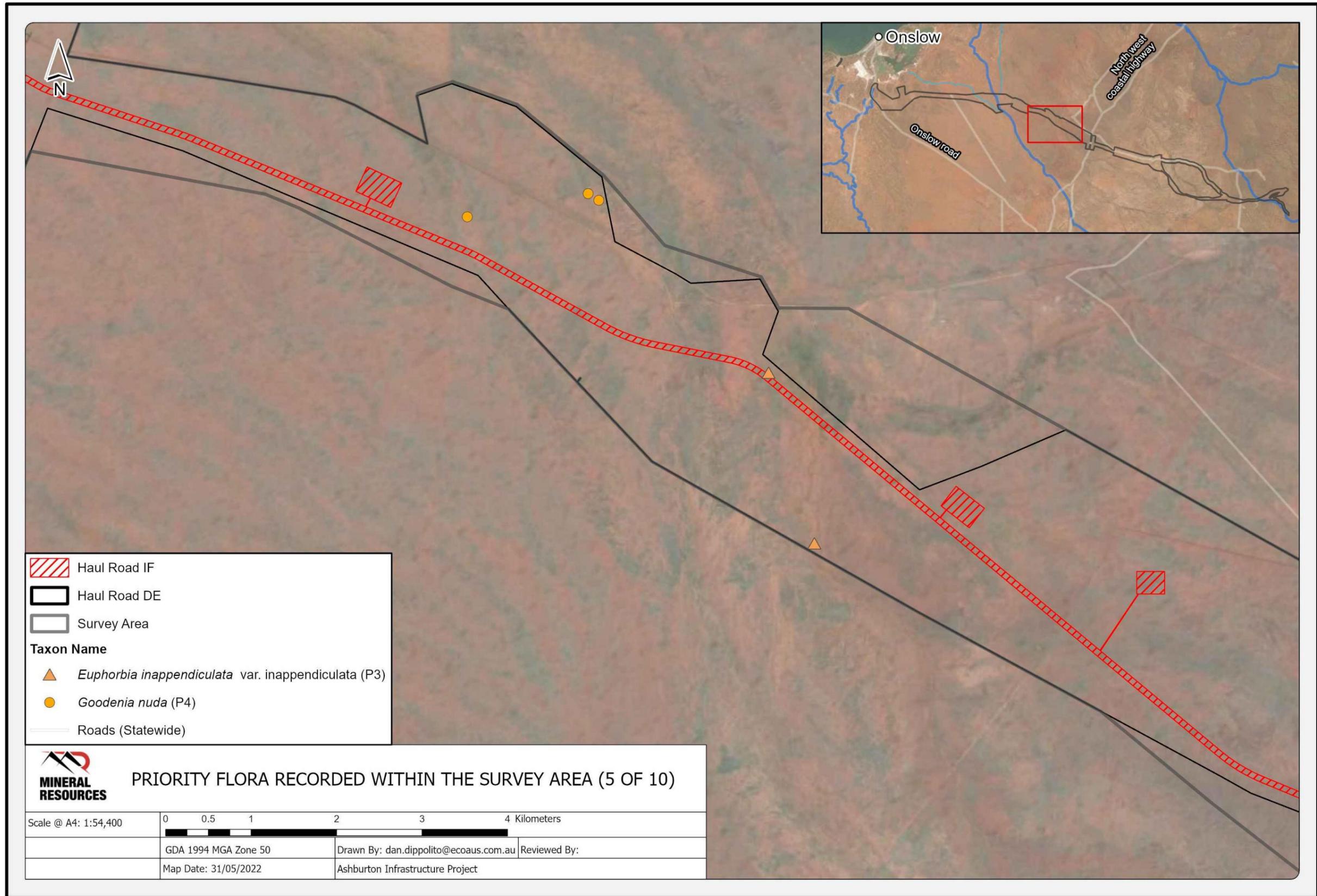


Figure 9-36: Priority Flora recorded within the Terrestrial Survey Area (5 of 10)

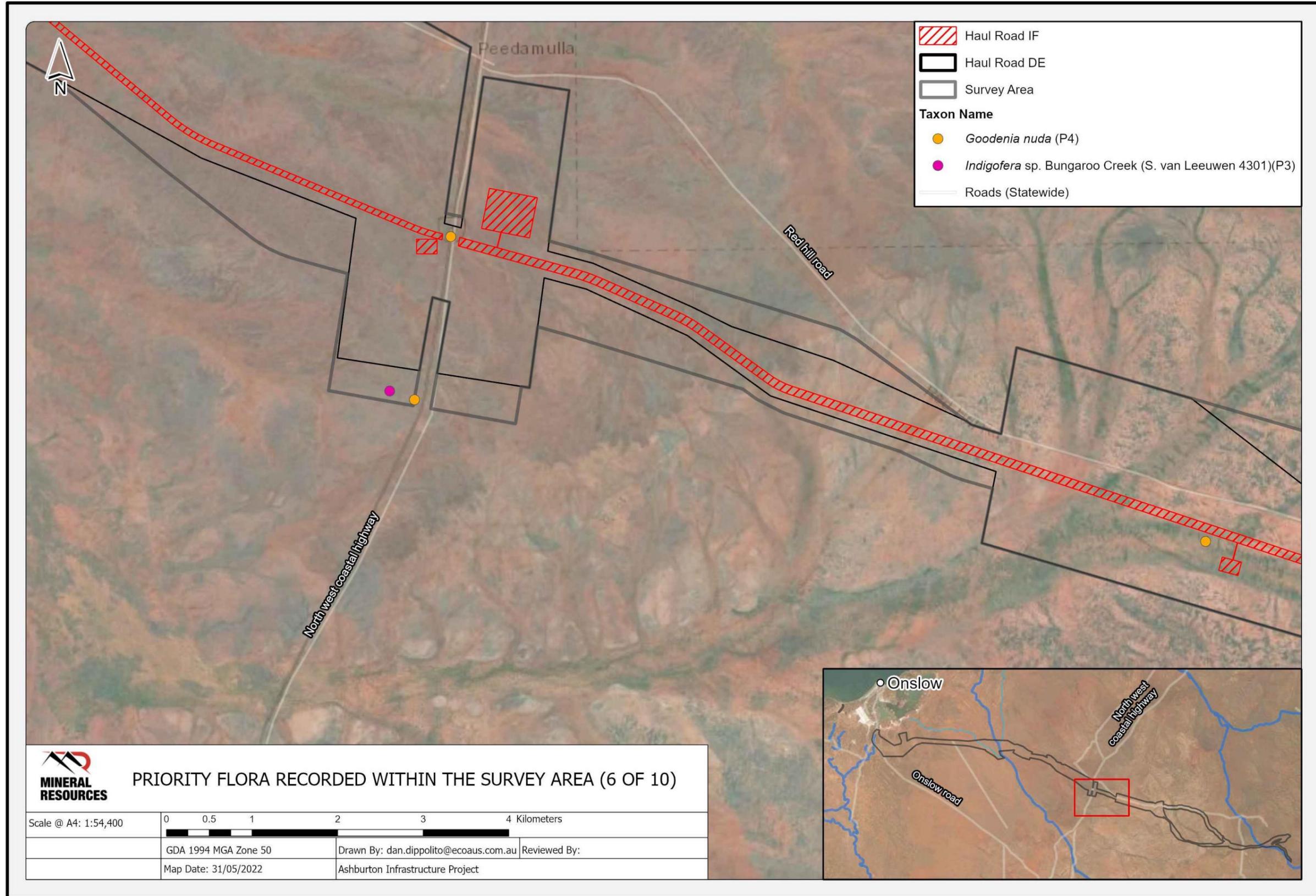


Figure 9-37: Priority Flora recorded within the Terrestrial Survey Area (6 of 10)

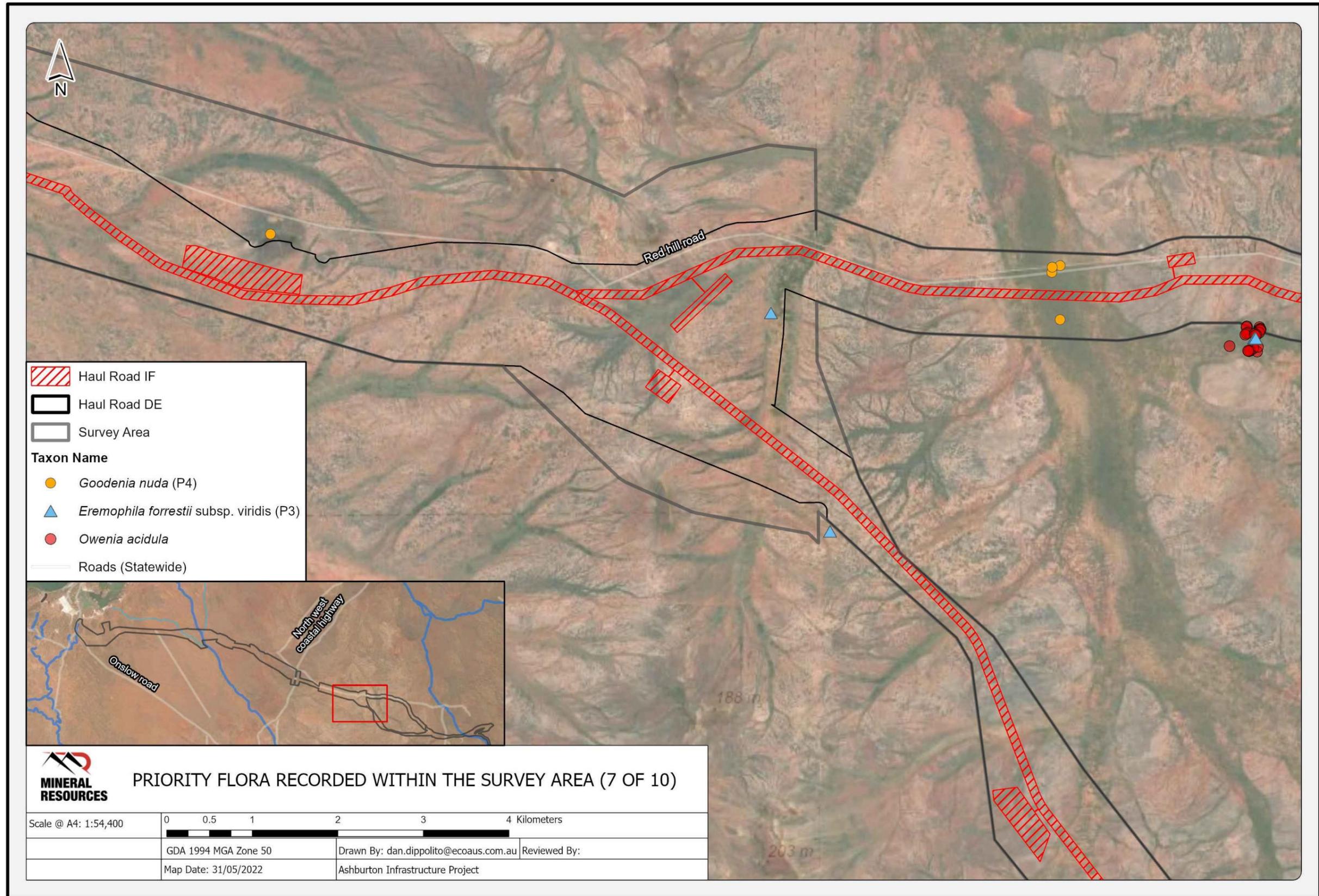


Figure 9-38: Priority Flora recorded within the Terrestrial Survey Area (7 of 10)

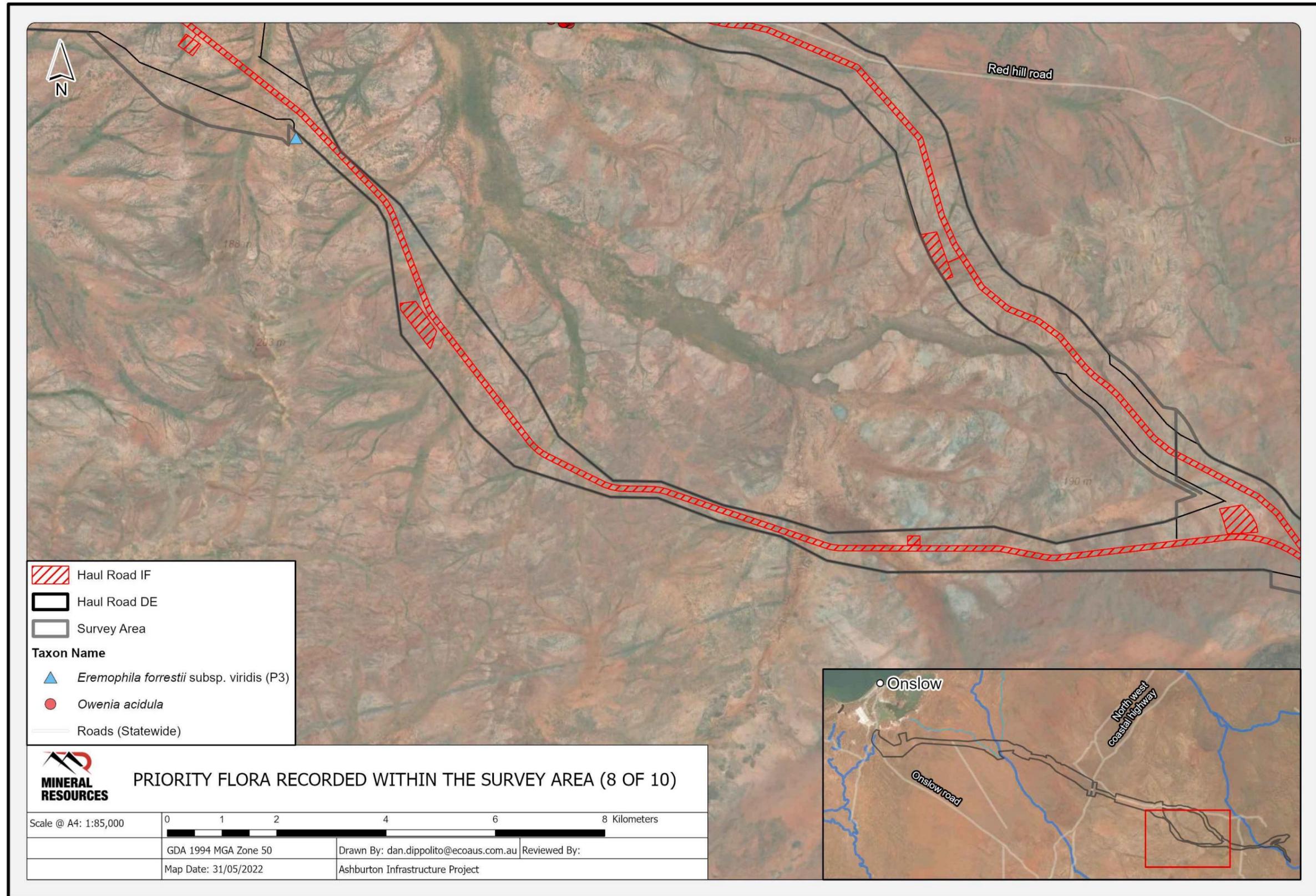


Figure 9-39: Priority Flora recorded within the Terrestrial Survey Area (8 of 10)

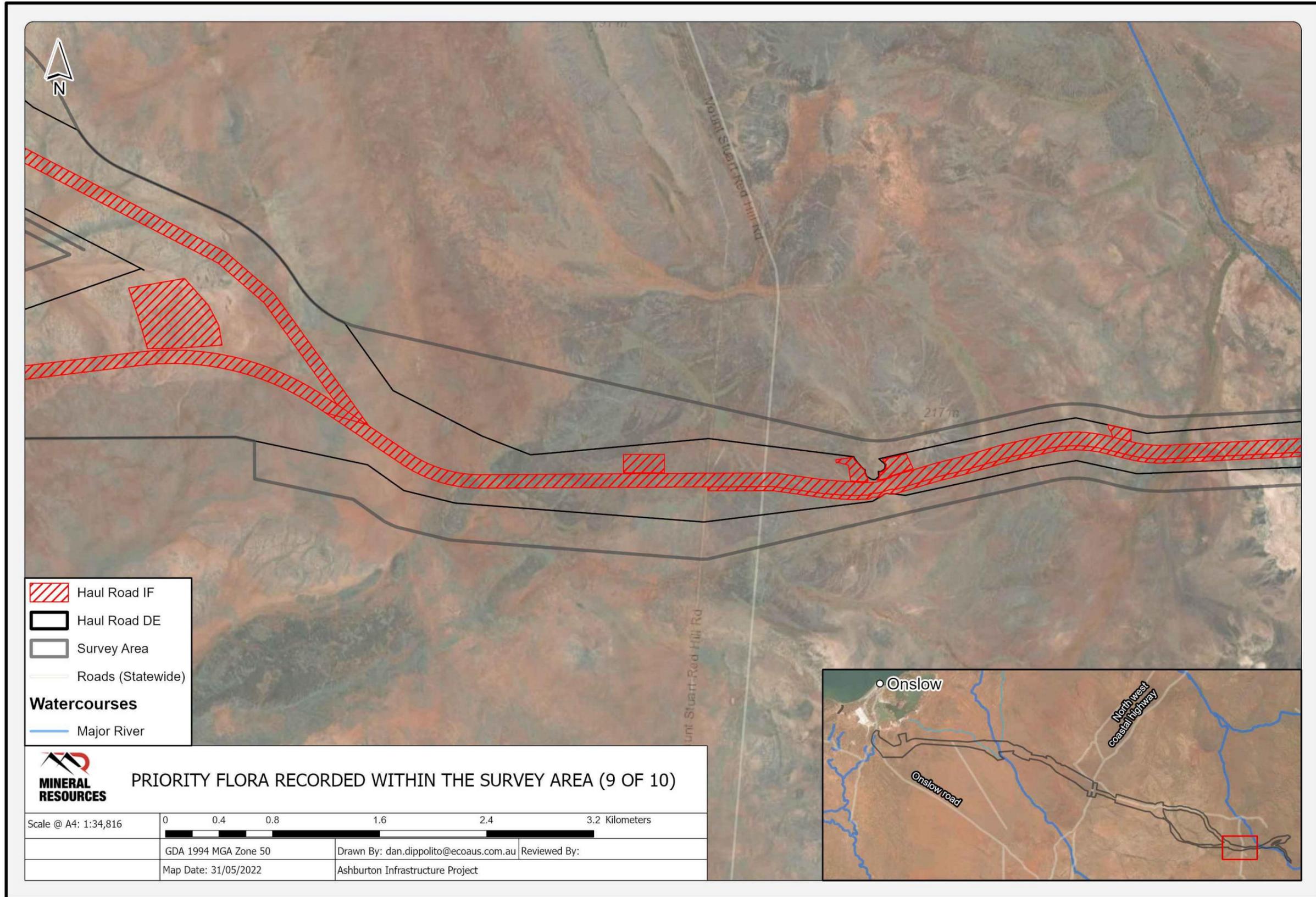


Figure 9-40: Priority Flora recorded within the Terrestrial Survey Area (9 of 10)

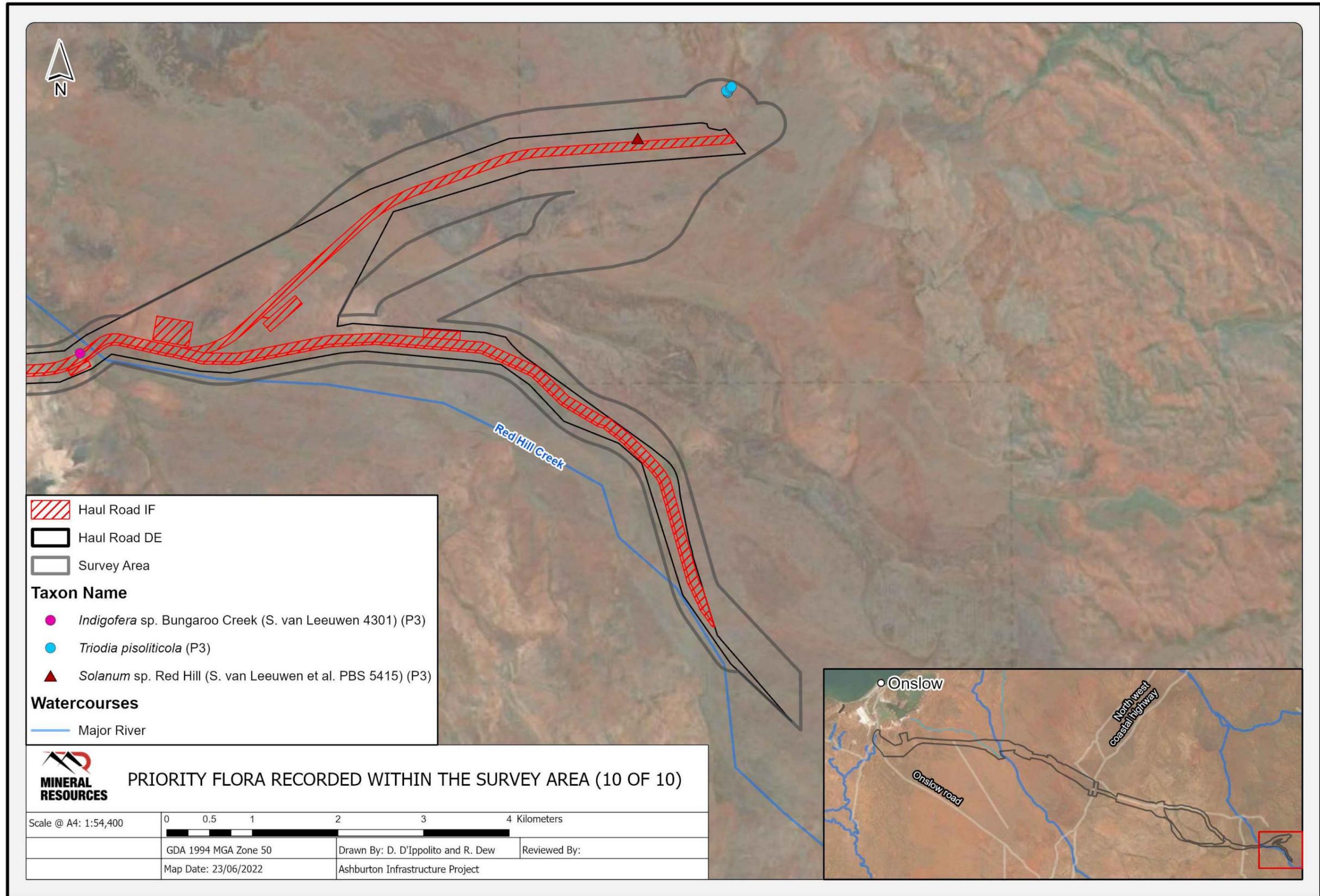


Figure 9-41: Priority Flora recorded within the Terrestrial Survey Area (10 of 10)

9.4 Potential Impacts

Clearing of native vegetation within the Haul Road DE is proposed and required to implement the Proposal. No clearing of native vegetation within the Landside DE is required; however, there is potential for the construction and operation of the Port to lead to temporary dust deposition to surrounding vegetation.

The potential direct, indirect and cumulative impacts from development within the Haul Road DE are identified below. The impacts to vegetation have been calculated based off the worst-case scenario (the southern alignment) for the haul road to account for the maximum disturbance to vegetation. For conservation significant values, a maximum impact was developed to provide project flexibility to alter the alignment and supporting infrastructure. It is important to note that the precise location of clearing is to be confirmed once the preferred alignment has been finalised

9.4.1 Direct Impacts

The potential direct impacts of the Proposal on flora and vegetation have been identified as:

- Loss of native vegetation due to clearing.
- Loss of conservation significant vegetation
- Loss of conservation significant flora due to clearing.

9.4.1.1 Loss of native vegetation due to clearing

The Proposal will result in the clearing of up to **1,564 ha** of native vegetation in predominately Very Good condition across the Roebourne and Hamersley subregions to enable the construction of the haul road and associated infrastructure. This section presents the approximate loss of vegetation based on the Haul Road IF. However, the Proposal includes flexibility to alter the alignment of the haul road and supporting infrastructure components (Haul Road IF) within the Haul Road DE and this flexibility will be assessed in **Section 9.6**.

Nine of the 13 pre-European vegetation associations will be impacted by clearing for the Proposal (**Table 9-10**).

Table 9-10: Loss of Pre-European Vegetation Associations in the Haul Road DE

Vegetation Associations	Current Extent (ha) (% of Pre-European Extent)	Extent within Haul Road IF (ha)	% of Pre-European Extent Remaining
Cape Range subregion			
Cape Yannare Coastal Plain 670	147,794.6 (100.0%)	119.5	0.2
Cape Yannare Coastal Plain 98	184,341.2 (100.0%)	33.4	0.0*
Hamersley subregion			
Stuart Hills 103	614463.8 (100.0%)	406.4	0.1
Stuart Hills 583	242,394.5 (100.0%)	457.7	0.2
Stuart Hills 612	476.2 (100.0%)	0.0	0.0
Roebourne subregion			
Onslow Coastal Plain 29	5,291.5 (100.0%)	14.4	0.3
Onslow Coastal Plain 585	145,559.3 (100.0%)	287.0	0.2

Vegetation Associations	Current Extent (ha) (% of Pre-European Extent)	Extent within Haul Road IF (ha)	% of Pre-European Extent Remaining
Onslow Coastal Plain 606	32,177.3 (100.0%)	17.9	0.1
Onslow Coastal Plain 641	720.5 (100.0%)	2.7	0.4
Onslow Coastal Plain 605	88,374.6 (100.0%)	224.8	0.3

* % loss because of the Proposal is considered insignificant relative to current pre-European extent

At a local scale, the Proposal will clear up to **1,564 ha** of native vegetation in the Haul Road DE across forty-four of the fifty-four (including cleared) mapped vegetation types (360 Environmental 2022b; **Table 9-11**). However, impacts to individual vegetation types as a result of the Proposal are considered to be **low**, due to the linear nature of the haul road.

Table 9-11: Approximate Clearing of Vegetation Types

Vegetation Types	Extent in Terrestrial Survey Area (ha)	Extent in Haul Road DE (ha)	Extent in Haul Road IF (ha)	Approximate % remaining in Terrestrial Survey Area	Approximate % remaining in Haul Road DE
Claypans/tidal flats and channels					
CT02	303.3	61.7	14.0	95.4	77.4
CT03	1149.8	224.4	31.9	97.2	85.8
CT04	174.2	26.1	0.6	99.7	97.8
CT05	43.1	9.9	0.3	99.3	96.9
CT07	82.7	14.6	3.4	96.0	77.0
Dunes and Swales					
DS01	1365.3	224.1	30.1	97.8	86.6
DS02	1205.2	141.2	21.8	98.2	84.5
DS03	570.8	162.8	17.0	97.0	89.5
Plains					
PL01	2432.9	1816.9	137.4	94.4	92.4
PL02	1403.1	321.0	77.42	94.5	75.9
PL03	1900.6	1698.7	92.3	95.1	94.6
PL04	356.4	76.2	19.0	94.7	75.1
PL05	1194.0	1045.9	116.7	90.2	88.8
PL06	2258.5	1856.4	186.9	91.7	89.9
PL08	596.0	393.0	61.7	89.6	84.3
PL09	37.8	14.2	1.8	95.2	87.2
PL10	218.6	111.3	31.3	85.7	71.9
PL11	799.5	407.6	114.7	85.7	71.9
PL13	428.4	281.9	63.2	85.2	77.6
PL14	255.5	148.5	13.7	94.6	90.8
PL15	323.7	148.8	3.6	98.9	97.6
PL16	831.9	278.9	17.9	97.8	93.6
PL17	107.6	107.3	0.0	100.0	100.0
PL18	122.4	7.2	1.7	98.6	75.7
PL19	2646.5	2077.9	125.2	95.3	94.0

Vegetation Types	Extent in Terrestrial Survey Area (ha)	Extent in Haul Road DE (ha)	Extent in Haul Road IF (ha)	Approximate % remaining in Terrestrial Survey Area	Approximate % remaining in Haul Road DE
PL20	212.7	68.7	2.4	98.9	96.5
PL21	296.2	266.4	6.5	97.8	97.6
PL22	145.0	126.0	6.4	95.6	94.9
PL23	473.4	292.3	27.3	94.2	90.6
Low Hills and Mesas					
HM01	34.9	9.5	1.9	94.6	80.2
HM02	523.5	457.2	73.3	86.0	84.0
HM03	42.0	22.0	11.0	73.7	49.6
HM05	104.8	15.4	1.5	98.6	90.1
HM06	12.6	0.3	0.0	100.0	100.0
HM08	122.1	60.9	9.7	92.1	84.1
HM09	702.7	485.9	32.5	95.4	93.3
Drainage					
DR01	1763.2	1483.6	101.9	94.2	93.1
DR02	639.9	624.6	37.4	94.2	94.0
DR03	66.5	16.1	2.0	97.0	87.7
DR04	35.0	3.3	0.4	98.9	88.5
DR05	11.2	10.1	0.0	100.0	100.0
DR06	138.7	50.1	10.1	92.7	79.8
DR07	245.7	168.5	32.9	86.6	80.5
DR08	113.9	59.9	4.3	96.2	92.8
DR09	59.7	32.3	14.2	76.2	56.0
DR10	126.3	126.2	0.0	100	100
DR11	9.0	6.4	0.6	93.4	90.7
Other					
Cleared	203.1	118.0	3.6	98.2	96.9
TOTAL*	26,994.8	16,209	1,564		

*Totals exclude areas classified as not assessed by 360 Environmental 2022b as these are not included in the Haul DE

Vegetation considered to be in Excellent to Good condition will be impacted by clearing for the Proposal (**Table 9-12**).

Table 9-12: Approximate Clearing within Haul Road DE by Vegetation Condition

Vegetation Conditions	Extent in Haul Road IF (ha)			Approximate total clearing (ha)	Extent in Haul Road DE (ha)
	Cape Range subregion	Roebourne subregion	Hamersley subregion		
Excellent	0.0	0.0	2.5	2.5	20.3
Very Good	41.2	319.7	759.7	1120.6	11,165.6
Good	83.8	230.4	83.9	398.1	4572.3
Poor	24.9	4.5	9.5	38.9	330.4
Cleared	2.4	0.3	1.0	3.7	118.1
Not Assessed	0.0	0.0	0.0	0.0	2.4

*Discrepancies in total extent in Haul Road DE due to rounding

The significant residual impacts of native vegetation clearing, and fragmentation are assessed in **Section 9.6.1.1** and **Section 9.6.2.1**.

9.4.1.2 Loss of conservation significant vegetation communities due to clearing

Clearing of vegetation for the construction and operation of the Proposal will not result in the clearing of any conservation significant vegetation. Clearing of vegetation will result in the loss of GDV within the Haul Road DE which are considered to have a high value. The approximate impacts of clearing for the Proposal on these vegetation types is outlined in **Table 9-13**. The significant residual impacts of native vegetation clearing on significant vegetation communities is assessed in **Section 9.6.1.2**.

Table 9-13: Approximate Clearing Extent of Water Dependent Vegetation Types

Vegetation Type	Extent in Terrestrial Survey Area*	Extent in Haul Road DE (ha)	Extent in IF (ha)	Approximate % remaining in Terrestrial Survey Area
DR03	66.5	16.1	2.0	97.0
DR04	35.0	3.3	0.4	98.9
DR06	138.7	50.1	10.1	92.7
DR07	245.7	168.5	32.9	86.6
DR08	113.9	59.9	4.3	96.2
PL03	1900.6	1698.7	92.3	95.1
PL20	212.7	68.7	2.4	98.9
PL21	296.2	266.4	6.5	97.8
Total	3009.3	2331.7	150.9	95.0

9.4.1.3 Loss of conservation significant flora due to clearing

The Haul Road DE contains seven conservation significant flora species. The Haul Road IF avoids four of these species, *Euphorbia inappendiculata* var. *inappendiculata* (P2) (**Figure 9-43**), *Owenia acidula* (P3) (**Figure 9-46**), *Solanum* sp. Red Hill (S. van Leeuwen et al. PBS 5415) (**Figure 9-47**) and *Goodenia nuda* (P4) (**Figure 9-48**). The Haul Road IF will result in clearing of individuals from three Priority flora species (**Figure 9-32** to **Figure 9-41**).

The approximate predicted impacts from the Proposal on six of the Priority flora species are shown in **Table 9-14**. The approximate predicted impacts from the Proposal on the seventh Priority flora species, *Abutilon* sp. Onslow (F. Smith s.n. 1/9/61) (P1) is shown in **Table 9-14** based on the density mapping shown in **Figure 9-42**. The density mapping has been used to assess the impact to this Priority flora species given the high numbers observed to occur (**Table 9-8**). The Proposal also includes flexibility to alter the alignment within the Haul Road DE and this flexibility will be assessed in **Section 9.6**.

Table 9-14: Indicative Loss of Priority Flora Species

Species	No. of individuals in Terrestrial Survey Area	No of Individuals in the Haul Road DE	No. of Individuals in the IF	Approximate % loss of Individuals known within the Terrestrial Survey Area
<i>Euphorbia inappendiculata</i> var. <i>inappendiculata</i> (P2) (Figure 9-43)	2	2	0	0.0
<i>Eremophila forrestii</i> subsp. <i>viridis</i> (P3) (Figure 9-44)	1067	875	3	0.3
<i>Indigofera rivularis</i> (previously known as <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)) (P3) (Figure 9-45)	13	12	12	92.3
<i>Owenia acidula</i> (P3) (Figure 9-46)	17	17	0	0.0
<i>Solanum</i> sp. Red Hill (S. van Leeuwen et al. PBS 5415) (P3) (Figure 9-47)	1	1	0	0.0
<i>Goodenia nuda</i> (P4) (Figure 9-48)	166	48	0	0.0

Table 9-15: Indicative Loss of Abutilon Sp. Onslow Density

Density bracket	<i>Abutilon</i> sp. Survey Area Extent (ha)	Area within Haul Road DE (ha)	Area within Haul road IF (ha)	Approximate % loss within the <i>Abutilon</i> sp. Survey Area
0-10	4472.4	481.7	50.2	1.1
11-50	3195.0	1114.4	15.6	0.5
51-200	1242.5	198.9	16.7	1.3
201-500	717.0	218.0	31.9	4.4
501-1000	68.9	3.5	2.4	3.5

The significant residual impacts of native vegetation clearing on significant conservation flora is assessed in **Section 9.6.1.3**.

9.4.2 Indirect Impacts

The potential indirect impacts of the Proposal to flora and vegetation within the Haul Road DE have been identified as degradation of vegetation due to:

- Fragmentation;
- Altered hydrological regimes;
- Introduction and/or spread of weed species; and
- Increased dust deposition.

An assessment of the potential indirect impacts to flora and vegetation is provided in **Section 9.4.2**.

9.4.3 Cumulative Impacts

The Proposal will contribute to the following cumulative impacts at a regional scale:

- Loss of native vegetation due to clearing; and
- Loss of conservation significant flora due to clearing.

The projects that are located within 50 km of the Haul Road DE that have been used to assess cumulative impacts are detailed in **Section 2.3.4** and shown in **Figure 2-26: Existing and Foreseeable Projects within the Pilbara and Carnarvon Bioregions**. The assessment of cumulative impacts to flora and vegetation as a result of this Proposal is discussed in **Section 9.6.3**

There will be no clearing of flora and vegetation in the Landside DE for this Proposal. The clearing from other Projects at the Port (in the vicinity of the Landside DE) will add to existing Port infrastructure impacts. However, flora and Vegetation values will be intact in areas north and south along the Western Australian coastline. Therefore, cumulative impacts have not been considered for the Landside DE.

9.5 Mitigation

The Proponent has applied the mitigation hierarchy (avoid, minimise and rehabilitate) during Proposal design to reduce the potential impacts to flora and vegetation. Potential impacts have been avoided or minimised through design of the Haul Road DE and IF. Areas of land disturbed as a result of implementing the Proposal will be progressively rehabilitated to agreed post mining land use outcomes and this will be documented in a MCP that will

accompany the Mining Proposal when Mining Act approvals are submitted. Specific mitigation measures are summarised in **Table 9-16** and discussed further below.

A number of management plans have been prepared for the Proposal to minimise the potential impacts of project construction and operational activities on flora and vegetation. The specific management plan that has been prepared that will assist to mitigate potential impacts on flora and vegetation includes:

- A **Terrestrial Environment Management Plan (TEMP)**: The TEMP has been prepared to detail the mitigation and management measures the Proponent proposes to implement to reduce direct and indirect impacts to surrounding inland waters, flora, vegetation, fauna and social surroundings. The management objectives for the plan relate to specific management objectives on each environmental factor.

Table 9-16: Proposed Mitigation Measures for Flora and Vegetation

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
<p>Direct impact: loss of vegetation due to clearing.</p> <p>Clearing will remove up to 1,564 ha of native vegetation.</p>	<p>The proposed clearing has been minimised as far as practicable to reduce the extent of clearing required. The Proponent has revised the Haul Road DE from 25,930 to 16,209 ha.</p> <p>A Site Disturbance Permit (SSDP) will be used for all land clearing activities to avoid impact on priority flora populations and ensure clearing within approval boundaries and avoids any clearing occurring outside of the Haul Road DE.</p>	<p>Vegetation clearing shall be kept to the minimum amount required, as far as practicable.</p> <p>Survey and clearly demarcate clearing areas prior to clearing commencing, including flagging and signage as required.</p> <p>Observers and spotters will be used when working near sensitive sites, e.g., near Priority flora, or when clearing boundaries may not be readily visible (for example due to dense vegetation).</p> <p>Induct relevant personnel and contractors on land disturbance and vegetation clearing management including:</p> <ul style="list-style-type: none"> • Significant vegetation and flora present in the Haul Road DE; • Key protection measures being implemented; • “no-go” areas; • Clearing boundaries; and • Requirements of the SSDP. 	<p>Progressive rehabilitation of approximately 1,200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I).</p>	<p>Yes, the cumulative impact of clearing of vegetation in Good to Very Good condition in both the Roebourne and Hamersley subregions of the Pilbara is considered significant and will require offsets. This is outlined in Section 15.</p>
<p>Direct impact: loss of vegetation communities of significance.</p> <p>Clearing will remove approximately of 150.9 ha of potential GDVs.</p>	<p>The Proponent has revised the Haul Road DE to avoid the Tanpool Land Systems PEC including a minimum buffer of 100m from the Haul Road DE.</p> <p>The Proponent has revised the Haul Road DE from 25,930 to 16,209 ha to avoid impacts to significant vegetation communities.</p>	<p>Vegetation clearing at creek crossings will be minimised as far as practicable.</p> <p>Observers and spotters will be used when working near sensitive sites, e.g., near Priority flora, or when clearing boundaries may not be readily visible (for example due to dense vegetation).</p> <p>Induct relevant personnel and contractors on land disturbance and vegetation clearing management including:</p> <ul style="list-style-type: none"> • Significant vegetation and flora present in the Haul Road DE; • Key protection measures being implemented; • “no-go” areas; • Clearing boundaries; and • Requirements of the SSDP. 	<p>Progressive rehabilitation of approximately 1,200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I).</p>	<p>No</p>
<p>Direct impact: loss of conservation significant flora species.</p> <p>Clearing will remove up to 1,564 ha of native vegetation including Priority flora of conservation significance.</p>	<p>The Haul Road DE has been designed to avoid direct impacts individual Priority species, where possible.</p> <p>The haul road has also been designed to avoid direct impacts to higher density areas of <i>Abutilon</i> sp Onslow (P1) where possible.</p> <p>The Proponent will ensure clearing only occurs in approved disturbance areas and will avoid any clearing occurring outside of the Haul Road IF in accordance with the SSDP Procedure process outlined in the TEMP (Appendix H).</p>	<p>The Proponent has designed the Proposal to minimise impacts to Priority flora species.</p> <p>Observers and spotters will be used when working near sensitive sites, e.g., near Priority flora, or when clearing boundaries may not be readily visible (for example due to dense vegetation).</p> <p>Induct relevant personnel and contractors on land disturbance and vegetation clearing management including:</p> <ul style="list-style-type: none"> • Significant vegetation and flora present in the Haul Road DE; • Key protection measures being implemented; • “No-Go” areas; 	<p>Progressive rehabilitation of approximately 1,200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I).</p>	<p>No</p>

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
	The Proponent will conduct a pre-clearance site walkover with a qualified botanist to avoid conservation significant flora where practicable.	<ul style="list-style-type: none"> Clearing boundaries; and Requirements of the SSDP. 		
Indirect impact: Fragmentation of vegetation as a result of clearing	<p>The proposed clearing has been minimised as far as practicable to reduce the extent of clearing required.</p> <p>An SSDP Procedure will be used for all land clearing activities to avoid any clearing occurring outside of the Haul Road DE.</p>	Vegetation clearing shall be kept to the minimum amount required, as far as practicable.	N/A	No
Indirect impact: Degradation of vegetation as a result of altered hydrological regimes.	<p>The Proposal has been redesigned to avoid and/or minimise interactions with, and disturbance to, watercourses, riparian vegetation and flood plains.</p> <p>Proposed engineering controls and water management structures (i.e. culverts) will be installed to ensure natural hydrological regimes are maintained, particularly low flows and receding flows.</p> <p>Construction activities will target earthmoving activities for when inundation and surface water flows are not present and also to avoid periods of extreme high tides.</p> <p>Water crossings (bridges/culverts/overpasses) will occur over major Rivers and Creeks to avoid impacts to hydrological regimes.</p>	<p>Water management structures will be designed to minimise the degradation of water quality by sedimentation, erosion or chemical pollutants.</p> <p>Culverts and other crossing will be regularly inspected (i.e. annually or after flood events, whichever is more frequent) to ensure flows are unobstructed.</p> <p>Water crossings and borrow areas within floodplains will only be excavated when inundation and surface water flows are not present, and all disturbed areas will be stabilized, including rock protection at waterway crossings where flow velocities are likely to exceed 2 m/s, prior to the commencement of the next wet season.</p> <p>Sedimentation controls and onsite dumps will be designed to contain most stormwater runoff from site, minimizing offsite discharge.</p> <p>Any planned disturbance to watercourses shall be completed during dry, non-flow periods to minimise environmental impacts, where possible.</p> <p>Engineering controls and water management structures (e.g. culverts, bridges and burrows) will be installed and maintained as part of the Proposal design to maintain hydrological regimes, capture and infiltrate rainfall, minimise the degradation of water quality by sedimentation, erosion or chemical pollutants</p> <p>Disturbed areas (including borrow pits) will also be progressively rehabilitated in accordance with the Closure Strategy (Appendix I), minimizing the area of exposed surfaces.</p>	N/A	No
Indirect Impact: degradation of vegetation due to the introduction and/or spread of weeds.	<p>Weeds are currently present within the Haul Road DE.</p> <p>The Proponent will implement strict hygiene procedures to prevent spread of current weeds, introduction of new or additional populations of weed species in the Haul Road DE.</p>	<p>Weed and hygiene control measures will be implemented within the Haul Road DE and areas around the clearing front, including the inspection of all vehicles and machinery prior to entering or exiting the site during construction and operation.</p> <p>The Proponent will undertake a baseline weed survey 100 m with either side of the proposed Haul Road centerline, access tracks and borrow pits, prior to construction to determine species presence, extent and cover, particularly around primary vector spread sources (i.e., altered drainage lines, pastoral boundaries, and areas in proximity to the populated regional area of Onslow.</p> <p>Weed monitoring will be undertaken annually during construction and two years post-construction following rainfall in summer/autumn.</p> <p>Biennially during operation in areas containing WoNs and/ or high risk areas within Redhill Station and Pedemulla Station until the Proponent demonstrates</p>	Progressive rehabilitation of approximately 1,200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I).	No

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
		<p>that there has been no spread or increase of WoNs and/or high risk areas within Red Hill Station and Pedumulla Station.</p> <p>Weed surveys will also be undertaken prior to rehabilitation to inform post rehabilitation and closure monitoring.</p> <p>The Proponent will develop a weed management procedure with particular focus on Declared Pests and WoNS following establishment of baseline weed presence, to ensure that weed species' extent and cover do not increase compared to baseline. The procedure will include:</p> <ul style="list-style-type: none"> • Management of clearing activities, • Frequency and type of weed control (spraying and/or manual removal) and monitoring; • Establishment of reference sites; and • Potential thresholds criterion and contingency measures. 		
<p>Indirect impact: degradation of vegetation as a result of dust deposition</p>	<p>Vegetation clearing, grubbing and earthworks during high winds (>40 km/hr) will be avoided where possible.</p> <p>Complete avoidance of dust is not possible.</p> <p>Haul Road will be sealed upon completion of construction, so dust will only be an issue during construction phase of the Proposal.</p>	<p>The Proponent will implement dust controls including:</p> <ul style="list-style-type: none"> • Avoid any high dust emission works during high wind (e.g., vegetation clearing) and implement additional use of dust management measures (such as water carts and misting sprays) where these works are not avoidable. • Implement dust suppression measures including utilising water carts and misting sprays on unsealed roads and access tracks, cleared areas and at locations of high dust risk during construction. Measures will be implemented where dust is visible and based on predicted meteorological conditions. Water used for dust suppression will be sourced from nearby groundwater bores along the Haul Road alignment. • Where possible, all dust suppression equipment will be operated to ensure that no inadvertent saline water impact on adjacent vegetation, and roadside drains will be installed to catch any runoff. Any dust suppression requirements are expected to be limited and localised due to the linear nature of the development, and the progressive nature of construction and rehabilitation. • Utilise dust control strategies at the Port Facility such as bin covers, dust extractors, dust containment enclosures; dump pockets where / when dust is identified as an issue • Maintain any dust-generating material at the Port facility at Dust Extinction Moisture (DEM) levels (or slightly above to account for evaporative losses) • Vehicle movements at the Port facility are to be in accordance with PPA's Traffic Management Plan (Ashburton) and kept to established roads, flow paths and speed limits • Temporarily cleared areas will be progressively sealed or rehabilitated reducing the area of bare earth susceptible to dust lift off. 	<p>Progressive rehabilitation of approximately 1,200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I). This will minimise the extent of cleared areas.</p>	

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
		<ul style="list-style-type: none"> The Haul Road will be sealed to minimise dust emissions during operation. Implement Port Dust Management Procedure and Land Clearing Procedure Establish community complaints register to log when and the reason for complaints occurring. 		
<p>Indirect impact: degradation of vegetation as a result of contaminated water run-off/spills</p>	<p>Engineering controls and water management structures (e.g. culverts, bridges and burrows) will be installed and maintained as part of the Proposal to avoid potentially contaminated stormwater (e.g. runoff) entering the local environment.</p>	<p>The Proponent will implement the following measures:</p> <ul style="list-style-type: none"> Liquid wastes will be securely stored in bunded areas to contain leaks/spills from containers and if not treated or reused on site, to be removed off site by a licensed controlled waste carrier. Solid wastes stored and segregated in bins and skips (with lids) and to be removed off site by an appropriately licensed contractor. Surface water diversion structures will be designed, installed and managed to enable non-contaminated water to be directed around disturbed and construction areas. <p>Hydrocarbon and chemical storage areas located and stored appropriately, with signage in accordance with relevant legislation and Australian Standards (Appendix H).</p>	<p>Any contamination will be remediated in accordance with MinRes' Waste Management Procedure.</p>	<p>No</p>

9.6 Assessment and Significance of Residual Impacts

9.6.1 Direct Impacts

9.6.1.1 Loss of Native Vegetation Due to Clearing

The Proposal involves the clearing of up to 1,564 ha of native vegetation to enable the construction of the haul road and supporting infrastructure within the Haul Road DE. Proposed vegetation clearing within the Haul Road DE represents nine Beard (1975) vegetation associations. At a regional and subregional scale, the percentage impact to the pre-European extent of these vegetation associations as a result of the Proposal is only 1.8% (**Table 9-10**). As a result, implementation of the Proposal will **not** result in a significant residual impact on the vegetation associations across the Carnarvon and Pilbara bioregions.

Of the forty eight vegetation types within the Haul Road DE, approximately 90% and 94% of vegetation will be retained within the broader Haul Road DE and the 360 Environmental (2022b) Terrestrial Survey Area, respectively.

Given flexibility of the footprint within the Haul Road DE, specific amounts of clearing within each vegetation type may change slightly. However, there are no TEC or PECs in the Haul Road DE and vegetation that has been assessed as locally restricted, is still widespread in the surrounding areas. Therefore, regardless of where within the Haul Road DE the final disturbance area is implemented (within the authorised extent limit), implementation of the Proposal is **unlikely** to result in a significant impact on these vegetation types.

The Proposal will result in clearing of native vegetation predominantly in Very Good condition (approximately 1120.6 ha), as well as the direct loss of native vegetation considered to be in Good condition (approximately 398.1 ha) and Excellent condition (approximately 2.5 ha). Given flexibility in the footprint within the Haul Road DE, the specific area of clearing of each vegetation condition may change slightly. This impact is not considered significant by itself however, the cumulative loss of clearing in the Pilbara bioregion is recognised by the EPA as a significant residual impact therefore, clearing of vegetation in good to excellent condition in the Hamersley subregion will be offset in accordance with EPA requirements (**Section 15**).

9.6.1.2 Loss of Conservation Significant Vegetation Communities

At a local scale, the Proposal will clear up to 1,564 ha of native vegetation across forty four mapped vegetation communities (**Table 9-11**).

No conservation significant vegetation communities (TECs or PECs) occur within the Haul Road DE. One Priority 1 PEC, the Tanpool Land System, occurs 660 m north of the Haul Road DE and has purposefully been avoided in the planning for the Proposal.

Approximately 150.9 ha of vegetation types representing potential GDVs will be cleared, representing approximately 6.5% of the extent mapped within the Haul Road DE (**Table 9-13**). Even with project flexibility, the alignment of linear infrastructure will minimise impact and at least 90% of these vegetation types would remain in the Terrestrial Survey Area. As a result, this loss is **not** considered a significant residual impact.

9.6.1.3 Loss of Conservation Significant Flora Species

Given the flexibility of the haul road alignment, implementation of the Proposal may result in clearing of individuals from six Priority flora species as summarised in **Table 9-14**.

***Abutilon* sp. Onslow (F. Smith s.n. 10/9/61) (P1)**

The local known occurrence of *Abutilon* sp. Onslow occurs within a portion of the western extent of the Haul Road DE (**Figure 9-42**). An estimated map of the density of individuals was produced within the *Abutilon* sp. Onslow Survey Area utilising targeted searches and aerial estimates.

The *Abutilon* sp. Onslow Survey Area covers an area of 9,696 ha, of which 2,016 ha occurs in the Haul Road DE and 117 ha occurs within the Haul Road IF.

Even with project flexibility, the alignment of linear infrastructure will minimise impact to high density areas of this species (**Figure 9-42**).

A maximum of:

- 3.5 ha (5.1%) of the density bracket 501-1000 plants per 2,500 m² will be cleared.
- 50.2 ha (7%) of the density bracket 201 - 500 plants per 2,500 m² will be cleared; and
- 124.3 ha (10%) of the density bracket 51 - 200 plants per 2,500 m² will be cleared.

Given the low number of individuals in the two lowest density brackets (<50 plants per 2,500 m²), and the extent of these low density areas occurring outside of the Haul Road DE (**Figure 9-42**), no limit has been attributed to these.

To provide an approximation of the estimated total number of individuals within the *Abutilon* sp. Onslow Survey Area, as well as the Haul Road IF, estimated species numbers were calculated using the midpoint of each density bracket (e.g., 5 for 1-10). Using this calculation approximately 2,310,000 were estimated to occur within the *Abutilon* sp. Onslow Survey Area and 63,000 (2.7%) within the Haul Road IF. Although these projections are far greater than the number of known individuals recorded from survey effort, this species is considered to be a locally common species with the predicted extent far greater than current records (360 Environmental 2022b).

Database searches for this taxon returned 12 locations, dating back to 1996, noting that the abundance was sometimes very high, with 'in excess of 1,000 plants recorded with numerous juveniles and seedlings noted following the above average rainfall', mirroring the results of this survey (360 Environmental 2022b).

As a result of implementation of the Proposal, the alignment of the Haul Road DE purposefully **avoids** clearing within higher density brackets of this species as much as possible. The Proposal is **unlikely** to represent a significant impact to this species.

***Euphorbia inappendiculata* var. *inappendiculata* (P2)**

Two known individuals of this species occur within the Haul Road DE. However, there are no individuals recorded within the Haul Road IF (**Figure 9-43**). To allow for flexibility, the number of known individuals to be cleared as a result of this Proposal is uncertain; however, given the small numbers of these species occurring within the Haul Road DE and given there are 11 records of this species in DBCA databases that occur beyond the Terrestrial Survey Area, this impact is **not** considered to be a significant residual impact.

***Eremophila forrestii* subsp. *viridis* (P3)**

1,067 known individuals of this species have been recorded within in the Terrestrial Survey Area, 875 known individuals in the Haul Road DE and three individuals within the Haul Road IF (**Figure 9-44**). To allow for flexibility, the Proponent commits to clearing no more than 5% of known individuals of this species in the Terrestrial Survey Area. Given the avoidance of impacts to 95% of individuals in the Terrestrial Survey Area and the occurrence of populations that extend beyond the Terrestrial Survey Area, this impact is **not** considered to be a significant residual impact.

***Indigofera rivularis* (previously known as *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301)) (P3)**

13 known individuals of this species have been recorded within the Terrestrial Survey Area and 12 known individuals in the Haul Road DE. All 12 individuals within the Haul Road DE are located within the Haul Road IF (**Figure 9-45**). To allow for flexibility, the number of known individuals to be cleared as a result of this Proposal is uncertain. However, given the small numbers of these species occurring within the Haul Road DE and given the occurrence of 1,626 known individuals recorded approximately 100 km north-west of the Haul Road DE, this impact is **not** considered to be a significant residual impact.

***Owenia acidula* (P3)**

17 known individuals of this species have been recorded within the Terrestrial Survey Area, all of which occur within the Haul Road DE. An additional 100 individuals have been recorded adjacent to the Terrestrial Survey Area. No individuals are found within the Haul Road IF (**Figure 9-46**). Given that all records within the Haul Road

DE are along the boundary, away from the Haul Road IF, the Proponent commits to no clearing of any known individuals of this species. Given the avoidance of impacts to all known individuals in the Haul Road DE and Terrestrial Survey Area, this impact is **not** considered to be a significant residual impact.

***Solanum* sp. Red Hill (S. van Leeuwen et al. PBS 5415) (P3)**

One known individual of this species has been recorded within the Terrestrial Survey Area. This individual was recorded within the Haul Road DE and outside of the Haul Road IF (**Figure 9-47**). Despite targeted searches in the area, no additional records of the species were located. The species is known to occur in rocky gullies of large hills and ranges, which is not consistent with the habitat the individual was recorded in within the Haul Road DE. Furthermore, the recorded individual was considered to be in poor condition, indicating unfavourable habitat and conditions. It is considered likely that seed from the Hamersley range to the east has been washed down into the area. Given that the habitat in which the species was located within the Haul Road DE is not typical for *Solanum* sp. Red Hill (S. van Leeuwen et al. PBS 5415), the removal of this individual is **not** considered to be a significant residual impact.

***Goodenia nuda* (P4)**

166 known individuals of this species have been recorded within the Terrestrial Survey Area, 48 of which occur within the Haul Road DE Haul Road DE and no individuals are found within the Haul Road IF (**Figure 9-48**). To allow for flexibility, the Proponent commits to clearing no more than 5% of known individuals of this species in the Terrestrial Survey Area. Given the avoidance of impacts to 95% of individuals in the Terrestrial Survey Area and the occurrence of 9,735 individuals in the Pilbara bioregion, this impact is **not** considered to be a significant residual impact (Fortescue Metals Group 2018).

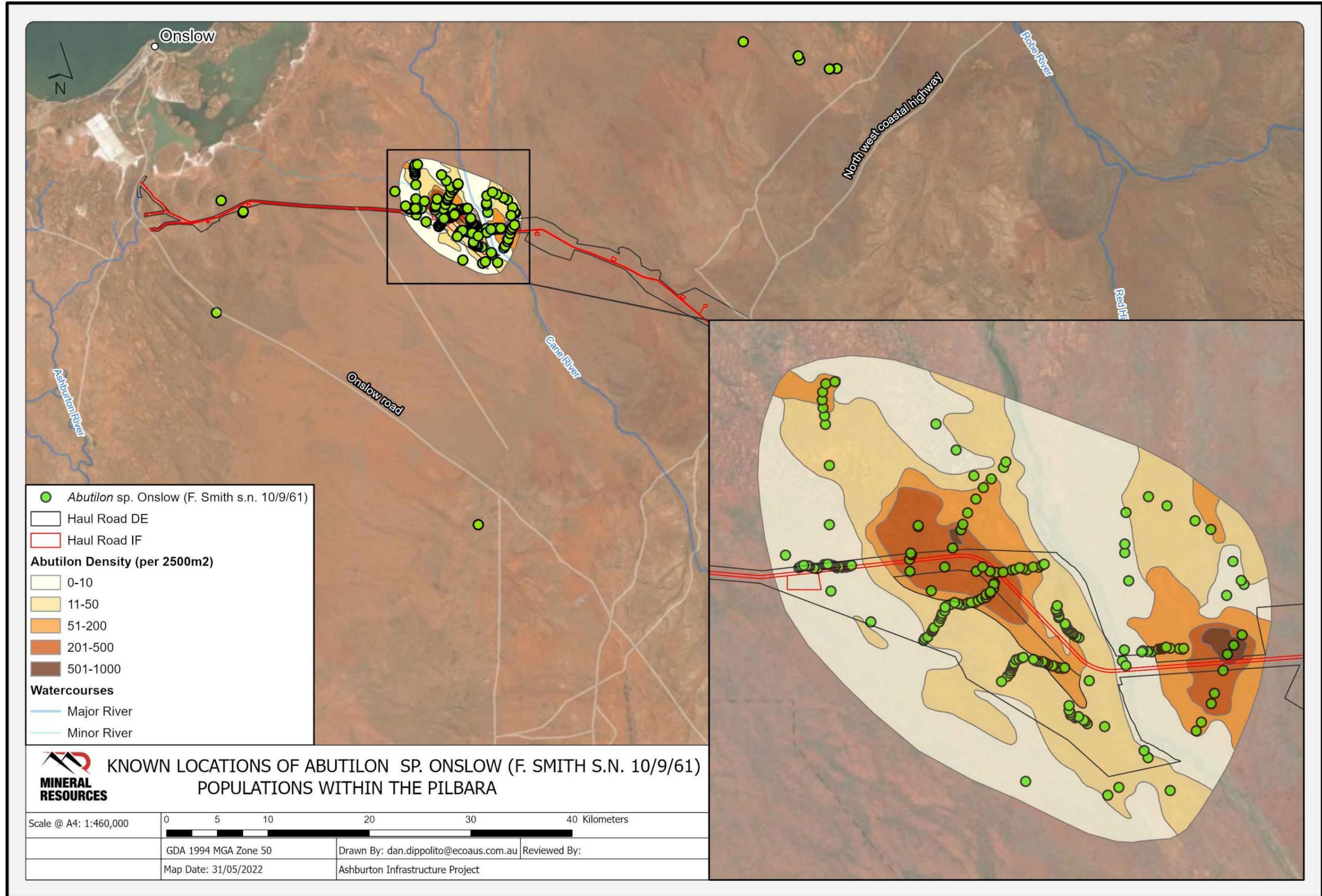


Figure 9-42: Extent of Known *Abutilon* Sp. Onslow (F. Smith S.N 10/9/61) Populations within the Pilbara

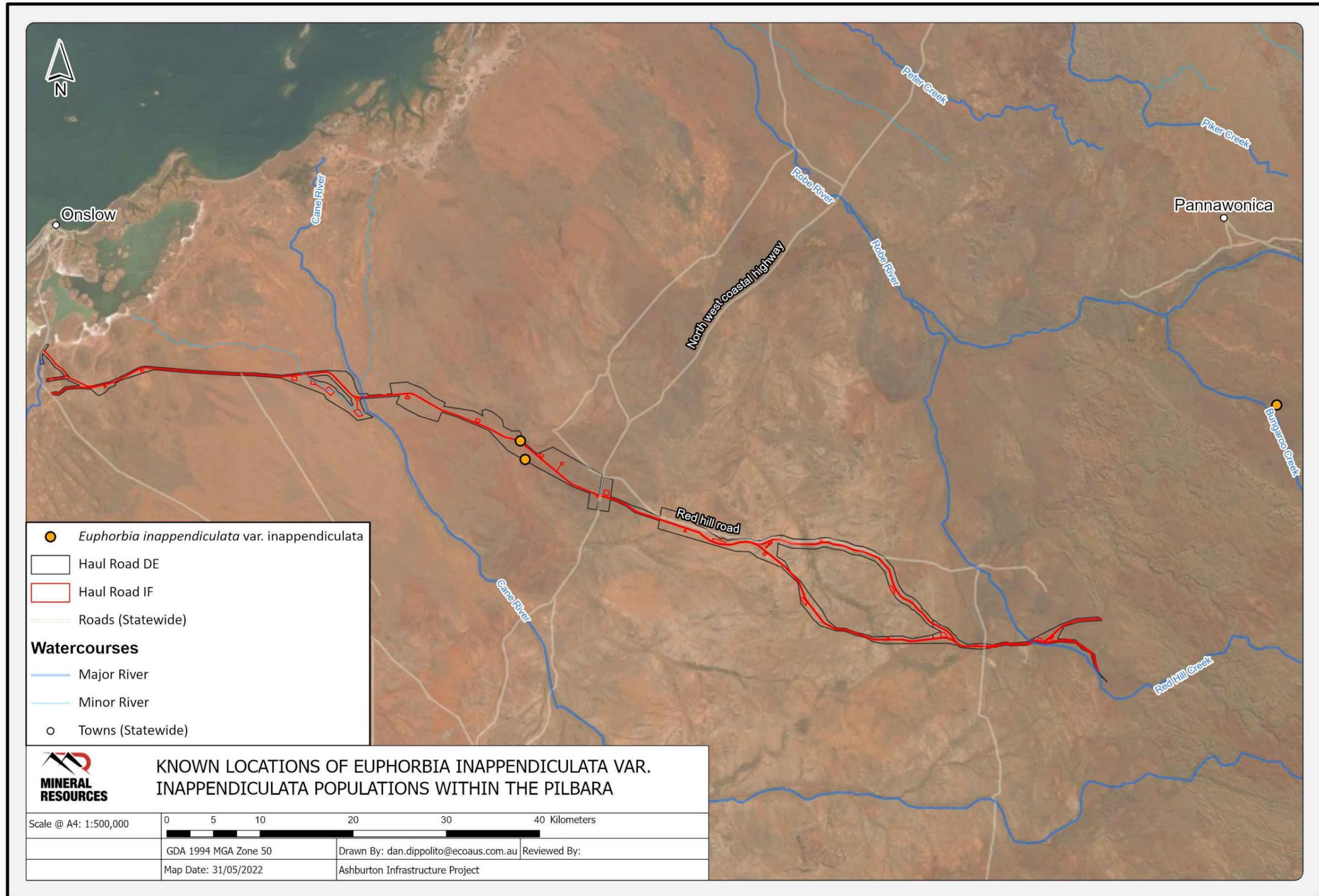


Figure 9-43: Extent of known *Euphorbia inappendiculata* var. *inappendiculata* populations within the Pilbara

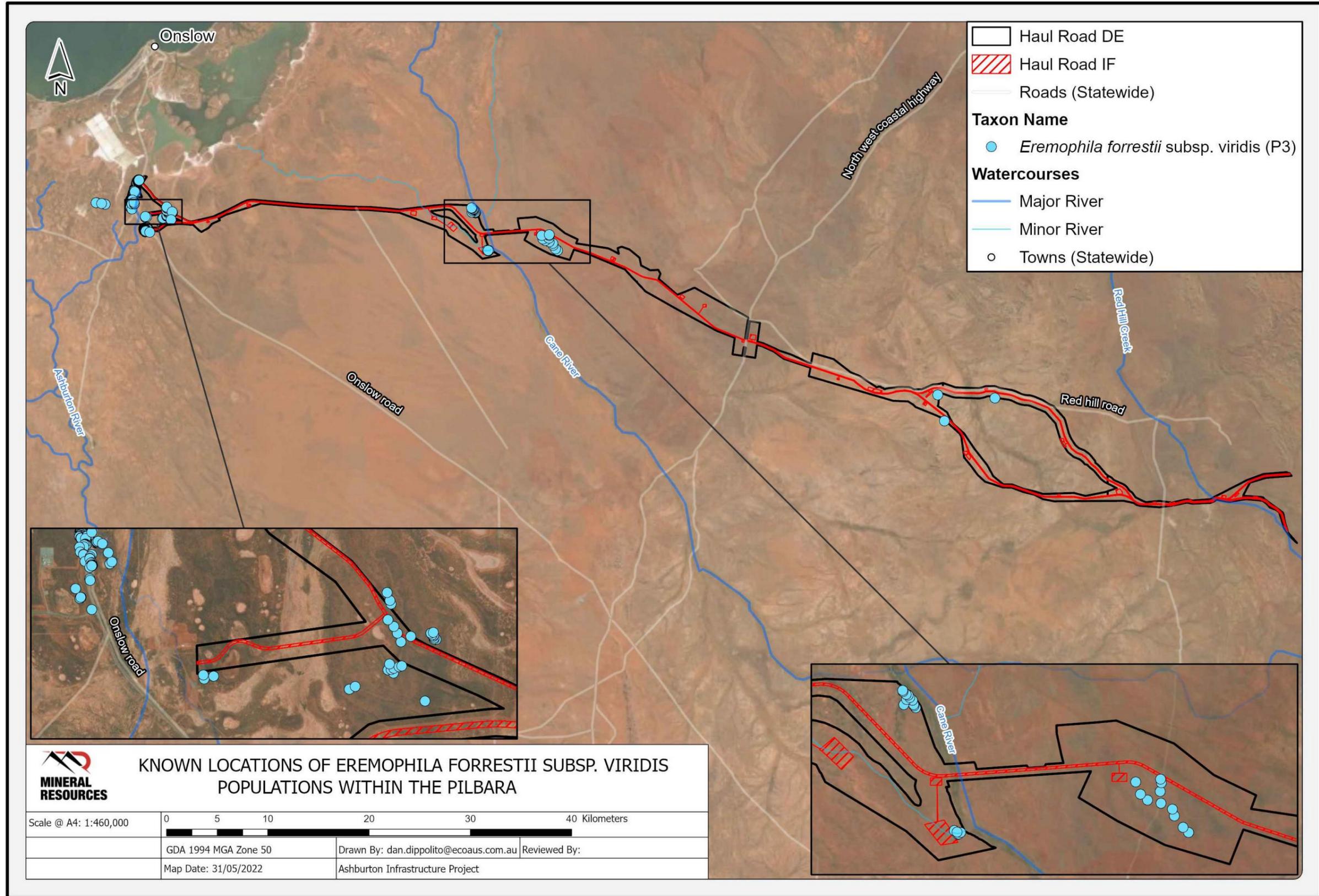


Figure 9-44: Extent of known *Eremophila Forestii* Sub Sp. *Viridis* populations within the Pilbara

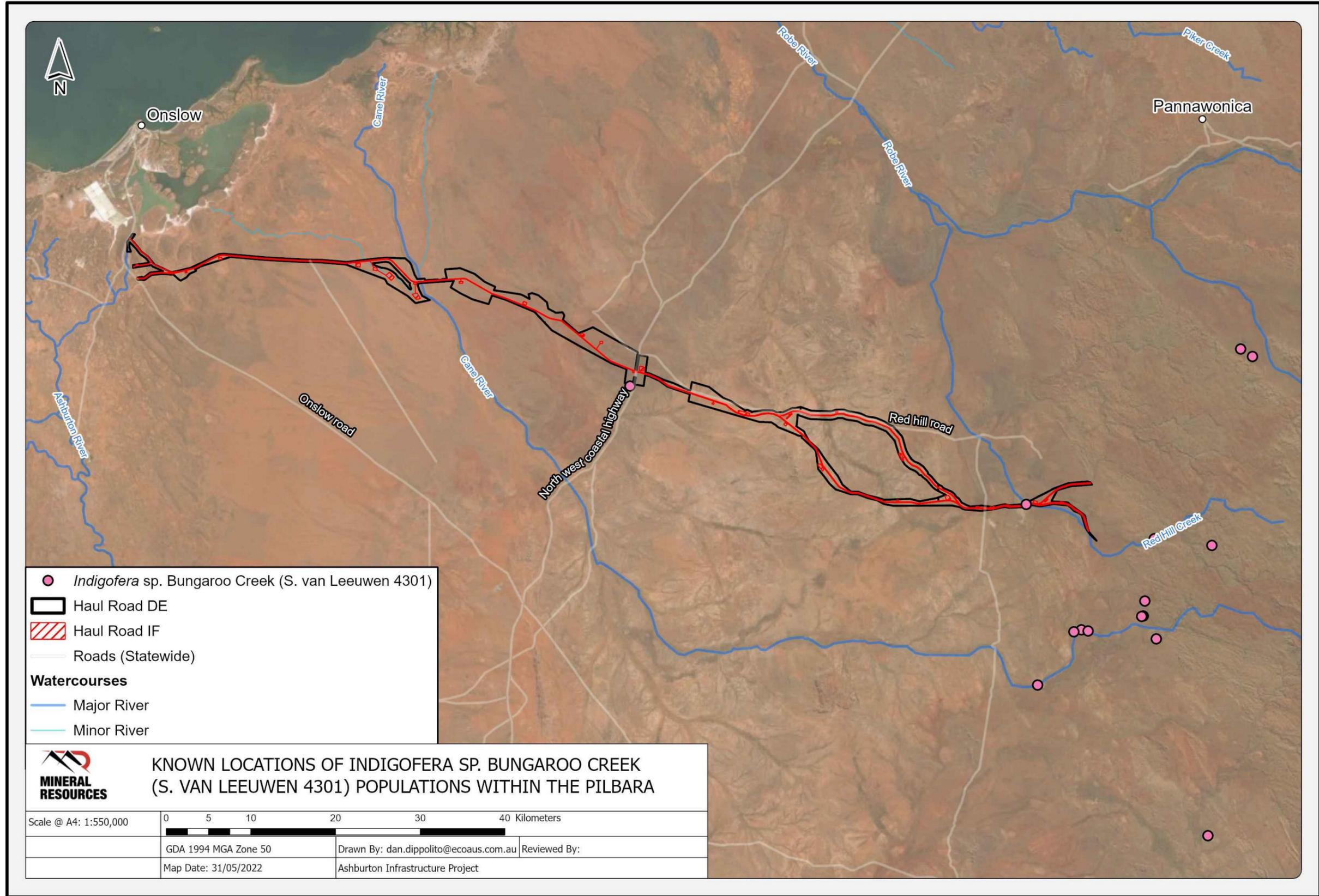


Figure 9-45: Extent of known *Indigofera rivularis* Populations within the Pilbara

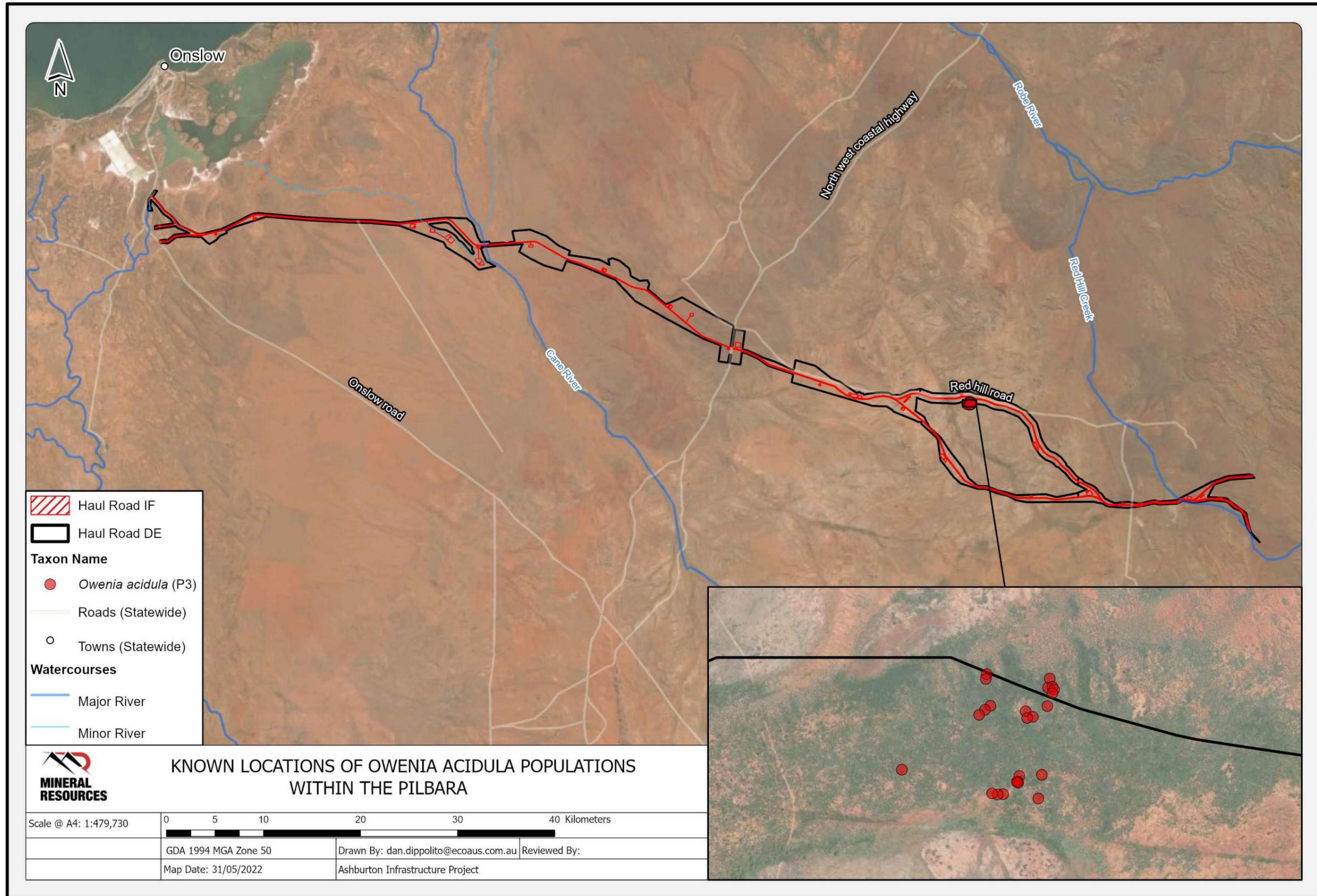


Figure 9-46: Extent of known *Owenia acidula* within the Pilbara

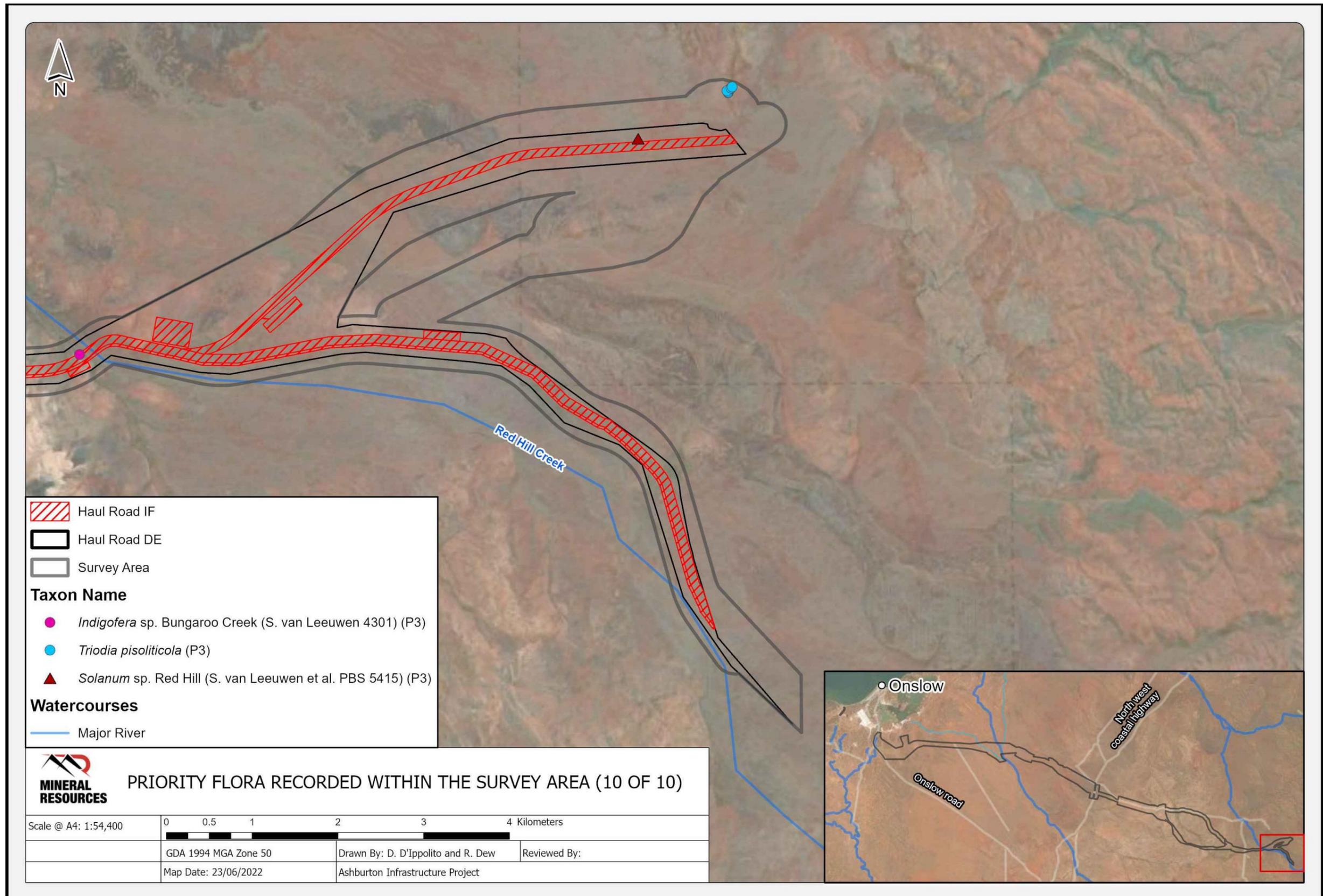


Figure 9-47: Extent of known *Solanum* sp. Red Hill (S. van Leeuwen et al. PBS 5415) within the Pilbara

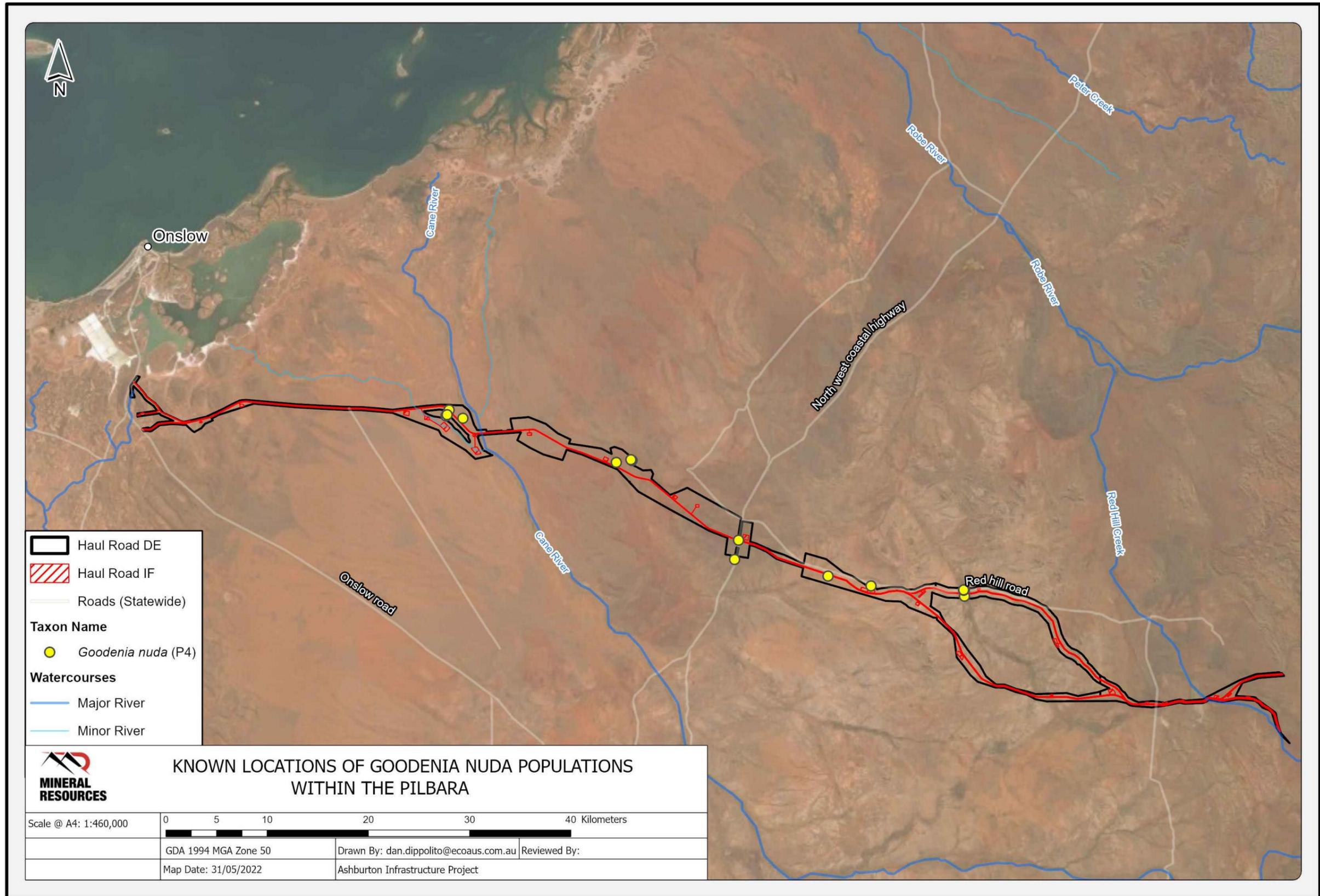


Figure 9-48: Extent of known *Goodenia nuda* Populations within the Pilbara

9.6.2 Indirect Impacts

9.6.2.1 Fragmentation as a Result of Clearing

Clearing of up to 1,564 ha of native vegetation for the construction of the Proposal and the placement of linear infrastructure has the potential to result in the fragmentation of vegetation. Fragmentation occurs when the continuity of vegetation is disrupted and reduced into a smaller number of patches. The spatial and temporal isolation of patches can lead to a decline in biodiversity due to a reduced ability for flora species recruitment, which can result in an altered community structure.

It is considered that the narrow and linear nature of the proposed haul road and infrastructure corridor is **not** sufficient to cause significant fragmentation of native vegetation. In addition, native vegetation within the IF is well represented within the wider Haul Road DE and Terrestrial Survey Area.

9.6.2.2 Degradation or Alteration of Vegetation as a Result of Altered Hydrological Regimes

Creeklines within the Pilbara are naturally dry and experience ephemeral flows in response to rainfall events. The installation of infrastructure and development of borrow pits has the potential to alter surface water regimes in the Haul Road DE, which could result in altered or degraded vegetation condition. The Proponent has designed the haul road and associated infrastructure to avoid, and where not possible, minimise impacts to surface water regimes (**see Section 11**). Proposed engineering controls and water management structures (i.e., culverts, bridges and burrows) will be installed to maintain current hydrological regimes, capture and infiltrate rainfall, and minimise the degradation of water quality by sedimentation, erosion or chemical pollutants. **No** significant residual impacts on creekline vegetation are expected as a result of changes to hydrological regimes.

9.6.2.3 Introduction and/or Spread of Weed Species

Clearing, vehicle and machinery movements have the potential to increase the spread and / or introduce weed species. Weeds are often able to rapidly invade locations due to disturbance, land clearing and / or altered hydrological regimes. Sixteen weed species have been recorded within the Haul DE. One species, *Prosopis pallida*, is listed as Declared Pests and WoNS (360 Environmental 2022b).

The Proponent will implement a TEMP and has established weed and hygiene management measures to reduce the risk of existing weeds being spread or new weeds being introduced into the Haul Road DE (**Appendix H**). Weed control measures will be implemented within the Haul Road DE, as well as in areas around the clearing front and in retained native vegetation adjacent to cleared areas, as outlined in **Table 9-16**. The proponent will undertake a baseline weed survey 100 m with either side of the proposed Haul Road centreline, access tracks and borrow pits, prior to construction to determine species presence, extent and cover, particularly around primary vector spread sources (i.e., altered drainage lines, pastoral boundaries, and areas in proximity to the populated regional area of Onslow). The Proponent will develop a weed management procedure with particular focus on Declared Pests and WoNS following establishment of baseline weed presence, to ensure that weed species' extent and cover do not increase compared to baseline during either construction or operation. The procedure will include the following as detailed in the TEMP (**Appendix H**):

- Frequency of weed control (at least annual; vehicle hygiene);
- Establishment of reference sites; and
- Contingency measures.

To manage weed spread during both construction and operation, vehicle inspection checkpoints will be established. Check points during construction have been designed to consider pastoral boundaries and major watercourses. Check points during operation will be established at the first entry point to the Project area at the Haul Road and access road, from the more populated regional area of Onslow. Vehicles will be inspected and washed down (if required) as dedicated areas detailed in the TEMP to avoid the spread of weeds. Plant material will be disposed of at appropriate waste receptacles.

On this basis, the Proposal is **unlikely** to significantly impact the condition of native vegetation through the spread or introduction of weed species. Any impacts are predicted to be localised to disturbed areas and will have no

impact on vegetation in surrounding areas. As a result, no significant residual impacts on vegetation condition from spread of weeds are expected from the Proposal.

9.6.2.4 Degradation of Vegetation through Increased Dust Deposition

During construction, the Proposal will result in dust emissions from clearing for the Haul Road. During operations, the Proposal has been designed to limit the potential for dust emissions by sealing the haul road. Construction of the haul road is expected to be completed within one year, during which time dust will be effectively managed using standard dust suppression techniques (as per TEMP). Temporary construction areas will be progressively rehabilitated to reduce bare open areas. This is further discussed in **Section 14.2**. The Proposal may result in a minor, temporary increase in localised dust deposition on vegetation during construction but is **unlikely** to significantly impact vegetation. Dust emissions during operation are expected to be minimal.

Mitigation measures for the creation of dust from Port facilities are within the within the DWER Guidelines for dust management at construction sites (DWER 2021a). Key mitigation measures include:

- Sealing all major roads within the Landside DE;
- Utilise dust control strategies such as water carts, misting sprays, bin covers, dust extractors, dust containment enclosures; dump pockets where / when dust is identified as an issue;
- Ensuring vehicle movements at the Port facility are to be in accordance with PPA's Traffic Management Plan (Ashburton) and kept to established roads, flow paths and speed limits;
- Ensuring that ore in-loading into hoppers will take place in a semi-enclosed tipping station;
- Delivering ore at or above the 6.5% dust extinction moisture level;
- Establish community complaints register to log when and the reason for complaints occurring;
- Implement Port Dust Management Procedure and Land Clearing Procedure; and
- Maintaining the product storage/reclaim building at negative internal pressure using baghouse dust collectors.

As a result, no significant residual impacts from dust generation on native vegetation are expected from the Proposal.

9.6.3 Cumulative Impacts

Potential cumulative impacts of the Proposal to flora and vegetation are associated with the clearing of native vegetation and Priority flora species.

9.6.3.1 Loss of Native Vegetation due to Clearing

Clearing of vegetation during construction of the Proposal will result in the loss of vegetation within the Haul Road DE. However, The Proposal is a linear infrastructure project and therefore only small portions of each vegetation type will be cleared, with most vegetation values being retained in surrounding areas.

Detailed vegetation mapping has been completed for the Haul Road DE, however, is not available for the Carnarvon and Pilbara bioregions more broadly. Projects described in **Section 2.3.4** that we have been able to obtain detailed vegetation mapping include:

- MRWA Warrirra Road Corridor Project.
- MinRes' Onslow Camp Dunes Project.
- PPA Eastern Port Precinct.

The MRWA Warrirra Road Corridor Project area was by Spectrum (2021). A comparison of vegetation types mapped in the Haul Road DE and the MRWA Warrirra Road Corridor Project has been undertaken by 360

Environmental (2021c). The MRWA Project will add to the linear infrastructure in the western extent of this Proposal providing access to the Port. The vegetation types within the Onslow Camp Dunes Project were surveyed as part of the 360 Environmental (2022b) Terrestrial Survey Area undertaken for this Proposal.

The vegetation types delineated in the EPP (within the Landside DE) have no affinity between the vegetation types within the Haul Road DE. This was confirmed by an assessment of species assemblages. Additionally, none of the vegetation types in the EPP are considered to be groundwater dependent (O2 Marine 2021e; Vicki Long & Associates 2020). The MRWA Warrirda Road Corridor Project and Onslow Camp Dunes Project will directly lose vegetation types that will be impacted as part of this Proposal.

Table 9-17 shows the cumulative impact of vegetation loss to specific vegetation types. The potential cumulative impact on specific vegetation types is a small proportion of the surveyed extent of these vegetation types, and they extend beyond the Terrestrial Survey Area.

Based on the below predicted impacts, clearing will not exceed 40% of the known extent of each vegetation type mapped (**Table 9-17**; 360 Environmental 2022b and Spectrum 2021). However, none of these vegetation types are of conservation significance or restricted in distribution, and all are expected to extend beyond the areas of survey effort. There are no vegetation types considered to be of high significance within the clearing extent of the MRWA Warrirda Road Corridor Project or Onslow Camp Dunes Project. As a result, there will be no cumulative pressure on the higher significance vegetation types (GDV's) within the Haul Road DE. As a result, this cumulative impact is **not** considered significant.

Detailed vegetation mapping is not publicly available for the remainder of the projects described in **Section 9.4.3**. Therefore, the total area of native vegetation cleared in each bioregion has been utilised to identify and assess the potential quantitative cumulative vegetation loss from the remaining existing and reasonably foreseeable projects in the regions. The predicted extents of impacts from the Proposal, existing and reasonably foreseeable projects are provided in **Table 9-18**.

Table 9-17: Proposed cumulative clearing on vegetation types (Spectrum 2021, 360 Environmental 2021c)

Vegetation Type	Known Extent (ha)*	Extent to be Cleared as Part of this Proposal (ha)	Extent to be Cleared as Part of MRWA Warrirda Road Corridor Project (ha)	Extent to be Cleared as Part of the Onslow Camp Dunes Project (ha)	Total Cumulative Clearing (ha)	Proportion of Known Vegetation Types to be Cleared (%)*
CT03	1,184.1	31.9	15.44	18.94	66.3	5.6
CT05	69.6	0.3	26.51	-	26.8	38.5
DS01	1,477.9	30.1	77.14	35.54	142.8	9.7
DS03	714.0	17	108.29	34.9	160.2	22.4
CT07	96.0	3.4	13.16	0.1	16.7	17.4

*Known extent has been calculated based off the totals of each vegetation type within both the 360 Environmental 2022b and Spectrum 2021 surveys.

Table 9-18: Cumulative Vegetation Clearing from Foreseeable Future Projects in Proximity to the Proposal

Project	Proposed Extent of Native Vegetation Disturbance (ha)
Pilbara	
Existing Projects	
Ashburton Salt Project	18,005
Bungaroo South	2,203
Pilbara Regional Waste Management Facility	70.0
Ashburton River Sand and Shingle Excavation	68
West Pilbara Iron Ore Project Stage 1	9,453
West Pilbara Iron Ore Project Stage 2	3,470
Onslow Marine Support Base Stage 2 Capital Dredging	20
Pilbara Total	33,289
Current extent of vegetation within the Pilbara bioregion	17,731,764
Carnarvon	
Existing Projects	
Macedon Gas Plant	516
Wheatstone LNG Project	3,300
Onslow Water Infrastructure Upgrade Project	Less than 100
Onslow Seawater Desalination Plant	8
Onslow Village	21
Onslow Camp Dunes Project	133
Reasonably Foreseeable Projects	
Onslow Rare Earth's Plant	85
MRWA Warrirda Road Corridor Project	303
PPA Eastern Port Precinct	26
The Proposal	152
Carnarvon Total	4644
Current extent of vegetation within the Carnarvon bioregion	8,360,801

The current extent of vegetation within the Carnarvon bioregion accounts for an area of 17,731,764 ha within WA (Kendrick and Mau 2002). Based on the above predicted impacts, the cumulative impact will contribute to approximately 0.05% of the vegetation clearing in the Carnarvon bioregion (**Table 9-18**). The current extent of

vegetation within the Pilbara bioregion accounts for an area of 8,360,801 ha within WA (Kendrick and Mau 2002). Based on the above predicted impacts, the cumulative impact will contribute to approximately 0.19% of the vegetation clearing in the Pilbara bioregion (**Table 9-18**). As a result, the Proposal will **not** contribute to any significant cumulative impacts associated with clearing in the Pilbara and Carnarvon bioregion.

9.6.3.2 Loss of conservation significant flora due to clearing

Each of the projects outlined in **Section 2.3.4** were assessed for any impacts to the Priority flora species with the potential to be impacted by this Proposal. Two Priority flora species with the potential to be impacted by this Proposal will be impacted cumulatively by other projects nearby as summarised in **Table 9-19**.

Table 9-19: Cumulative Impact on Priority Flora Species (Chevron 2010a; Strategen 2012, Spectrum 2021)

Status	Species	Project	No. of Individuals	No. of known Individuals	Proportion of Known Individuals
P3	<i>Eremophila forrestii</i> subsp. <i>viridis</i>	Proposal	3 (Up to 53 maximum)	4,995*	22.8
		Wheatstone LNG Project	12 locations ¹		
		Onslow Rare Earths	Unknown**		
		MRWA Warrida	1,073		
P3	<i>Indigofera rivularis</i> (previously known as <i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301))	Proposal	12	1,626*	1.8
		Bungaroo South	18 ²		
		West Pilbara Iron Ore Project Stage 1 & 2	Unknown**		

*Number of known individuals taken from targeted searches (ELA 2021 and 360 Environmental 2022b)

**Number of known individuals to be impacted has not been quantified

¹number of individuals has not been quantified for this Proposal, however individuals were recorded to cover less than 1% of the Proposal area

²this number of individuals has been extrapolated from Figure 8 the supporting information report from Strategen (2012)

Any projects listed in **Table 9-18** that are not included in **Table 9-19**, have no predicted impacts to conservation significant flora species that are proposed to be potentially impacted by this Proposal. Approximately 22.8% of known *Eremophila forrestii* subsp. *viridis* individuals will be removed from the region (following the Proposal). The known extent of this species has been calculated based off three surveys undertaken within vicinity of the Proposal and does not account for the potential range of the species throughout the Pilbara more broadly (ELA 2021 and 360 Environmental 2022b). As a result, this cumulative impact is **not** considered significant.

Cumulatively, impacts to *Indigofera rivularis* (previously known as *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301)) will be less than 2% and is **not** considered to be significant as the known occurrence of the species extends approximately 100 km north-west of the Haul Road DE and is considered to exist more widely in the region.

9.7 Environmental Outcomes

The outcomes of the assessment of potential impacts and proposed mitigation measures to protect environmental values associated with flora and vegetation meet the EPA's objective for this factor. The predicted environmental outcomes for flora and vegetation are summarised below:

- Clearing of up to 1,564 ha of native vegetation comprising:
 - Approximately 2.5 ha in Excellent condition;
 - Approximately 1120.6 ha in Very Good condition; and
 - Approximately 398.1 ha in Good condition.
- Vegetation types considered to be potential GDVs will be limited to clearing of up to 10% of the mapped extent of GDVs within the Terrestrial Survey Area;
- Impacts to surface water regimes will be negligible, with appropriate implementation of avoidance and minimisation measures;
- Spread of weeds, dust deposition and contamination are expected to be managed within the Haul Road DE with the application of standard weed, dust and waste management measures as outlined in the TEMP. As a result, the Proposal is **unlikely** to significantly alter the condition of vegetation in the Haul Road DE; and
- No listed Threatened flora species, TECs or PECs are present within the Haul Road DE.

Allowing for flexibility, **Table 9-20** outlines the maximum assessed loss of Priority flora. This includes allowance for project flexibility in the final footprint. There are no maximum case limit set for *Euphorbia inappendiculata* var. *inappendiculata*, *Indigofera rivularis* (previously known as *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301)) or *Solanum* sp. Red Hill (S. van Leeuwen et al. PBS 5415) given the small numbers present within the Haul Road DE.

Table 9-20: Maximum and Most Likely Case Scenarios for Priority Flora Loss as a Result of the Proposal

Status	Priority species	Maximum case Scenario
Priority1 (P1)	<i>Abutilon</i> sp. <i>Onslow</i> (F. Smith s.n. 10/9/61)	Loss of 3.5 ha of the density bracket 501-1000 plants per 2,500 m ² Loss of 50.2 ha of the density bracket 201 - 500 plants per 2,500 m ² Loss of 124.3 ha of the density bracket 51 - 200 plants per 2,500 m ²
Priority3 (P3)	<i>Eremophila forrestii</i> subsp. <i>viridis</i>	Loss of up to 5% in the Terrestrial Survey Area
Priority4 (P4)	<i>Goodenia nuda</i>	Loss of no more than 5% of known individuals in the Terrestrial Survey Area.

Impacts to Priority flora species are **unlikely** to be significant nor are they expected to result in a change to their conservation status.

The significant residual impacts, after the implementation of the mitigation hierarchy, is clearing of up 846.1 ha of native vegetation in Good to Excellent condition in the Hamersley subregion. Environmental Offsets are proposed for the clearing of native vegetation and are discussed in **Section 15**.

Therefore, the Proponent considers the Proposal can be managed to meet the EPA’s objective for flora and vegetation.

10. TERRESTRIAL FAUNA

10.1 EPA Objective

The EPA's objective for terrestrial fauna is to: '*Protect terrestrial fauna so that biological diversity and ecological integrity are maintained*' (EPA 2016g).

10.2 Policy and Guidance

The Proponent has considered published policy and guidance relevant to this factor, as summarised in **Table 10-1**. Species-specific policy and guidance are described for each relevant species in **Section 10.3.3**.

Table 10-1: Policy and Guidance for Terrestrial Fauna

Policy / Guidance	Consideration
Instructions on how to prepare an Environmental Review Document (EPA 2020b)	This RSD has been prepared in accordance with the Instructions.
Statement of Environmental Principles, Factors and Objectives (EPA 2020e)	Impacts of the Proposal have been assessed against the EPA objective for all relevant factors.
Instructions on how to prepare <i>Environmental Protection Act 1986</i> Part IV Environmental Management Plans (EPA 2020c)	The attached TEMP has been prepared in accordance with this guidance.
Environmental Factor Guideline – Terrestrial Fauna (EPA 2016g)	The information provided in this chapter addresses the 'considerations for environmental impact assessment' listed in this document.
Technical Guidance Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020i)	This document guides the appropriate obtainment and collation of terrestrial fauna data to be used in EIA. All studies conducted for the Proposal are in accordance with this guidance document.
Technical Guidance Sampling of short-range endemic invertebrate fauna (EPA 2016h)	The offset policy and guidelines have been considered concerning the definition of significant residual impacts and the proposed offset strategy.
Government of Western Australia (2011) <i>WA Environmental Offsets Policy</i> (Gov of WA 2011)	This RSD has been prepared in accordance with the Instructions. The offset policy and guidelines have been considered concerning the definition of significant residual impacts and the proposed offset strategy.
Government of Western Australia (2014) <i>WA Environmental Offsets Guidelines</i> (Gov of WA 2014)	

10.3 Receiving Environment

10.3.1 Environmental Studies

Several ecological surveys have been undertaken within and surrounding the Haul Road and Landside DEs, enabling a detailed understanding of the existing fauna values.

A basic terrestrial vertebrate fauna survey was undertaken in June 2020 followed by detailed and targeted conservation significant terrestrial vertebrate fauna surveys, which were undertaken in October 2020, April 2021, and June 2021 (360 Environmental (2021b)). An additional study was completed by 360 Environmental (2022a)

which covered 3,418 ha within the Haul Road DE, which was unable to be surveyed previously due to access restrictions.

The key fauna studies completed by 360 Environmental (2021b, 2022a) consolidates previous and historical survey data, along with database searches and on-ground survey work to provide an overview of the fauna assemblages of the Haul Road DE and immediate surroundings. The studies include recorded and possibly occurring conservation significant fauna and SRE invertebrate fauna (360 Environmental 2022a).

The Terrestrial Survey Area covers 26,999 ha, which encapsulates the whole of the Haul Road DE (16,210 ha) in addition to surrounding areas (360 Environmental 2021b, 2022a) (the Terrestrial Survey Area; **Figure-10-1** and **Figure-10-2**).

The spatial extent of studies and surveys completed for the terrestrial fauna factor is shown in **Figure-10-1** and **Figure-10-2** is described further in **Table 10-2**.

Table 10-2: Studies for Terrestrial Fauna

Studies and Surveys	Area	Scope and Timing	Survey/study effort	Consistency with guidance and limitations
<p>360 Environmental 2021b</p> <p>Vertebrate Fauna and Short-Range Endemic Invertebrate Fauna Assessment</p> <p>(Appendix T)</p>	<p>Ashburton Infrastructure Project</p> <p>Survey Area: Approximately 30,238 ha (includes the haul road alignment, buffer and associated borrow pit areas).</p> <p>Includes 3,418 ha of extrapolation mapping.</p>	<p>Scope: Detailed two-phase fauna assessment comprising:</p> <ul style="list-style-type: none"> A desktop assessment including relevant database searches and a literature review to compile and summarise existing records; A basic terrestrial vertebrate fauna survey; A baseline detailed terrestrial vertebrate fauna survey; A targeted conservation significant vertebrate fauna survey; and Define and delineate main SRE habitats. <p>Timing:</p> <ul style="list-style-type: none"> 5 – 15 June 2020; 7 – 20 October 2020; 16 – 27 April 2021; 31 May – 5 June 2021; and 3 – 9 June 2021. 	<p>12 trap sites, comprising:</p> <ul style="list-style-type: none"> 1,140 pitfall trap nights; 1,020 funnel trap night; 140 small Elliott trap nights; 168 cage trap nights; 204 camera trap days and nights; 55 ultrasonic call autonomous recording units (ARU) recording nights; and 36 audible call ARU recording nights. <p>Unbounded bird surveys were undertaken at each habitat assessment and trap site for 10 minutes.</p> <p>Nocturnal spotlighting (one night).</p> <p>Opportunistic observations.</p> <p>Active searches including searching leaf litter, peeling bark, and splitting wood.</p>	<p>Bamford Consulting Ecologists have independently reviewed this report (herein referred to as 'Bamford').</p> <p>Study compliant with:</p> <ul style="list-style-type: none"> EPA Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020i); Technical Guidance – Sampling of short-range endemic invertebrate fauna (EPA 2016h); and Interim guideline for preliminary surveys of night parrot (<i>Pezoporus occidentalis</i>) in Western Australia (DPAW 2017). <p>Limitations:</p> <p>Site access was identified as a limitation as 6,663 ha could not be accessed for the field survey component.</p>
<p>Biota Environmental Services (2010)</p> <p>Wheatstone Project Terrestrial Fauna Survey</p>	<p>Survey Area: Approximately 9,738 ha (Includes the Landside DE).</p>	<p>Scope: Detailed Level 2 fauna assessment comprising:</p> <ul style="list-style-type: none"> A desktop assessment including relevant database searches and a literature review to compile and summarise existing records; A basic terrestrial vertebrate fauna survey; A baseline detailed terrestrial vertebrate fauna survey; and Define and delineate main SRE habitats. <p>Timing: April 2009</p>	<p>16 trap sites, comprising:</p> <ul style="list-style-type: none"> 950 pitfall trap nights; 150 funnel trap night; 500 small Elliott trap nights; 12 Anabat; 12 Harp Trap; and 32 bird surveys (30- minutes each). <p>Opportunistic observations.</p> <p>Active searches including searching leaf litter, peeling bark, and splitting wood.</p>	<p>EPA Position Statement No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002).</p> <p>Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004a).</p> <p>Guidance Statement No. 20: Sampling of Short-range endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia (EPA 2009).</p>
<p>Pendoley Environmental 2021</p> <p>Ashburton Infrastructure Project: Artificial Light Impact Assessment and Management Plan</p> <p>(Appendix F)</p>	<p>Survey Area: Nearshore DE and Offshore DE.</p>	<p>Scope: Undertake an Artificial Light Impact Assessment.</p> <p>Timing: February 2021.</p>	<p>The 'Project Area' is a 20 km buffer surrounding</p> <ul style="list-style-type: none"> The Landside and Nearshore facilities; The TSVs while transiting along a navigation route between the Port and the anchorage area (Offshore DE); and The OGVS(s) when at the anchorage area. 	<p>National Light Pollution Guidelines for wildlife including Marine Turtles, Seabirds and Migratory Shorebirds (DotEE 2020).</p> <p>EPA Environmental Factor Guideline: Marine Fauna (EPA 2016b).</p> <p>EPA Environmental Assessment Guideline No. 5 Protecting Marine Turtles from Light Impacts (EPA 2010).</p>
<p>360 Environmental 2022a</p> <p>Red Hill North and South Haul Road: Vertebrate Fauna and Short-Range</p>	<p>Survey Area: Approximately 3,418 ha within the Red Hill station (within the Haul Road DE) .</p>	<p>Scope: A terrestrial vertebrate and SRE invertebrate fauna assessment including:</p> <ul style="list-style-type: none"> A desktop assessment including relevant database searches and a literature review to compile and summarise existing records; 	<p>Two trap sites, comprising:</p> <ul style="list-style-type: none"> 70 pitfall trap nights each 56 funnel trap nights each 	<p>EPA Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020i)</p> <p>Technical Guidance – Sampling of short-range endemic invertebrate fauna (EPA 2016h)</p>

Studies and Surveys	Area	Scope and Timing	Survey/study effort	Consistency with guidance and limitations
<p>Endemic Invertebrate Fauna Assessment</p> <p>(Appendix JJ)</p>		<ul style="list-style-type: none"> A single season detailed terrestrial vertebrate fauna survey; A targeted conservation significant vertebrate fauna survey; and A single season SRE survey. <p>Timing: September- October 2021.</p>	<p>Targeted Northern Quoll camera trapping comprising 15 camera traps over 70 trap days and nights.</p> <p>Ultrasonic call recording at one site over seven recording nights.</p> <p>Night Parrot audible call recording at two sites, with seven recording nights per site.</p> <p>Targeted active searches at pitfall and SRE sites for one person hour.</p> <p>Unbounded bird surveys were undertaken at each terrestrial vertebrate fauna trap site and SRE site for a minimum of one person hour.</p> <p>SRE single season survey, comprising:</p> <ul style="list-style-type: none"> 15 sites that were actively sampled, including leaf litter sifting and hand searching for a minimum of one person hour per site; and Opportunistic sampling. 	<p>Interim guideline for preliminary surveys of night parrot (<i>Pezoporus occidentalis</i>) in Western Australia (DPaW 2017).</p> <p>Limitations</p> <p>Survey scope was identified as a partial limitation as the detailed terrestrial vertebrate fauna survey was limited to a single season. Given that information was available from previous surveys nearby, it is considered unlikely that a second season would have identified additional species.</p> <p>Timing was identified as a partial limitation as the survey occurred outside of the recommended optimal survey time for amphibians and birds (immediately after rainfall) and SREs. However, detection of SRE invertebrates is not dependent on activity levels and therefore this is unlikely to affect the identification of specimens.</p>
<p>Bamford Consulting Ecologists 2022</p> <p>Ashburton Infrastructure Project – Migratory Birds Desktop Assessment</p> <p>(Appendix II)</p>	<p>Survey Area: Desktop review of the Haul Road DE.</p>	<p>Scope: A desktop assessment of migratory birds including:</p> <ul style="list-style-type: none"> Review available background information and literature relevant to the Proposal and surrounding area; and Discuss the likelihood and nature of occurrence of migratory and otherwise listed waterbird species that are of relevance to the Proposal. This includes the local and regional context of each species, and type of use of the Proposal. 	<p>Desktop assessment</p>	<p>N/A</p>
<p>Bat Call 2022</p> <p>Ashburton Infrastructure Project – Desktop bat assessment</p> <p>(Appendix KK)</p>	<p>Survey Area: Desktop review of the Haul Road DE.</p>	<p>Scope: A desktop assessment including:</p> <ul style="list-style-type: none"> A review of available background information relevant to the Proposal and surrounding area; A discussion of the likelihood of occurrence of significant bat species, including local and regional context, and type of use, and the value of the habitat present; and A discussion of the potential impact pathways from the project in relation to bat species and the significance of these impacts to the species. 	<p>Desktop assessment</p>	<p>N/A</p>

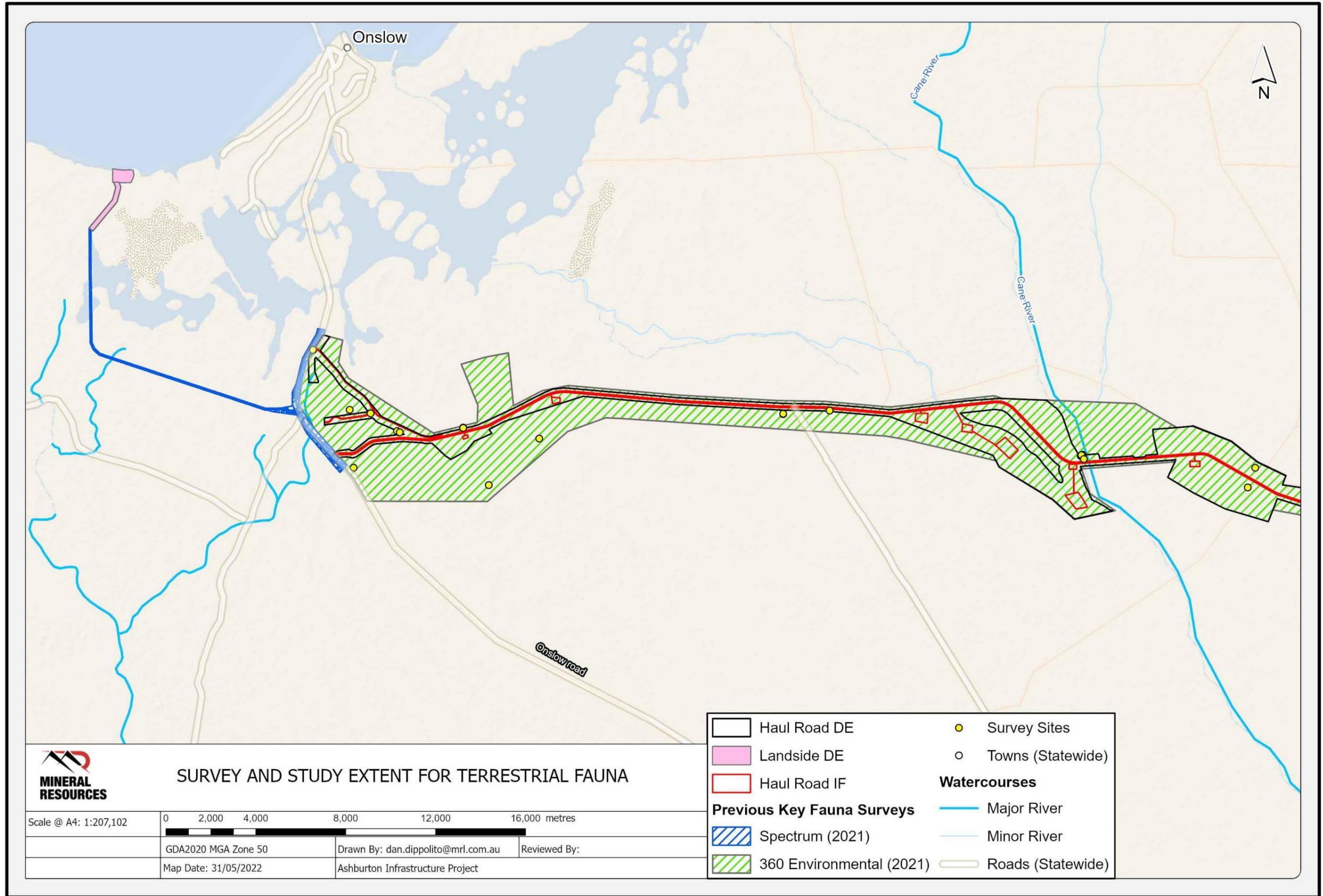


Figure-10-1: Survey and Study Extent for Terrestrial Fauna (1 of 2)

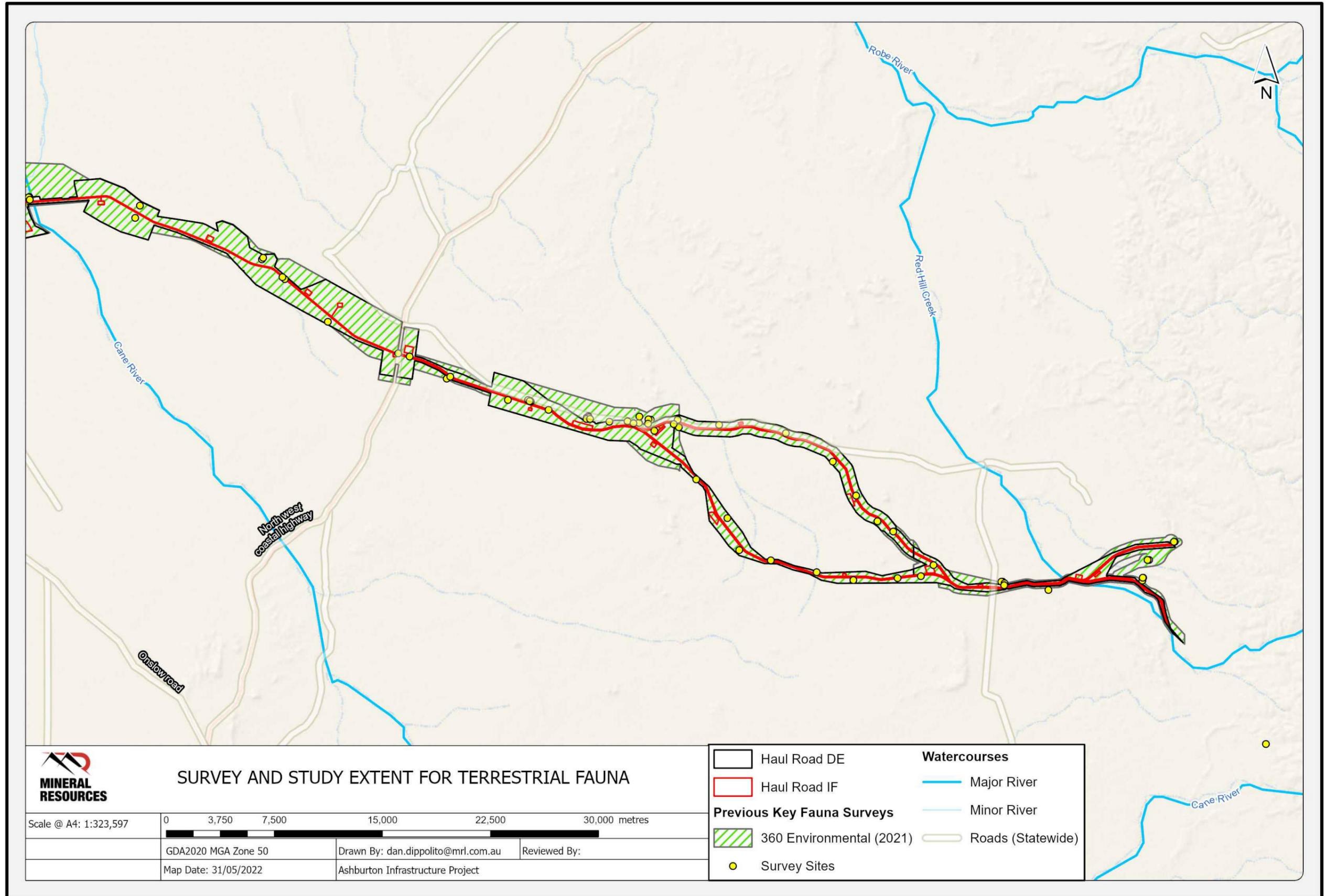


Figure-10-2: Survey and Study Extent for Terrestrial Fauna (2 of 2)

10.3.2 Occurrence of Fauna

10.3.2.1 Fauna Species

Database searches were conducted for the wider area. A total of 441 vertebrate fauna species have been recorded or can occur within the Haul Road DE and Landside DE (360 Environmental 2021b, 2022a). This comprises 52 mammals, 247 birds, 132 reptiles, and ten amphibian species. This includes 59 conservation significant fauna species.

Many of these species would be unlikely to occur in the Haul Road DE or Landside DE, given that the records have been collected from a large area encompassing a wide range of habitats. In addition, some small, common, ground-dwelling reptile and mammal species are patchily distributed even where appropriate habitats are present. Many species of bird can occur as regular migrants, occasional visitors or vagrants, and so may not always be present (360 Environmental 2021b, 2022a).

The fauna survey was undertaken across the Haul Road DE and part of the Landside DE. The Terrestrial Survey Area recorded 145 fauna species from 59 families, including 26 mammals, 62 birds, 53 reptiles, and three amphibians (360 Environmental 2021b, 2022a). This includes five terrestrial vertebrate species of conservation significance recorded within the Terrestrial Survey Area (**Figure 10-3** and **Figure 10-4**). However, the majority of these records occur outside of the Haul Road or Landside DEs as the Proponent redesigned the Haul Road DE after 360 Environmental’s (2021b) survey was completed to remove these areas, therefore avoiding potential impacts to conservation significant species (as described further in **Section 2.2.3.1**).

Two introduced (feral) fauna species have been recorded in Terrestrial Survey Area, including *Felis catus* (feral Cat) and *Bos taurus* (European Cattle). In addition, one potentially introduced species was also recorded, *Canis familiaris*/dingo? (Dog/Dingo) (360 Environmental 2021b).

10.3.2.2 Conversation Significant Vertebrate Fauna

Terrestrial Conservation Significant Fauna Species

A total of 11 terrestrial conservation significant fauna species (i.e. excluding threatened or migratory shorebirds (collectively called ‘waterbirds’ here on) were identified as possibly occurring from historical surveys and database searches (360 Environmental 2021b, 2022a). An assessment of the likelihood of these species occurring was undertaken by 360 Environmental based on the criteria outlined in **Table 10-3**.

Table 10-3: Likelihood of Occurrence Criteria

Likelihood	Criteria
Confirmed	Recorded during the field surveys.
High	Preferred habitat is present within the Terrestrial Survey Area. The Terrestrial Survey Area is within the species’ known distribution. The species has been recorded within the Desktop Study Area in the last 15 years. The Terrestrial Survey Area and surrounding habitat is expected to support individuals or populations of the species.
Medium	The high likelihood of occurrence criteria has not been met, however suitable (not necessarily preferred) habitat occurs within the Terrestrial Survey Area, and the Terrestrial Survey Area is within or near the species’ known distribution. The Terrestrial Survey Area and surrounding habitat may support individuals or populations of the species.
Low	No suitable habitat is present within the Terrestrial Survey Area, or the Terrestrial Survey Area is well outside the species’ known distribution, or the species is considered locally or regionally extinct. The Terrestrial Survey Area and surrounding habitat are unlikely to support individuals or populations of the species; however, individuals may rarely occur as transients or vagrants.

Six conservation significant fauna species were recorded during the surveys (**Table 10-4, Figure 10-3, Figure 10-4**, 360 Environmental 2021b, 2022a) including:

- Northern Quoll (*Dasyurus hallucatus*) – listed as Endangered under both the EPBC Act and BC Act;
- Ghost Bat (*Macroderma gigas*) - listed as Vulnerable under both the EPBC Act and BC Act;
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) – listed as Vulnerable under both the EPBC Act and BC Act;
- Pilbara Olive Python (*Liasis olivaceus barroni*) – listed as Vulnerable under both the EPBC Act and BC Act (opportunistic record outside the Terrestrial Survey Area)
- Western Pebble-mound Mouse (*Pseudomys chapmani*)– listed as Priority 4 by DBCA; and
- Long-tailed Dunnart (*Sminthopsis longicaudata*) listed as Priority 4 by DBCA.

Due to the redesign of the Haul Road DE, most of these fauna species were recorded outside but in proximity to the Haul Road DE but have a high likelihood of occurring within the Haul Road DE (**Table 10-4**). Three species (Northern Quoll, Pilbara Leaf-nosed Bat and Long-tailed Dunnart) were recorded within the Haul Road DE within Stony Hills and Slopes and Drainage Line/River/Creek (major) habitat types (360 Environmental 2022a).

A further three terrestrial conservation significant fauna species were not recorded during the surveys but have a high likelihood of occurrence within the Haul Road DE and Landside DE, including (**Table 10-4**; 360 Environmental 2021b, 2022a):

- Grey Falcon (*Falco hypoleucos*) – listed as Vulnerable under the BC Act;
- Short-tailed Mouse (*Leggadina lakedownensis*) – listed as Priority 4 by DBCA (DBCA 2000); and
- Peregrine Falcon (*Falco peregrinus*) – listed as Other Specially Protected Fauna under Schedule 7 of the BC Act.

A further two species have a medium likelihood of occurrence within the Haul Road DE and Landside DE (**Table 10-4**; 360 Environmental 2021b):

The remaining terrestrial conservation significant fauna identified as possibly occurring from database searches were considered to have a low likelihood of occurrence due to a lack of suitable habitat or lack of nearby records (360 Environmental 2021b, 2022a). These species have not been discussed further.

All conservation significant fauna species considered as having a high likelihood of occurring are described in further detail in **Section 10.3.3**. Potential impacts from the Proposal are assessed in detail for each species with a high likelihood of occurrence in **Section 10.6.3**.

Table 10-4: Conservation Significant Fauna Species Likelihood of Occurrence (Haul Road and Landside DEs)

Common Name	Scientific Name	Conservation Status	Habitat Preference	Likelihood of Occurrence in the Haul Road and Landside DEs
Haul Road DE				
Mammals				
Northern Quoll	<i>Dasyurus hallucatus</i>	Endangered -EPBC and BC Act	<p>Variety of habitat including rocky areas, or structurally diverse woodland or forest (DoE 2016a).</p> <p>Habitat within Haul Road DE:</p> <ul style="list-style-type: none"> • Drainage Line/River/Creek habitat provides foraging and dispersal habitat; and • Stony Hills and Slopes provide foraging and dispersal habitat.. 	<p>High</p> <p>Recorded at multiple locations within Mesas/Breakaway habitat outside the Haul Road DE.</p> <p>Motion cameras at all five targeted trap sites (KBT01 to KBT05) outside the Haul Road DE.</p> <p>Two individuals in a cage trap (KBT02 and KBT03) outside the Haul Road DE</p> <p>Two potential tracks were recorded within Sand Dunes and Swales habitat types near the western end of the Haul Road DE.</p> <p>At least one individual recorded via spot pattern analysis at one camera trap site (Cam02) within Stony Hills and Slopes habitat (within the Haul Road DE).</p>
Ghost Bat	<i>Macroderma gigas</i>	Vulnerable – EPBC and BC Act	<p>Roost sites include caves, rock crevices and disused mine pits. The species regularly forages out to 10 to 12 km from its roost caves, and further, and does not limit its foraging habitat to drainage lines, stony hills and slopes (Bat Call 2022).</p> <p>Habitat within Haul Road DE:</p> <ul style="list-style-type: none"> • All Haul Road DE habitats can provide foraging and dispersal capacity for the Ghost Bat (Bat Call 2022). 	<p>High</p> <p>Recorded at two sites within Mesas/Breakaway habitat outside the Haul Road DE.</p> <p>One individual by motion camera and six calls were recorded at KBT05 outside the Haul Road DE.</p> <p>One call recorded on one night at site Trap02 inside the Haul Road DE.</p> <p>A possible call was recorded at KBT02 outside the Haul Road DE.</p> <p>No night, diurnal or maternity roosts were recorded within the Haul Road DE.</p> <p>However, interaction with Ghost Bats is considered very low west of NWCH, low between NWCH and Red Hill Creek, and moderate to high east of Red Hill Creek for foraging and dispersal only (Bat Call 2022).</p>
Pilbara Leaf-nosed Bat	<i>Rhinoicteris aurantia</i>	Vulnerable – EPBC and BC Act	<p>Roost within rocky areas, including deep, complex cave systems. Extensive surveying using echolocation detectors in recent years has provided a very large data set of Pilbara Leaf-nosed Bat activity at a large variety of sites that show that the Pilbara Leaf-nosed Bat forages very widely and utilizes almost all productive and semi-productive habitats (Bat Call 2021b).</p> <p>Habitat within Haul Road DE:</p> <ul style="list-style-type: none"> • All Haul Road DE habitats can provide foraging and dispersal capacity for the Pilbara Leaf-nosed Bat (Bat Call 2022). 	<p>High</p> <p>Recorded at five sites within Mesas/Breakaway habitat (outside the Haul Road DE).</p> <p>Calls were recorded at KBB11, KBT03, KBT04 and KBT05 (outside the Haul Road DE).</p> <p>One call was recorded within Drainage Line/River/Creek (major) habitat at Trap02 (within the Haul Road DE).</p> <p>No diurnal or maternity roosts were recorded within the Haul Road DE.</p> <p>However, interaction with Pilbara Leaf-nosed Bat is considered very low west of NWCH, low between NWCH and Red Hill Creek, and moderate to high east of Red Hill Creek for foraging and dispersal only (Bat Call 2022).</p>
Western Pebble-mound Mouse	<i>Pseudomys chapmani</i>	Priority 4 – DCBA listed	<p>Variety of habitat including rocky areas, or structurally diverse woodland or forest (DoE 2016a).</p> <p>Habitat within Haul Road DE:</p> <ul style="list-style-type: none"> • Drainage Line/River/Creek habitat provides foraging and dispersal habitat; and • Stony Hills and Slopes provide foraging and dispersal habitat. 	<p>High</p> <p>Recorded at multiple locations within Mesas/Breakaway habitat outside the Haul Road DE.</p> <p>Motion cameras at all five targeted trap sites (KBT01 to KBT05) outside the Haul Road DE.</p> <p>Two individuals in a cage trap (KBT02 and KBT03) outside the Haul Road DE.</p> <p>Two potential tracks were recorded within Sand Dunes and Swales habitat types near the western end of the Haul Road DE.</p>

Common Name	Scientific Name	Conservation Status	Habitat Preference	Likelihood of Occurrence in the Haul Road and Landside DEs
				At least one individual recorded via spot pattern analysis at one camera trap site (Cam02) within Stony Hills and Slopes habitat (within the Haul Road DE).
Long-tailed Dunnart	<i>Sminthopsis longicaudata</i>	Priority 4 – DBCA listed	Plateaus with breakaways and rugged scree slopes, typically with shrubs, open woodland and spinifex hummock grassland (360 Environmental 2022a). Habitat within Haul Road DE: <ul style="list-style-type: none"> Stony Hills and Slopes habitat provide shelter and foraging. 	High Recorded within Stony Hills and Slopes habitat via camera trap (Cam03; within the Haul Road DE).
Northern Brushtail Possum	<i>Trichosurus vulpecula</i>	Vulnerable (at subsp level) – EPBC Act	Tall Eucalypt open forest with large hollow-bearing trees. The subspecies also occurs in mangrove communities. Habitat within Haul Road DE: <ul style="list-style-type: none"> Drainage Line/River/Creek (major and minor) habitat provides shelter, foraging and dispersal. 	Medium Suitable habitat within Drainage Line/River/Creek (major and minor). One record 37 km south of Haul Road DE.
Reptiles				
Pilbara Olive Python	<i>Liasis olivaceus barroni</i>	Vulnerable – EPBC and BC Act	Prefers escarpments, gorges, rock -piles and water holes. Habitat within Haul Road DE: <ul style="list-style-type: none"> Drainage Line/River/Creek (major and minor) habitat for foraging and dispersal; and Stony Hills and Slopes provide foraging and dispersal habitat. 	High 20 km south of the Haul Road DE, adjacent to the Drainage Line/River/Creek (major and minor) habitat.
Birds				
Grey Falcon	<i>Falco hypoleucos</i>	Vulnerable - EPBC and BC Act	Prefers timbered lowlands plains, particularly acacia shrubland that cross tree-lined watercourse nesting in tall trees along watercourses (TSSC 2020). Habitat within Haul Road DE: <ul style="list-style-type: none"> Drainage Line/ River/Creek habitat; and All habitats within the Haul Road DE for hunting. 	High Recorded 4 km east of the Haul Road DE in 2015 by Biota Environmental Sciences.
Peregrine Falcon	<i>Falco peregrinus</i>	Schedule 7 – BC Act	Habitat within Haul Road DE: <ul style="list-style-type: none"> Drainage Line/ River/Creek habitat; and All habitats within the Haul Road DE for hunting. 	High Preferred nesting habitat occurs within Mesas and breakaways habitat; however, may use all habitats within Terrestrial Survey Area and Haul Road DE for hunting.
Haul Road and Landside DE				
Mammals				
Short-tailed Mouse	<i>Leggadina lakedownensis</i>	Priority 4 – DCBA listed	Occurs in a range of habitats, including spinifex and <i>Acacia</i> on seasonally inundated sandy-clay soils as well as sandy soils and cracking clays to build burrows (Van Dyck and Strahan 2008). Habitat within Haul Road and Landside DE: <ul style="list-style-type: none"> Claypan habitat; Tidal Flat; Plains; and Stony Plains. 	High Suitable habitat is available. 56 records occurring within 1 km of PPA (Landside DE). Two records 1.6 km and 5 km west of Haul Road DE.

Common Name	Scientific Name	Conservation Status	Habitat Preference	Likelihood of Occurrence in the Haul Road and Landside DEs
Reptiles				
Maryan's Keeled Slider	<i>Lerista planiventralis maryani</i>	Priority 1 – DBCA listed	Coastal consolidated dunes and low shrubland on the upper west coast of WA between Onslow and Barradale (Cogger 2014). Habitat within Haul Road and Landside DE: <ul style="list-style-type: none"> Sand Dunes and Swales. 	Medium Suitable habitat is present within the western section of the Haul Road DE and in the Landside DE.

*Descriptions adapted from 360 Environmental (2021b, 2022a)

Confirmed: Recorded during the field surveys within the Haul Road DE

High:

- Preferred habitat is present within the Haul Road DE
- Haul Road DE is within the species' known distribution
- The species has been recorded within the Desktop Study Area in the last 15 years
- The Haul Road DE and surrounding habitat is expected to support individuals or populations of the species.

Medium - the high likelihood of occurrence criteria has not been met, however

- Suitable, but not necessarily preferred, habitat occurs within the Terrestrial Survey Area
- Haul Road DE is within or near the species' known distribution
- The Haul Road DE and surrounding habitat may support individuals or populations of the species.

The remaining species from the database searches are considered unlikely to occur, as there is a lack of suitable habitat within the Haul Road or Landside DE or local records.

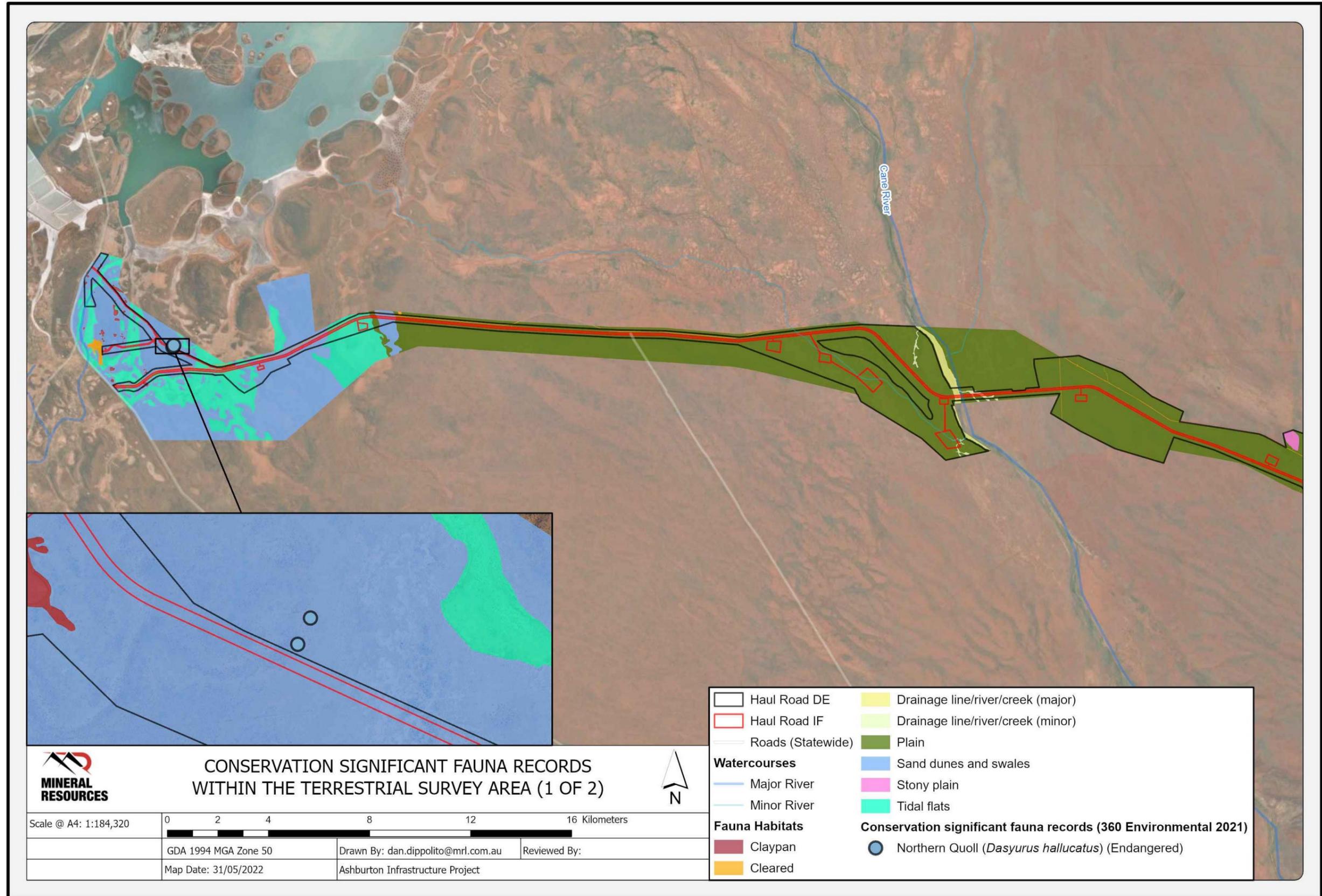


Figure 10-3: Conversation Significant Fauna Records within the Terrestrial Survey Area (1 of 2)

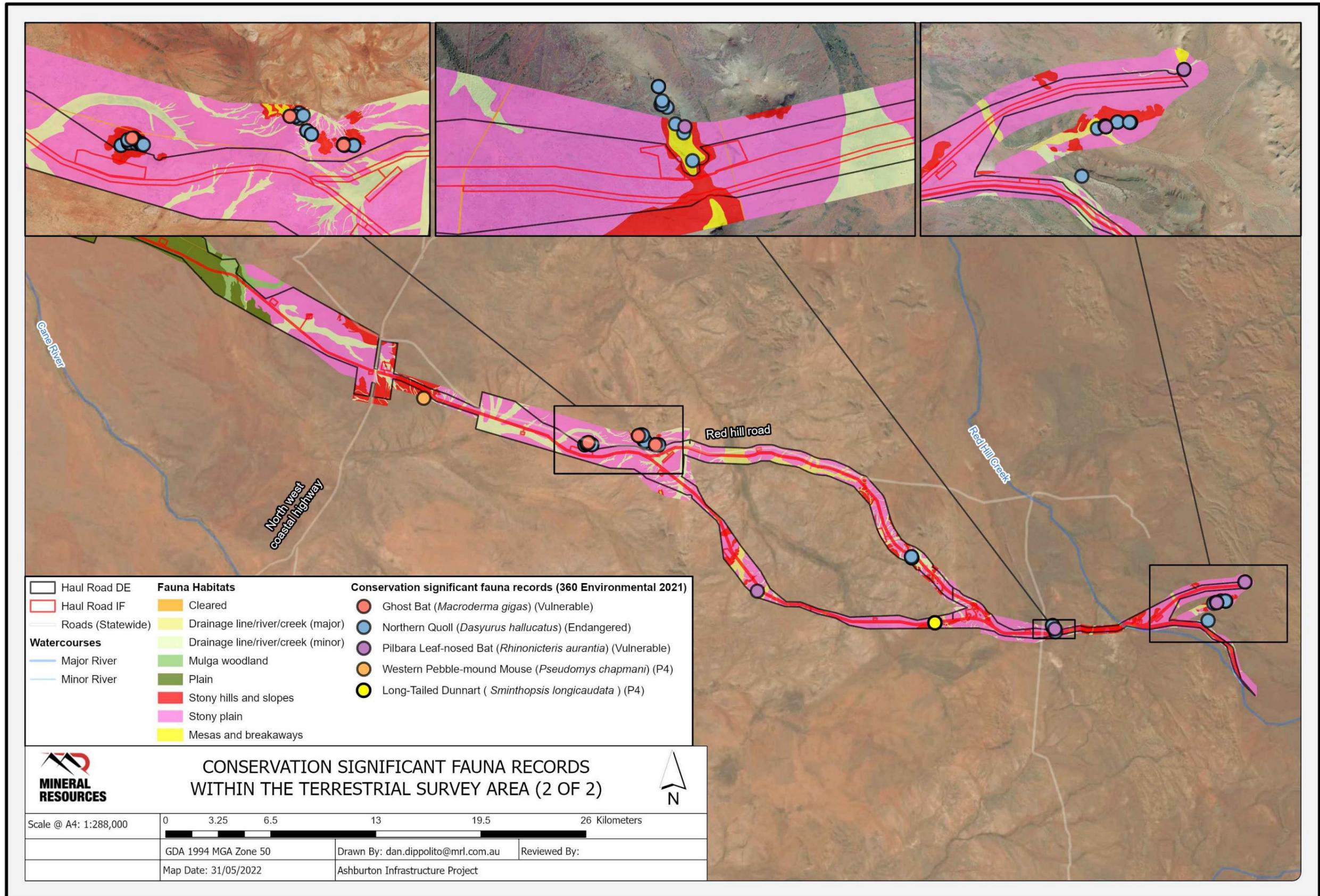


Figure 10-4: Conservation Significant Fauna Records within the Terrestrial Survey Area (2 of 2)

Waterbirds

Bamford Consulting Ecologists (BCE) undertook a desktop assessment (BCE 2022) which combined the database search undertaken by 360 Environmental (2021b, 2022a) along with additional records obtained from relevant literature and databases to determine the likelihood and nature of waterbird occurrence within and in proximity to the Haul Road and Landside DEs.

The desktop assessment identified 45 waterbirds (**Table 10-5**) as occurring in the Onslow area (BCE 2022). Of these species, 35 species are considered to potentially interact with the Proposal based on their habitat preferences (BCE 2022).

For the purpose of the impact assessment, a likelihood of occurrence assessment is considered of lesser importance than the nature of that occurrence, as many species may occasionally visit a place without relying on it (BCE 2022). Of particular importance is the number of individuals of that species may be present, how often they are present and how they utilise the site (such as roosting and/or feeding).

Important habitat for waterbirds has been defined by the EPBC Act Policy Statement 3.21 – Industry Guidelines for avoiding, assessing and mitigating impacts of EPBC listed migratory shorebird species (DotEE 2017d) as sites considered to be of international and national importance. The widely accepted and applied approach to identifying internationally important waterbird habitat throughout the world has been through the use of criteria adopted under the Ramsar Convention on Wetlands. According to this approach, waterbird habitat should be considered internationally important if it regularly supports:

- 1% of the individuals in a population of one species (or subspecies); or
- A total abundance of at least 20,000 waterbirds.

Nationally important habitat for waterbirds can be defined using a similar approach to these international criteria, i.e. if it regularly supports:

- At least 0.1% of the flyway population of a single species of migratory shorebirds; or
- At least 2,000 migratory shorebirds; or
- At least 15 migratory shorebird species.

Based on the approach above and the results of the desktop assessment (summarized in **Table 10-5** and detailed in **Section 10.3.3.10**), **no habitats in the Haul Road DE are considered as internationally or nationally important habitats for waterbirds** (BCE 2022). In addition, the Proposal is more than 10 km away from any areas where waterbirds are known to aggregate, which is considered to be almost certainly due to the quality of the habitat types present (BCE 2022), which is discussed further in **Section 10.3.3.10**.

Table 10-5: Waterbirds with the Potential to Interact with the Proposal

Common Name	Scientific Name	Conservation Status	Habitat Preference	Potential to Interact with the Proposal
Migratory Shore/Wetland birds (BCE 2022)				
Australian Fairy Tern	<i>Sternula nereis</i>	Vulnerable	<p>Beaches, spits, wetlands and offshore, estuarine or lacustrine (lake) islands (DSEWPaC 2011c).</p> <p>Nests on sandy islands and beaches inside estuaries; open sandy beaches; or coral cays or coral shingle on continental islands. Nesting occurs above the high-water mark, in clear view of the water (Higgins & Davies 1996).</p>	<p>Possible</p> <p>Internationally important records within 100 km.</p> <p>Nationally important records 12 km from the Port .</p>
Australian Painted Snipe	<i>Rostratula australis</i>	Endangered	<p>Inhabits shallow terrestrial freshwater wetlands, including lakes, swamps, claypans, dams, bore drains and sewage farms, typically covered with rushes, reeds, grasses, low scrub or samphire (DSEWPaC 2013).</p> <p>Nesting habitat requirements are quite specific, described as shallow wetlands with areas of bare wet mud and upper and canopy cover nearby (DAWE 2021b). Almost all nesting records are from or nearby small islands in freshwater wetlands.</p> <p>Known to breed in Australia, no records of breeding in WA.</p>	<p>Possible</p> <p>No internationally or nationally important records within 100 km.</p>
Bridled Tern	<i>Onychoprion anaethetus</i>	Migratory	<p>Widespread throughout Australia. Foraging is rarely recorded on the mainland coast, and typically occurs in offshore continental shelf waters (DAWE 2021b).</p> <p>Breeding occurs on offshore islands, with one record of a mainland breeding site in far-southern Western Australia.</p>	<p>Possible</p> <p>There is no flyway population estimate available; however, it is considered unlikely that nationally or internationally important sites for this species are within 15 km of the Proposal.</p>
Common Noddy	<i>Anous stolidus</i>	Migratory	<p>Mainly occurs in the ocean off the coast of Queensland; however, also occurs off the north-west and central Western Australian coast (DAWE 2021b).</p> <p>Inhabits islands, or shoals or cays of coral or sand during the breeding season. The species remains in the pelagic zone (open ocean) during the non-breeding season. Foraging occurs offshore.</p> <p>Breeding occurs on islands throughout Australia.</p>	<p>Possible</p> <p>No internationally or nationally significant records within 100 km.</p>
Common Sandpiper	<i>Actitis hypoleucos</i>	Migratory	<p>Occurs along all Australian coastlines and throughout many inland areas (DAWE 2021b). Typically found on coastal and inland wetland habitat, mostly on rocky shores and muddy margins.</p> <p>Foraging habitat includes the edges of wetlands, in shallow water and soft mud. Roosting occurs on rocks, roots and vegetation branches, such as mangroves.</p> <p>Does not breed in Australia. The population that migrates to Australia breeds in far east Russia.</p>	<p>Possible</p> <p>No internationally or nationally significant records within 100 km</p>
Common Greenshank	<i>Tringa nebularia</i>	Migratory	<p>Occurs in wetlands throughout Australia (DAWE 2021b).</p> <p>Prefers coastal or inland wetlands, in estuaries and mudflats, mangrove swamps and lagoons. Foraging habitat includes mudflats, channels, or the edges of mangroves, sedges and saltmarsh.</p> <p>Does not breed in Australia. Breeding occurs in the Palaearctic..</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>
Eastern Osprey	<i>Pandion haliaetus</i>	Migratory	<p>The species is distributed along Australia’s northern coastline, from south-west Western Australia to south-east New South Wales (DAWE 2021b).</p>	<p>Possible</p> <p>There is no flyway population estimate available; however, it is considered unlikely that nationally or internationally important sites for this species are within 15 km of the Proposal.</p>

Common Name	Scientific Name	Conservation Status	Habitat Preference	Potential to Interact with the Proposal
			<p>Habitat includes coastal habitat and terrestrial wetlands of tropical and temperate Australia and offshore islands. Foraging requires the presence of extensive areas of saline, brackish or fresh water.</p> <p>Breeding in Australia occurs from Albany in Western Australia's south and around the northern coastline to southern New South Wales.</p>	
Great Knot	<i>Calidris tenuirostris</i>	Critically Endangered / Migratory	<p>Recorded around the entire Australian coastline, with scattered inland records (TSSC 2016a). Commonly occurs on the Pilbara and Kimberly coastlines.</p> <p>Inhabits sheltered coastal habitats, including intertidal mudflats or sandflats. Roosting occurs in shallow water or along the waters edge, close to foraging habitat.</p> <p>Does not breed in Australia, with breeding occurring in the Northern Hemisphere.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>
Gull-billed Tern	<i>Gelochelidon nilotica</i>	Migratory	<p>Recorded along the majority of Australia's coastline, with scattered inland distribution (ALA 2021b).</p> <p>Inhabits shallow wetlands, both coastal and inland lakes, swamps and lagoons (BirdLife International 2021c). Rarely found over the ocean. Nesting typically occurs in colonies on temporary islands in marsh or lakes, or on high and dry ground.</p>	<p>Possible</p> <p>There is no flyway population estimate available; however, it is considered unlikely that nationally or internationally important sites for this species are within 15 km of the Proposal.</p>
Red Knot	<i>Calidris canutus</i> ; <i>Calidris canutus rogersi</i>	Endangered / Migratory	<p>Records distributed along Australia's coast, with a large abundance of records in north-west Australia (TSSC 2016g).</p> <p>Inhabits intertidal mudflats, sandflats and sandy beaches. Occasionally inhabits terrestrial saline wetlands. Foraging habitat includes intertidal mudflats or sandflats when exposed at low tide. Feeding may occur at lakes, sewage ponds and floodwaters during high tide.</p> <p>Does not breed in Australia, with breeding occurring in the Northern Hemisphere.</p>	<p>Possible</p> <p>No internationally or nationally important records within 100 km.</p>
Oriental Pratincole	<i>Glareola maldivarum</i>	Migratory	<p>Widespread in northern Australia, particularly along the coast of the Pilbara and Kimberly regions of Western Australia, the Northern Territory and the Gulf of Carpentaria (DAWE 2021b).</p> <p>Inhabits open grasslands and muddy flood plains. Also known to inhabit terrestrial wetlands and along the coast, including beaches, mudflats and islands. Foraging is typically aerial.</p> <p>Does not breed in Australia, with breeding occurring in southern and eastern Asia.</p>	<p>Possible</p> <p>No internationally or nationally significant records within 100 km.</p>
Pectoral Sandpiper	<i>Calidris melanotos</i>	Migratory	<p>Distributed throughout Australia, although rarely recorded in Western Australia. The species has been recorded in the Pilbara region (DAWE 2021b).</p> <p>In Australia, the species' preferred habitat is shallow, fresh to saline wetlands. The species also inhabits grassy edges of shores and tidal marshes, muddy shores.</p> <p>Does not breed in Australia, with breeding occurring in Russia and North America.</p>	<p>Possible</p> <p>No internationally or nationally important records within 100 km.</p>
Wood Sandpiper	<i>Tringa glareola</i>	Migratory	<p>Recorded in largest numbers in north Western Australia, although also distributed throughout Queensland, Victoria, New South Wales and South Australia (DAWE 2021b). The species occurrence in Western Australia is widespread but scattered.</p> <p>Typically inhabits shallow freshwater wetlands that are well-vegetated with emergent reeds and grass, surrounded by tall plants and dead trees. Foraging occurs in wet or dry mud at the edges of wetlands (Higgins & Davies 1996).</p> <p>Does not breed in Australia, with breeding occurring throughout Eurasia.</p>	<p>Possible</p> <p>No internationally or nationally important records within 100 km.</p>

Common Name	Scientific Name	Conservation Status	Habitat Preference	Potential to Interact with the Proposal
Oriental Plover	<i>Charadrius veredus</i>	Migratory	<p>Occurs in coastal and inland areas of Australia, mostly in the north (DAWE 2021b). The majority of records occur along the north west coast, between Derby and the Exmouth Gulf.</p> <p>Occasionally inhabits coastal habitat but more often inhabit open plains with sparse cover of short grass. Preferred foraging habitat includes short grass or hard, bare ground, although foraging also occurs on mudflats or seaweed covered beaches.</p> <p>A non-breeding visitor to Australia, with breeding occurring in Mongolia, Munchuria and Siberia.</p>	<p>Possible</p> <p>No internationally or nationally important records within 100 km.</p>
Lesser Sand Plover	<i>Charadrius mongolus</i>	Endangered / Migratory	<p>Widespread in the coastal regions of Australia, with records in all states (TSSC 2016c). Mostly occurs in eastern and northern Australia.</p> <p>In Australia, habitat is almost exclusively restricted to coastal areas. This includes tidal flats, mangroves, ocean beaches and rocky shorelines. Foraging typically occurs in intertidal mudflats and sandflats on beaches and estuaries.</p> <p>Does not breed in Australia, with breeding occurring in the Northern Hemisphere.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>
Greater Sand Plover	<i>Charadrius leschenaultii</i>	Vulnerable/ Migratory	<p>Widespread Australian distribution, with most records found in the north (TSSC 2016b).</p> <p>Inhabits coastal areas almost exclusively in Australia, including intertidal mudflats, sheltered beaches, coral reefs, rocky islands and dunes. Seldom occurs at shallow freshwater wetlands. Foraging typically occurs in wet sand or mud of intertidal flats in sheltered estuaries, lagoons or embayments.</p> <p>Does not breed in Australia, with breeding occurring in central Asia.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>
Grey Plover	<i>Pluvialis squatarola</i>	Migratory	<p>Recorded along the coast of all Australian states (DAWE 2021b). Particularly abundant in Western Australia on the coastline extending from Albany to the northern Kimberly.</p> <p>Inhabits coastal areas almost exclusively, with occasional use of inland wetlands or salt lakes. Foraging occurs on exposed mudflats and sheltered coastal beaches. Does not breed in Australia, with breeding occurring in northern Siberia and Alaska.</p>	<p>Possible</p> <p>No internationally or nationally important records within 100 km.</p>
White-winged Black Tern	<i>Chlidonias leucopterus</i>	Migratory	<p>Widespread distribution along the central-eastern, northern and south-western coasts of Australia, with a small number of scattered records in southern Australia (DAWE 2021b).</p> <p>Inhabits fresh, saline or brackish coastal or subcoastal wetlands. Foraging is aerial and occurs over water or the muddy edges of wetlands.</p> <p>A non-breeding migrant to Australia, with breeding occurring in Eurasia.</p>	<p>Possible</p> <p>Internationally important records within 100 km.</p> <p>Internationally important records potentially within 15 km (exact location is unknown as ALA records are accurate to within 10 km).</p>
Caspian Tern	<i>Hydroprogne caspia</i>	Migratory	<p>Widespread throughout Australia, occurring in both inland and coastal habitat (DAWE 2021b).</p> <p>Foraging typically occurs in open wetlands. Nesting occurs on sandbars, spits, and rocky islands. They roost on ocean beaches.</p> <p>Breeds throughout Australia and Western Australia, including the Pilbara region from Point Cloates to North Turtle Island.</p>	<p>Possible</p> <p>Internationally important records within 100 km.</p> <p>Nationally important records 12 km from the Port.</p>
Crested Tern	<i>Thalasseus bergii</i>	Migratory	<p>Occurs on coastlines around Australia (BirdLife International 2021a).</p> <p>Inhabits coastal areas, with occasional records further inland. Forages over water. Nesting occurs on sandbars, spits and rocky islands, and roosting occurs on beaches and rock platforms.</p>	<p>Possible</p> <p>There is no flyway population estimate available; however, it is considered unlikely that nationally or internationally important sites for this species are within 15 km of the Proposal.</p>

Common Name	Scientific Name	Conservation Status	Habitat Preference	Potential to Interact with the Proposal
			Breeding occurs on small, offshore islands.	
Little Tern	<i>Sternula albifrons</i>	Migratory	<p>Widespread in Australia, from north-western Western Australia, around the north and east coastline to south-eastern Australia (DAWE 2021b).</p> <p>Nesting occurs on banks, ridges and sand-spits of sheltered coastal environments. This species forages in the shallow waters of lagoons, lakes and estuaries, and also along the open coastline.</p> <p>Breeding occurs in south-eastern and eastern Asia, the Philippines, Indonesia, New Guinea and northern and eastern Australia, including records within north Western Australia (TSSC 2002).</p>	<p>Possible</p> <p>Nationally and internationally important records within 100 km.</p> <p>Nationally important records potentially within 15 km (exact location is unknown as ALA records are accurate to within 10 km).</p>
Roseate Tern	<i>Sterna dougallii</i>	Migratory	<p>Distributed along the west, north and north-east coasts of Australia, with rare records from northern New South Wales (DAWE 2021b). In Western Australia, the species is commonly recorded from Mandurah to Eight Mile Beach in the Pilbara region.</p> <p>Inhabits coastal and marine areas, including rocky and sandy beaches and offshore islands. Foraging typically occurs along coral reefs, including within lagoons and along the seaweed margin. Foraging rarely occurs in sheltered inshore waters.</p> <p>Breeding occurs off of the coasts of Queensland, the Northern Territory and Western Australia.</p>	<p>Possible</p> <p>There is no flyway population estimate available; however, it is considered unlikely that nationally or internationally important sites for this species are within 15 km of the Proposal.</p>
Common Tern	<i>Sterna hirundo</i>	Migratory	<p>Most commonly found on the eastern coast of Australia parts of the northern coast, with scattered records throughout Western Australia (DAWE 2021b).</p> <p>The species is pelagic, marine and coastal. In Australia, the Common Tern commonly inhabits coastal waters, beaches and sandy and rocky shores. They forage in marine environments close to shore and terrestrial wetlands.</p> <p>Does not breed in Australia. Breeding occurs in Eurasia and North America.</p>	<p>Possible</p> <p>Internationally important records within 100 km.</p> <p>Internationally important records 12 km from the Port.</p>
Ruddy Turnstone	<i>Arenaria interpres</i>	Migratory	<p>Widespread distribution throughout Australia, mostly occurring in coastal regions (DAWE 2021b).</p> <p>Inhabits mostly coastal regions and often prefers mudflats. Forging mostly occurs on foreshores, between the strand-line and wave-zone, and they often forage among seaweed.</p> <p>Does not breed in Australia, with breeding occurring on the coasts of Europe, Asia and North America.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>
Sanderling	<i>Calidris alba</i>	Migratory	<p>Distributed throughout the coastal areas of Australia (DAWE 2021b). Within Western Australia, the species is mostly recorded on the south and southwest coast and north to around Shark Bay. Records in the Pilbara region are sparsely scattered.</p> <p>Inhabits coastal areas and tidal flats. May inhabit mangroves, ocean beaches and rocky shorelines. Foraging occurs in breaking waves on the surface of beaches, or on the edges of mudflats and shallow pools.</p> <p>Does not breed in Australia. Breeding occurs in North America, Russia and islands of the Arctic Ocean (Higgins & Davies 1996).</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p> <p>Nationally important records potentially within 15 km (exact location is unknown as ALA records are accurate to within 10 km).</p>
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Migratory	<p>Records are distributed throughout Australia, mostly to the south-east (DAWE 2021b). In Western Australia, species records are widespread, including within the coastal and subcoastal plains of the Pilbara region.</p>	<p>Possible</p> <p>No internationally or nationally important records within 100 km.</p>

Common Name	Scientific Name	Conservation Status	Habitat Preference	Potential to Interact with the Proposal
			<p>The species inhabits several habitats, including saline inland wetlands, damp grasslands, and tidal flats. Foraging occurs in wetlands or intertidal mudflats, and the vegetation of saltmarsh, grass or sedges.</p> <p>Spends the non-breeding season in Australia, with breeding occurring in Siberia.</p>	
Curlew Sandpiper	<i>Calidris ferruginea</i>	Critically Endangered / Migratory	<p>Widespread throughout Australia, both along coastlines and inland (DoE 2015d).</p> <p>Abundant on intertidal mudflats, sheltered coastal areas and non-tidal wetlands near the coast. Foraging occurs on mudflats and in shallow water nearby.</p> <p>Does not breed in Australia. Breeding occurs in the Russian Arctic.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>
Red-necked Stint	<i>Calidris ruficollis</i>	Migratory	<p>Distributed along the majority of Australia's coastline, with most abundant records on the coast of Tasmania and Victoria (DAWE 2021b).</p> <p>Most abundant on tidal flats, also occurs on brackish and fresh inland wetlands. Foraging habitat includes intertidal mudflats or sandflats, and in very shallow water. Foraging may occur in non-tidal wetlands during high tide.</p> <p>Does not breed in Australia, with breeding occurring in Alaska and Siberia.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p> <p>Nationally important records potentially within 15 km (exact location is unknown as ALA records are accurate to within 10 km).</p>
Bar-Tailed Godwit	<i>Limosa lapponica</i>	Migratory (Critically Endangered (EPBC and BC Act) at subspecies level (<i>Limosa lapponica menzbieri</i>))	<p>Recorded throughout all Australian states in coastal areas (DAWE 2021b).</p> <p>Typically inhabits coastal areas, tidal flats. May inhabit mangroves, ocean beaches and rocky shorelines. Foraging habitat includes the edge of water or shallow water, and the species prefers exposed sandy substrates on intertidal flats, beaches and banks.</p> <p>Does not breed in Australia. Nesting occurs in the Northern Hemisphere summer.</p>	<p>Possible</p> <p>Internationally important records within 100 km.</p>
Black-tailed Godwit	<i>Limosa limosa</i>	Migratory	<p>Occurs throughout all Australian states and territories, with a preference for coastal regions (DAWE 2021b).</p> <p>Preferred habitat includes sheltered bays, lagoons, estuaries with large intertidal sandflats or mudflats. Also found in near-coastal wetlands, including river pools, swamps, saltmarsh, floodplains and lagoons (DAWE 2021b). Foraging habitat consists of intertidal sandflats or mudflats, soft mud and shallow water.</p> <p>Does not breed in Australia. Nesting occurs in the Northern Hemisphere summer.</p>	<p>Possible</p> <p>No internationally or nationally significant records within 100 km.</p>
Eastern Curlew	<i>Numenius madagascariensis</i>	Critically Endangered / Migratory	<p>Australian distribution is mainly coastal, with the species found in all states (DoE 2015e).</p> <p>Typically inhabits sheltered coastal areas and tidal flats. May inhabit mangroves, ocean beaches and rocky shorelines. Foraging occurs on intertidal mudflats, sandflats and open beaches.</p> <p>Does not breed in Australia, with breeding occurring in the Northern Hemisphere in summer.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>
Grey-tailed Tattler	<i>Tringa brevipes</i>	Migratory	<p>Distributed in most coastal regions of Australia, primarily along the northern coast (DAWE 2021b). In Western Australia, the species is widespread from the mainland near the Kimberly Division to the Houtman Abrolhos, with scattered records further south.</p> <p>Inhabits coastal areas, tidal flats. May inhabit mangroves, ocean beaches and rocky shorelines. Foraging habitat includes the shallow water of hard intertidal substrates, such as rock platforms, reefs and rock pools. Foraging also occurs on exposed intertidal mudflats or sandflats.</p> <p>Does not breed in Australia, with breeding occurring in the Northern Hemisphere.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>

Common Name	Scientific Name	Conservation Status	Habitat Preference	Potential to Interact with the Proposal
Whimbrel	<i>Numenius phaeopus</i>	Migratory	<p>Distributed along most of Australia's coastline, with scattered inland records (DAWE 2021b).</p> <p>It is most abundant in the north and is found in all states. Inhabits coastal areas, tidal flats. May inhabit mangroves, ocean beaches and rocky shorelines. Foraging typically occurs on intertidal mudflats, among mangroves, on sandy beaches, and on the muddy banks of coastal lagoons and estuaries.</p> <p>Does not breed in Australia, breeding in east Siberia.</p>	<p>Possible</p> <p>Nationally important records within 100 km.</p>
Little Curlew	<i>Numenius minutus</i>	Migratory	<p>Distributed throughout northern Australia from Port Hedland in Western Australia to the Queensland coast (DAWE 2021b). Scattered records occur along the east coast and inland.</p> <p>Foraging habitat is short, dry grassland, including dry floodplains with scattered freshwater pools or seasonally inundated areas.</p> <p>Does not breed in Australia, with breeding occurring in Russia.</p>	<p>Possible</p> <p>No internationally or nationally significant records within 100 km.</p>
Glossy Ibis	<i>Plegadis falcinellus</i>	Migratory	<p>Commonly occurs in the Eyre Peninsula of South Australia and the Kimberley of Western Australia (DAWE 2021b). There are scattered records throughout the rest of Western Australia, and rare records in Tasmania.</p> <p>Preferred foraging and breeding habitat occurs within freshwater marshes, lakes and floodplains, and swamps. Occasionally found in coastal locations.</p> <p>Breeding occurs at a limited number of locations in Australia, including the lower Ord/Keep River of Western Australia and the Northern Territory.</p>	<p>Possible</p> <p>There is no flyway population estimate available; however, it is considered unlikely that nationally or internationally important sites for this species are within 15 km of the Proposal.</p>
Barn Swallow	<i>Hirundo rustica</i>	Migratory	<p>Occurs in northern Australia, with rare records in South Australia and to the south of Western Australia (DAWE 2021b).</p> <p>In Australia, the species has been recorded in freshwater wetlands, Melaleuca woodland, tussock grasslands, coastal lowlands and near water, towns and cities (DAWE 2021b).</p> <p>Breeding occurs throughout the northern hemisphere.</p>	<p>Unlikely</p> <p>Largely aerial species, common around Onslow townsite in summer but appears to remain within the townsite (BCE 2022).</p>
Flesh-footed Shearwater	<i>Ardenna carneipes</i>	Migratory	<p>Commonly occurs along the continental shelf and slope of southern Australia (DAWE 2021b). Foraging generally occurs offshore over continental shelves (TSSC 2014). The species nests in burrows under shrubs or trees in colonies.</p> <p>In Australia, breeding occurs on Lord Howe Island and off south-west Western Australia.</p>	<p>Unlikely</p> <p>This species is a marine species of the open ocean and does not make landfall on the Pilbara mainland (BCE 2022).</p>
Fork-tailed Swift	<i>Apus pacificus</i>	Migratory	<p>Recorded in all states and territories of Australia (DAWE 2021b). In Western Australia, the species has been recorded along most of the coastline, including scattered records from the south-west Pilbara to the northern Kimberley.</p> <p>The species is almost exclusively aerial, mostly occurring over inland plains.</p> <p>A non-breeding visitor to Australia, with breeding occurring in Siberia.</p>	<p>Unlikely</p> <p>Largely aerial species that is an infrequent visitor of the area but virtually never makes landfall (BCE 2022).</p>
Grey Wagtail	<i>Motacilla cinerea</i>	Migratory	<p>The species has a widespread global distribution, including occurrences throughout Europe, Russia and Asia (BirdLife International 2022a). The species is a rare vagrant to the Pilbara region (BCE 2022).</p>	<p>Unlikely</p> <p>Rare vagrant to the region therefore very unlikely to be present (BCE 2022).</p>

Common Name	Scientific Name	Conservation Status	Habitat Preference	Potential to Interact with the Proposal
Lesser Frigatebird	<i>Fregata ariel</i>	Migratory	Records off the coastline of Australia, extending from Western Australia around the northern coast to Victoria and Tasmania (ALA 2021a). The species occurs in the open ocean (BCE 2022).	Unlikely This species is a marine species of the open ocean and does not make landfall on the Pilbara mainland (BCE 2022).
Southern Giant Petrel	<i>Macronectes giganteus</i>	Endangered/Migratory	Distribution in Australia is limited to the breeding colonies of Heard Island and Macquarie Island, and in the Australian Antarctic Territory (TSSC 2001).	Unlikely This species is a marine species of the open ocean and does not make landfall on the Pilbara mainland (BCE 2022).
Streaked Shearwater	<i>Calonectris leucomelas</i>	Migratory	The species is regarded as vagrant, with records occurring in the waters off of northern Australia (Carter 1983).	Unlikely This species is a marine species of the open ocean and does not make landfall on the Pilbara mainland (BCE 2022).
Wedge-tailed Shearwater	<i>Ardenna pacifica</i>	Migratory	The species occurs along the east and west coasts of Australia, and on off-shore islands (DAWE 2021b). The species is pelagic (occurs in the open ocean), typically occurring in tropical and subtropical waters. Breeding occurs on offshore islands along the east and west coast of Australia.	Unlikely This species is a marine species of the open ocean and does not make landfall on the Pilbara mainland (BCE 2022).
Wilson's Storm Petrel	<i>Oceanites oceanicus</i>	Migratory	Most Australian records of this species are from the edge of the continental shelf, and the species is known to breed on Heard Island (DAWE 2021b). The species has been observed off the coast of Western Australia during migration. Foraging mostly occurs in the cold waters over continental shelves.	Unlikely This species is a marine species of the open ocean and does not make landfall on the Pilbara mainland (BCE 2022).
Yellow Wagtail	<i>Motacilla flava</i>	Migratory	The species has a large global distribution, extending from Europe and east in Siberia, west to Asia, and south to Egypt (BirdLife International 2022b). The species is a rare vagrant to the Pilbara region (BCE 2022).	Unlikely Rare vagrant to the region therefore very unlikely to be present (BCE 2022).

10.3.3 Conservation Significant Fauna of High Likelihood of Occurrence

10.3.3.1 Northern Quoll

Relevant Policy and Guidance

The Northern Quoll (*Dasyurus hallucatus*) is listed as Endangered under the EPBC Act and BC Act. The species was once common across northern Australia, occurring almost continuously from the Pilbara, Western Australia, to near Brisbane in Queensland. The Pilbara population of Northern Quoll is genetically distinct from the nearest Kimberley population. This is likely due to the physical separation of the populations by the Great Sandy Desert, which prevents gene flow between the two populations (Cramer and Dunlop 2018). Both the mainland Pilbara and Kimberley populations of Northern Quolls retain high levels of genetic diversity and show no evidence of recent or long-term population bottlenecks. This indicates that despite habitat fragmentation and population decline, the Pilbara population has not yet suffered a loss in genetic diversity (Cramer and Dunlop 2018).

The Northern Quoll is a medium-sized carnivorous, solitary and predominantly nocturnal marsupial. It favours rocky areas, particularly rock crevices used for shelter and denning, and gullies and drainage lines for foraging and dispersal. They have a relatively large home-range size of up to 150 ha for males and 35 ha for females, with males being capable of moving up to 1.85 km between den sites in one night (Oakwood 2000; Hill and Ward 2010).

There is no approved Conservation Advice for this species; however, the following statutory documents are relevant for the species:

- Commonwealth Listing Advice on Northern Quoll (*Dasyurus hallucatus*) (TSSC 2005);
- National Recovery Plan (Hill and Ward 2010);
- EPBC Act referral guideline for the endangered Northern Quoll *Dasyurus hallucatus* (DoE 2016a);
- Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (DSEWPaC 2011a);
- Threat abatement plan for predation by feral cats (DoE 2015b); and
- Threat Abatement Plan for Predation by the European Red Fox (DEWHA 2008a).

Collectively, these documents describe the key threats for the species and define habitat critical to the survival of the Northern Quoll.

Habitat and Distribution

The EPBC referral guideline for the endangered Northern Quoll defines critical habitat for Northern Quoll as 'habitat within the modelled distribution for the species which provides shelter for breeding, refuge from fire, and predation by the Cane Toad' including (DoE 2016a):

- Offshore islands where the Northern Quoll is known to exist;
- Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines; and
- Structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs.

Critical habitat includes dispersal and foraging habitat associated with, or connecting, populations important to the species' long-term survival (DoE 2016a). Foraging and dispersal habitat is any land that comprises:

- Predominantly native vegetation in the immediate area (i.e., within 1 km) of shelter or denning habitat;
- Northern Quoll records; and

- Land containing mostly native vegetation that is connected to shelter habitat within the range of the species.

Critical habitat as defined in the National Recovery Plan for the Northern Quoll, *Dasyurus hallucatus* (Hill and Ward 2010) is habitat “where northern quolls are least exposed to threats or least likely to be in the future. Two particular broad habitat types fall into this category: rocky areas and offshore islands. Daytime den sites, in particular, provide important shelter and protection for northern quolls from predators and weather” and rocky areas, which contain these features, can retain water and microhabitats, creating greater prey diversity than nearby non-rocky areas (Hill and Ward 2010). While the surrounding foraging and dispersal habitats are also important, they are generally more widespread, and any clearing of these habitats is considered less significant.

There are 8,172 known records of Northern Quoll within WA; however, population size estimates are currently unavailable (DBCA 2007-2021, DAWE 2021b).

Occurrence in the Terrestrial Survey Area

The EPBC Act Referral Guidelines (DoE 2016a) for the species indicate that a high-density population may be characterised by numerous camera triggers of multiple individuals across multiple cameras or trap sites. A low-density population may be represented by infrequent captures of one or two individuals confined to one or two traps or where trapping has captured no individuals, but there is latrine evidence.

This species was recorded 89 times within the Terrestrial Survey Area at four sites (KBT02, KBT03, KBT04, KBT05 and Cam02) (**Figure 10-3, Figure 10-4 and Figure 10-5**; 360 Environmental 2021b, 2022a). In the original survey, this included capturing three individuals in cage traps, 71 records using camera traps, 11 scats, and one record of tracks. Spot analysis identified 17 individuals of Northern Quolls, with an average of 11.1 individuals recorded per 100 trap nights within the Terrestrial Survey Area (360 Environmental 2021b). Most of these recordings occurred in the Mesas and Breakaway habitat (avoided in the Haul Road DE).

In the most recent survey of Red Hill north and south Haul Road options, spot analysis identified one individual within the Stony Hills and Slopes habitat (at Cam02), with another recording at the same location where the images were not clear enough to establish whether this was the same or a different individual (360 Environmental 2022a).

The number of records in the Terrestrial Survey Area indicates a high-density population (DoE 2016a, 360 Environmental 2021b). High-density populations are considered important for the species' long-term survival under the EPBC Referral Guidelines (DoE 2016a) and the protection of these populations from further decline is one of the major recovery objectives (Action 3.3) presented in the National Recovery Plan for the species (Hill and Ward 2010). In addition, an adult and juvenile were photographed together at site KBT03, 45 m from the Haul Road DE, indicating that breeding and denning occur in the Terrestrial Survey Area (360 Environmental 2021b).

Habitat in the Terrestrial Survey Area

The Northern Quoll can occupy various habitats across its range, including rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (TSSC 2005). Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats foraging and dispersal. Rocky habitats are usually of high relief, often rugged and dissected, and include fields or caves in low-lying areas (TSSC 2005).

In the National Recovery Plan, rocky areas are identified as critical habitat for the Northern Quoll, as they provide important shelter and protection, retain water and provide greater prey diversity and microhabitats. The Mesa/Breakaway habitat type that occurs within the Terrestrial Survey Area (but outside of the Haul Road DE) are considered rocky areas and are therefore considered habitat critical to the survival of the species. No rocky areas occur within the Haul Road DE and therefore there is no critical habitat for Northern Quolls within the Haul Road DE. Drainage Line/River/Creek (major and minor) and Stony Hills and Slopes habitat provide foraging and dispersal habitat for the Northern Quoll.

The Commonwealth listing advice states that the upper home range for this species is up to 150 ha for males and 35 ha for females (TSSC 2005), which would have an approximate radius of 0.62 km (based on a 150 ha home range). This represents the approximate distance an individual would travel from the denning habitat to disperse

and forage. Given this, foraging and dispersal habitat within 0.62 km (rounded up to 1 km to be conservative) of the Mesa/Breakaway habitat, which is only present outside the Haul Road DE, is considered supporting habitat for the Northern Quoll.

The approximate amount of supporting habitat associated with this Proposal is shown in **Table 10-6** and shown in **Figure 10-5**. It is noted that the Stony Plain habitat was not identified as high or moderate value foraging habitat for Northern Quoll; however the EPBC Act referral guidelines identify all native vegetation in the immediate area (i.e. 1 km) of shelter or denning habitat as potentially important habitat, and therefore to provide a conservative assessment of the impact to this species, the impact to Stony Plain habitat within 1 km of potential denning habitat has been included in **Table 10-6** and **Figure 10-5**.

Table 10-6: Foraging and Dispersal Habitat within 1 km of Potential Denning Habitat (Mesas and Breakaways)

Habitat Type	Terrestrial Fauna Survey Area (ha)	Haul Road DE (ha)	Haul Road IF (ha)
Stony Hills and Slopes	139.3	19.8	4.1
Drainage Line/Creek (minor)	89.7	10.8	3.8
Stony Plain	402.2	379.1	109.4
Cleared	7.3	2.4	0.3
Total	663.5	412.1	117.4

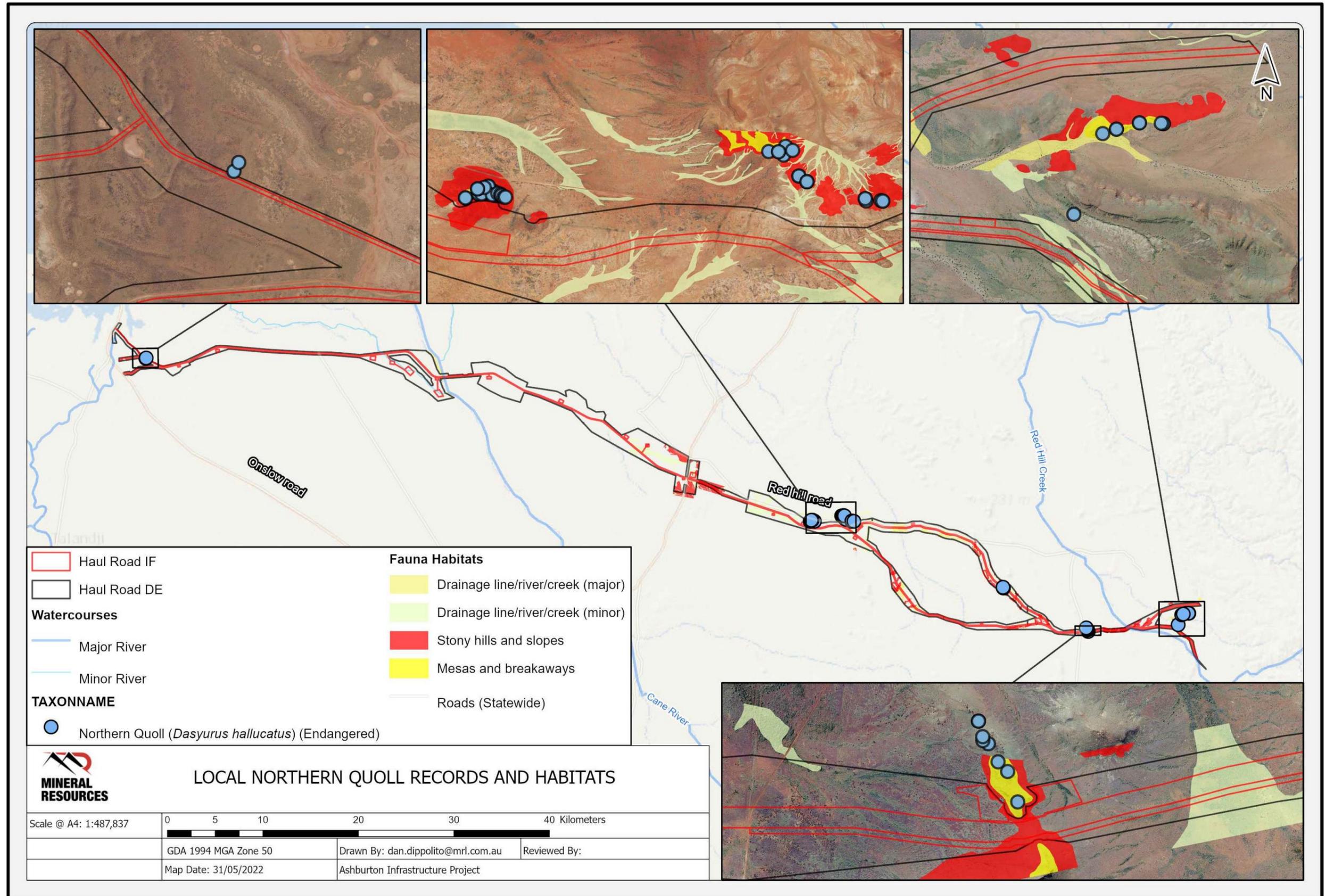


Figure 10-5: Local Northern Quoll Records and Habitats

10.3.3.2 Pilbara Leaf-nosed Bat

Relevant Policy and Guidance

There is an approved Conservation Advice document for the species (TSSC 2016f); however, no recovery plan is available. The following statutory documents are relevant to the species:

- Conservation Advice *Rhinonictoris aurantia* (Pilbara form) Pilbara Leaf-nosed Bat (TSSC 2016f);
- A review of Pilbara Leaf-nosed Bat ecology, threats and survey requirements (Bat Call 2021b);
- Threat Abatement Plan for predation by feral Cats (DoE 2015b); and
- Threat Abatement Plan for Predation by the European Red Fox (DEWHA 2008a).

Collectively, these documents describe the key threats for the species, detail the recovery objectives and define habitat critical to the survival of the Pilbara Leaf-nosed Bat.

Habitat and Distribution

The Pilbara Leaf-nosed Bat (*Rhinonictoris aurantia*) is listed as Vulnerable under the EPBC Act and the BC Act. The Pilbara Leaf-nosed Bat was originally considered to be the same species as the Orange Leaf-nosed Bat, which occurs in the Kimberley, Northern Territory, and northwest Queensland; however, it is now considered to be a separate form based on morphology (Van Dyck and Strahan 2008). The Pilbara Leaf-nosed Bat is restricted to the Pilbara and parts of the upper Gascoyne region, with records spread throughout the region (Armstrong 2001). Pilbara and upper Gascoyne population of Pilbara Leaf-nosed Bat are recognised as an important population composed of one isolated interbreeding population of national significance that shows genetic divergence (TSSC 2016f).

The species generally require rocky areas that provide an opportunity for roosting in caves or disused underground mines, including the ironstone hills of the Hamersley Range and granite boulder piles and disused mines in greenstone ranges of the eastern Pilbara (Armstrong 2001). During the dry season, the species roosts in deep, warm, humid caves or mines and forages nearby, whereas, in the wet season, the species is more widespread and is less reliant on deep caves for roosting (360 Environmental 2021b).

Since the release of the Approved Conservation Advice for Pilbara Leaf-nosed Bat in 2016 (TSSC 2016f), DAWE engaged Bat Call WA Pty Ltd to undertake a review of Pilbara Leaf-nosed Bat ecology, threats and survey requirements based on more recent data (Bat Call 2021b). Extensive survey activity has occurred in the last decade that has led to the proposal of types of roosting habitat used by Pilbara Leaf-nosed Bat in the Pilbara region including:

- Permanent diurnal roosts (Category 1 and Category 2) – Category 1 permanent roosts are maternity roosts where seasonal presence of young is proven. Category 2 permanent roosts are occupied year-round but without the proven presence of young;
- Semi-permanent diurnal (Category 3) – These are used diurnally during some part of the year, but not occupied year-round; and
- Nocturnal refuge (Category 4) – These are occupied or entered at night for resting, feeding or other purposes, with perching not a requirement.

Category 1, 2 and 3 caves are considered to be critical habitat. Category 4 caves are not considered to be critical habitat (Bat Call 2021b).

Currently within in the Pilbara, there are 48 confirmed permanent diurnal category 1 and 2 roost sites; with 17 of these known and the other 31 yet to be found that are predicted to occur within a 5 km diameter circle on the basis of systematic survey data (Bat Call 2021b, **Figure 10-6**). Population size is currently unknown (Bat Call 2021b). Thirty-eight of the known or suspected permanent diurnal roosts are in natural caves in banded iron formations in the Hamersley Ranges and eastern Pilbara and six are disused underground gold and copper mines of the eastern Pilbara. Four are not yet well enough defined and may be in either (Bat Call 2021b).

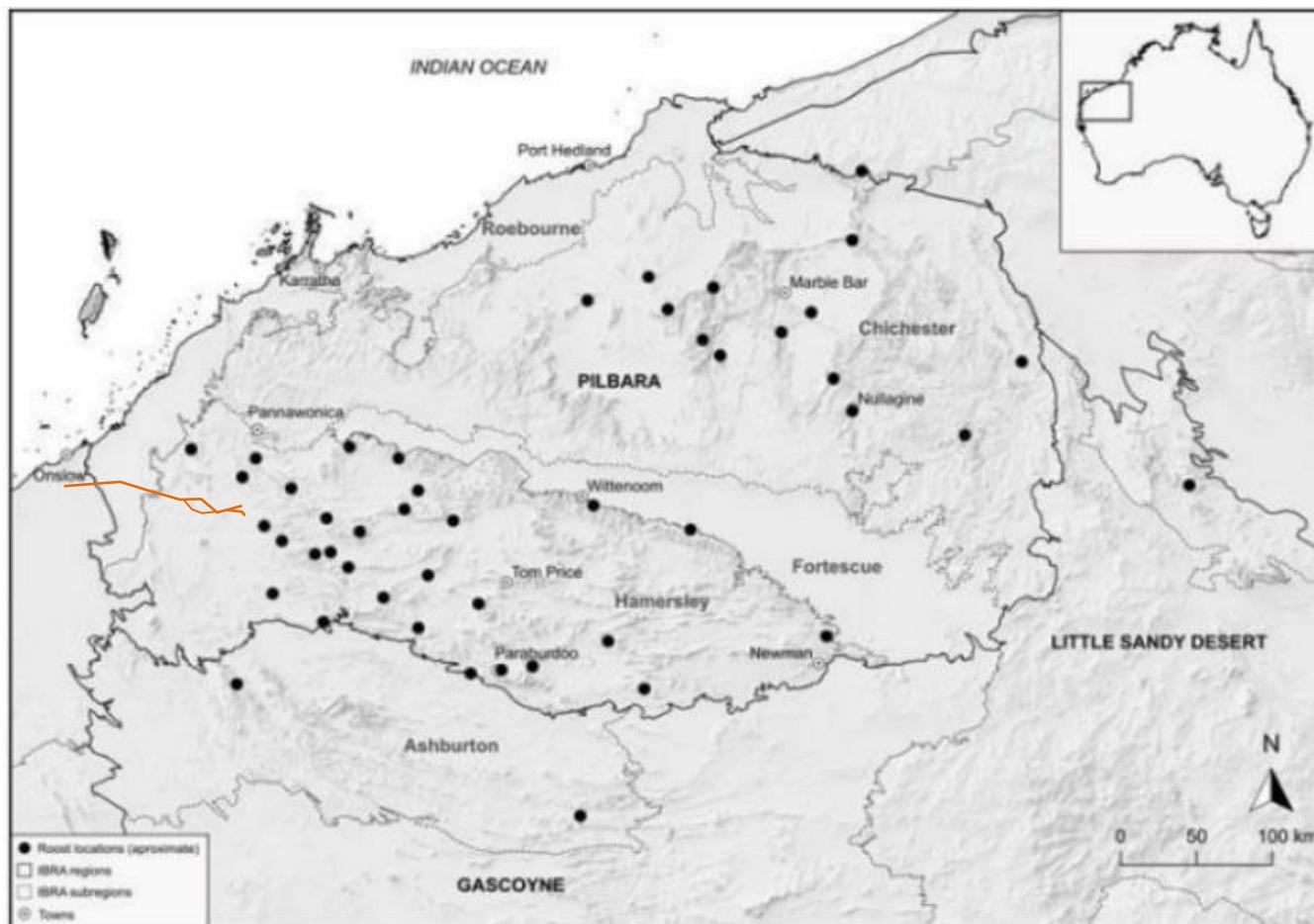


Figure 10-6: Distribution of Permanent Diurnal Pilbara Leaf-nosed Bat Roosts (Bat Call 2021b)
b) Orange line indicates approximate location of the Haul Road DE in relation to the roosts

Generally, the species is known to be more commonly encountered within 20 km from its permanent diurnal roosts (this gives a potential foraging range of approximately 125,000 ha), but there is increasing numbers of records in April and May in areas much more distant (Bat Call 2021b). These records correspond to the more benign months that have lower temperatures than late summer, and humidity higher than later in the dry season, and also correspond to the months following the reproductive period that young adult bats might be spreading across the landscape from primary roost caves (Bat Call 2021b).

Extensive surveying using echolocation detectors in recent years has provided a very large data set of Pilbara Leaf-nosed Bat activity at a large variety of sites that show that the Pilbara Leaf-nosed Bat forages very widely and utilises almost all productive and semi-productive habitats (Bat Call 2021b). Foraging habitat has not been identified as critical habitat (Bat Call 2021b); however, foraging habitat in proximity to critical habitat (20 km) is considered to be supporting foraging habitat.

Occurrence in the Terrestrial Survey Area

No calls of Pilbara Leaf-nosed Bat were identified from within the Haul Road DE.

A total of 12 Pilbara Leaf-nosed Bat records occur across four sites outside of the Haul Road DE, within Mesas and Breakaway habitat and one site inside the Haul Road DE, within Drainage Line/River/Creek (major) habitat (**Figure 10-4** and **Figure 10-7**). The records consist of calls recorded using Autonomous Recording Units (ARUs). Fifteen calls were recorded across four nights at site KBB11, five calls recorded over two nights at site KBT03, 95 calls recorded over four nights at site KBT04, one call recorded on one night at site KBT05, and one call recorded on one night at site Trap02. Most of these recordings were of low numbers of individual foraging calls.

Higher numbers of calls were recorded near the eastern end of the Terrestrial Survey Area (outside of the Haul Road DE) at site KBT04. These are likely to represent foraging individuals consistent with known roost site including (**Figure 10-7**):

- A large known roost at Cane River (Category 1), approximately 12 km south east of the Haul Road DE; and
- An inferred roost at Mungarathoona Creek (Category 2), approximately 17 km north of the eastern end of the Haul Road DE (Bat Call 2021b).

The next closest Pilbara Leaf-nosed Bat Category 1, 2 and/or 3 roosts are close to the Robe River over 25 km to the north (Bat Call 2022).

Habitat in the Terrestrial Survey Area

Deep caves with a suitable microclimate for the species were not observed during the field survey, therefore Category 1, 2 or 3 roost are unlikely to occur within the Terrestrial Survey Area (360 Environmental 2021b, Bat Call 2022). Furthermore, none of these Category 1, 2 or 3 roost are known to occur within 12 km of the Haul Road DE. Therefore, **there is no critical habitat within or adjacent to the Haul Road DE**. Nevertheless, all Mesa and Breakaway habitats have been avoided. Suitable roosts (shallow caves or overhangs, Category 4 roosts) were observed within the Mesa and Breakaway habitat, which may be used for occasional roosting by individuals or small groups during the wet season, when the taxon is not reliant on deep, humid caves (360 Environmental 2021b, **Figure 10-7**):

All Haul Road DE habitat can provide foraging and dispersal capacity for the Pilbara Leaf-nosed Bat. This species may be regularly recorded foraging along the length of Red Hill Creek, Kununda Creek near Kens Bore mesa and in the adjoining ranges. It is also very occasionally recorded foraging across the plains to the west of Red Hill Creek, in particular along ephemeral drainage lines. Occurrence of and/or interaction with this species along the proposed Haul Road is expected on a very occasional basis (Bat Call 2022). However, the foraging habitat to the east of Red Hill Creek is within 20 km of Category 1 and 2 roosts and is therefore considered supporting foraging habitat (**Table 10-7, Figure 10-7, Bat Call 2022**).

Table 10-7: Foraging and Dispersal Habitat East of Red Hill Creek

Habitat Type	Terrestrial Fauna Survey Area (ha)	Haul Road DE (ha)	Haul Road IF (ha)
Claypans	0	0	0
Drainage Line/River/Creek (major)	81.3	30.5	6.7
Drainage Line/River/Creek (minor)	106.1	41.1	16.9
Mesa and Breakaway	0	0	0
Mulga Woodland	0	0	0
Plain	0	0	0
Sand Dunes and Swales	0	0	0
Stony Hills and Slopes	142	65.8	11.7
Stony Plain	1210	577.7	177.4
Tidal Flats	0	0	0
Cleared	3.5	1.8	0.3
Total	1542.9	716.9	213

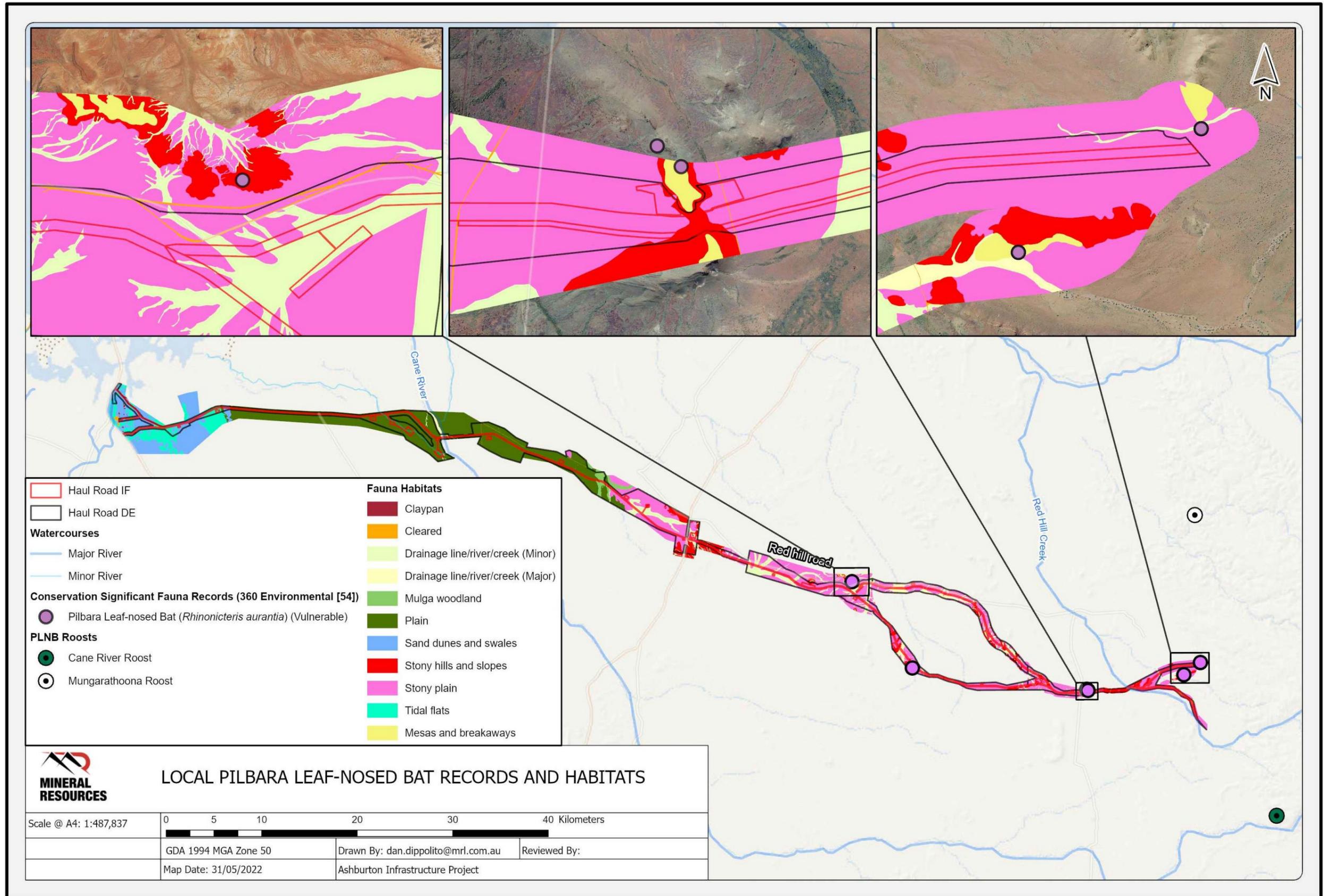


Figure 10-7: Pilbara Leaf Nosed Bat Records and Habitats

10.3.3.3 Ghost Bat

The Ghost Bat (*Macroderma gigas*) is listed as Vulnerable under the EPBC Act and BC Act.

Relevant Policy and Guidance

There is no approved Recovery Plan for this species; however, the following key policy and guidance documents relevant to this species are:

- Approved Conservation Advice *Macroderma gigas* (Ghost Bat) (TSSC 2016e);
- A review of ghost bat ecology, threats and survey requirements (Bat Call 2021a);
- Threat abatement plan for predation by feral cats (DoE 2015b);
- Threat Abatement Plan for Predation by the European Red Fox (DEWHA 2008a); and
- Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPac 2012b).

Collectively, these documents describe the key threats for the species, detail the recovery objectives and define habitat critical to the survival of the Ghost Bat.

Habitat and Distribution

The Ghost Bat has a distribution that extends from north-west Western Australia across the northern extent of Australia, including the Northern Territory across to Queensland (TSSC 2016e). The Pilbara Ghost Bat population is genetically distinct and divergent, implying no movement of individuals between these areas. The Pilbara population has been assumed to be an important population based on the definition in the Significant Impact Guidelines "Key source population either for breeding or dispersal" (DoE 2013).

Ghost Bats move between a number of caves seasonally or as dictated by weather conditions and/or foraging opportunities, so they require a range of cave sites. They disperse widely when not breeding but may concentrate in a relatively few roost sites when breeding. Roost sites include caves, rock crevices and disused mine adits (Bat Call 2021a). The Ghost Bat requires a group of caves/shelters that provide diurnal (day) and nocturnal (night) roost with stable temperature and humidity within a gully or gorge system (TSSC 2016e). This system needs to have vertical vegetation complexity that opens onto plains or riparian drainage lines to provide good foraging opportunities (TSSC 2016e). Ghost Bats do not require free surface water for drinking and forage after sunset and again before sunrise (TSSC 2016e).

There is an approved Conservation Advice paper for this species (TSSC 2016e); however, no recovery plan exists. Since the release of the Approved Conservation Advice for Ghost Bats in 2016, DAWE engaged Bat Call to undertake a review of Ghost Bat ecology, threats and survey requirements based on more recent data (Bat Call 2021a). Extensive survey activity has occurred in the last decade that has led to the definition of four categories of roosting habitat used by Ghost Bats in the Pilbara region including:

- Category 1 maternity/diurnal roosts sites with permanent Ghost Bat occupancy;
- Category 2 maternity/diurnal roost caves with regular occupancy;
- Category 3 diurnal roost caves with occasional occupancy; and
- Category 4 nocturnal roost caves with opportunistic usage.

Category 1 and 2 caves are considered to be critical habitat, while Category 3 caves are only considered critical habitat when adjacent to Category 2 caves and described as "apartment blocks" that support the viability of Category 2 caves. Isolated Category 3 and 4 caves are not considered to be critical habitat (Bat Call 2021a).

Ghost Bats require several suitable caves, of varying shapes and sizes, throughout their home ranges to fulfil various ecological requirements. Individuals also move between roosts seasonally or according to weather conditions, and populations tend to be widely dispersed when not breeding and concentrate in relatively few roost

sites when breeding (TSSC 2016e). The Ghost Bat has a patchy distribution in the Pilbara, with 903 records in Western Australia (DBCA 2007-2021). The regional Pilbara Ghost Bat population is estimated at 1,300 to 2,000 individuals, and in the Hamersley subregion, approximately 350 individuals (TSSC 2016e).

Early studies found that foraging was centred on average, 1.9 km from the day roost, and the mean size of foraging areas was 61 ha (TSSC 2016e). More recent studies using VHF track and GPS/satellite tracking technology show that Ghost Bats forage over much larger areas, up to 12 km from their diurnal roost with round trip lengths up to 30 km being recorded (Bat Call 2021a), and, further, do not limit its foraging habitat to drainage lines and stony hills and slopes (Bat Call 2022). This gives a potential foraging range of approximately 45,000 ha from roosts sites (assuming an approximately 12 km range). Foraging habitat has not been identified as critical habitat (Bat Call 2021a), however, foraging habitat in proximity to critical habitat (10- 12 km) is considered supporting foraging habitat.

The Ghost Bat has a patchy distribution in the Pilbara, with 903 records in Western Australia (DBCA 2007-2021). The regional Pilbara Ghost Bat population is estimated at 1,300 to 2,000 individuals, and in the Hamersley subregion, approximately 350 individuals (TSSC 2016e).

Occurrence in the Terrestrial Survey Area

No Ghost Bats have been recorded within the Haul Road DE.

Several calls were recorded at two sites (KBT02 and KBT05) during the fauna survey in the Terrestrial Survey Area (**Figure 10-4** and **Figure 10-8**), with one call from an ARU and six calls recorded from another ARU. One Ghost Bat was captured on a motion camera (360 Environmental 2021b, 2022a). These results are consistent with bats using the mesas in the local area for foraging and possibly roosting. Suitable night roosts (shallow caves or overhangs) were observed outside the Haul Road DE. No deeper, more complex caves were recorded that would be required for a diurnal or maternity roosts (Category 1 or 2, 360 Environmental 2021b, 2022a). The results of the survey are consistent with its known regional distribution and behaviour, including for roosting and foraging (Bat Call 2022).

Roosting habitat in proximity to the Haul Road DE includes (**Figure 10-8**):

- Several small mesas containing caves between Red Hill Creek and NWCH (within 1 km of the Haul Road DE) – which are mostly Category 4 shelters, but which may contain isolated Category 3 caves (Bat Call pers comm. 1 April 2022);
- Kens Bore Mesa (approximately 1 km east of the Haul Road) – which includes a number of isolated Category 3 caves and Category 4 overhangs, but does not include Category 1 or Category 2 caves (Bat Call pers comm. 1 April 2022); and
- Hamersley Range uplands (approximately 5 km east of the Haul Road) – this range contains a number of Category 2 and Category 3 caves including “apartment block” groupings (i.e. critical habitat), as well as a number of isolated Category 3 and Category 4 caves (Bat Call pers comm. 1 April 2022).

Based on the above there is **no critical habitat within or adjacent to the Haul Road DE**.

Habitat in the Terrestrial Survey Area

All Haul Road DE habitats can provide foraging and dispersal capacity for the Ghost Bat. Occurrence of and/or interaction with this species along the proposed Haul Road is considered very low west of NWCH, low between NWCH and Red Hill Creek, and moderate to high east of Red Hill Creek for foraging and dispersal only (Bat Call 2022). However, the foraging habitat to the east of Red Hill Creek is within 12 km of a Category 2 roosts and is therefore considered **supporting foraging habitat** (**Table 10-8, Figure 10-8, Bat Call 2022**).

Table 10-8: Foraging and Dispersal Habitat East of Red Hill Creek****Within 12 km of Maternal/Diurnal Roost Caves**

Habitat Type	Terrestrial Fauna Survey Area (ha)	Haul Road DE (ha)	Haul Road IF (ha)
Claypans	0	0	0
Drainage Line/River/Creek (major)	81.3	30.5	6.7
Drainage Line/River/Creek (minor)	106.1	41.1	16.9
Mesa and Breakaway	0	0	0
Mulga Woodland	0	0	0
Plain	0	0	0
Sand Dunes and Swales	0	0	0
Stony Hills and Slopes	142	65.8	11.7
Stony Plain	1210	577.7	177.4
Tidal Flats	0	0	0
Cleared	3.5	1.8	0.3
Total	1542.9	716.9	213

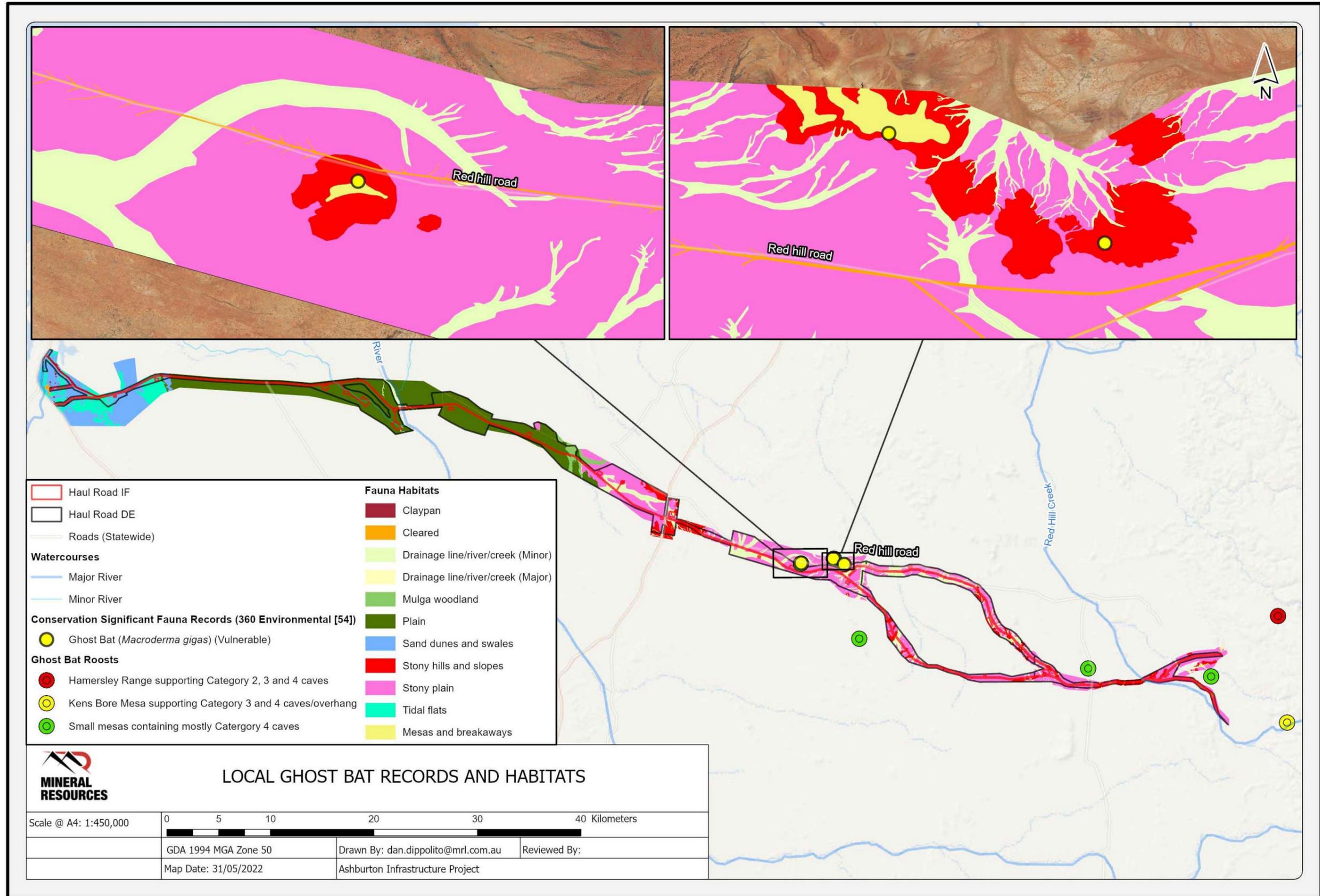


Figure 10-8: Ghost Bat Records and Habitats

10.3.3.4 Pilbara Olive Python

The Pilbara Olive Python (*Liasis olivaceous barroni*) is listed as Vulnerable under the EPBC Act and BC Act.

Relevant Policy and Guidance

The following statutory documents are also relevant to this species:

- Approved Conservation Advice for *Liasis olivaceous barroni* (Olive Python – Pilbara Subspecies) (DEWHA 2008b);
- Threat abatement plan for predation by feral cats (DoE 2015b); and
- Survey guidelines for Australia's threatened reptiles (DSEWPaC 2011b).

Habitat and Distribution

This species is restricted to ranges within the Pilbara region of Western Australia, including the Hamersley Range and islands of the Dampier Archipelago (DAWE 2021b).

The Pilbara Olive Python prefers deep gorges and water holes in the ranges of the Pilbara region (DEWHA 2008b). In the cooler winter months, it hides in caves and rock crevices away from water sources and in the warmer months they move around widely usually in close proximity to water and rock outcrops (DEWHA 2008b). The species is known to have large home ranges, with individuals having been recorded with a home range of roughly 450 ha (360 Environmental 2021b). However, males can travel distances of up to 4 km during the breeding season (June to August) to locate females (DotEE 2019a).

In the warmer summer months, the pythons were found to move around widely, usually in close proximity to water and rock outcrops (DEWHA 2008b, DSEWPaC 2011a). The species is adept at swimming, utilising water holes to hunt. Individuals spend the cooler winter months within caves and rock crevices away from water sources (DEWHA 2008b). Males can travel distances of up to 4 km during the breeding season (June to August) to locate females (DotEE 2019a).

The species is restricted to ranges within the Pilbara region and occurs as scattered populations. The Pilbara Olive Python is currently known from 21 locations within the Pilbara, including populations at Pannawonica, Millstream, Tom Price and Burrup Peninsula. There are currently 190 known records of the species within the Pilbara (DBCA 2007-2021; DAWE 2021b). It also occurs within the Rangelands (WA) Natural Resource Management Region, and habitat is conserved in Karijini National Park.

At present, there are no species-specific policy guidelines on defining habitat critical to the survival of the Pilbara Olive Python or how an important population is defined. This may be due to the species' cryptic nature, making reliable surveys difficult (DEWHA 2008a).

Based on the Significant Impact Guidelines (DoE 2013) all habitats that support key life-cycle activities such as foraging, breeding, dispersal or shelter could be considered critical or important habitat for the survival of this species.

Occurrence in the Terrestrial Survey Area

No individuals were recorded on automated cameras or other evidence such as scats or tracks within the Haul Road DE. No permanent or semi-permanent water features, which would be important potential habitat for Pilbara Olive Python, occur in the Haul Road DE or the Terrestrial Survey Area. One Pilbara Olive Python was opportunistically recorded 20 km south of the Haul Road DE in a water trough near the Drainage Line/River/Creek (major) habitat, outside the Survey Area (**Figure 10-9**) (360 Environmental 2021b, 2022a).

Habitat in the Terrestrial Survey Area

Given the cryptic nature of the species and that it is difficult to survey, all suitable habitat in the Haul Road DE is considered as potential habitat. Approximately 4,499 ha of potential denning, shelter, foraging and dispersal habitat for Pilbara Olive Python occurs within the Terrestrial Survey Area. This includes:

- 48 ha of Mesa and Breakaways habitat (avoided in the Haul Road DE);
- 695 ha Drainage Line/River/Creek (major);
- 1,499 ha of Stony Hills and Slopes; and
- 2,257 ha of Drainage Line/River/Creek (minor).

All other Terrestrial Fauna Survey habitats provide limited foraging and dispersal capacity for the Pilbara Olive Python and are widespread within the local area.

The most important habitat for this species is considered the Mesa and Breakaway habitat, particularly at the eastern end of the Terrestrial Survey Area where drainage lines are in close proximity (360 Environmental 2021b). The Haul Road DE has been specifically designed to avoid Mesa and Breakaway habitat. In addition, no semi-permanent or permanent pools were recorded in the Terrestrial Survey Area.

The Drainage Line/River/Creek (major) habitat are considered to have a greater presence of gully and water erosion, potential for permanent or semi-permanent pooling of water than Drainage Line/River/Creek (minor) habitat and is therefore considered potentially important foraging and dispersal habitat for Pilbara Olive Python, when adjacent to the Mesa and Breakaway Habitat (360 Environmental 2021b). This habitat only occurs in proximity to Mesa and Breakaway habitat (i.e. within 1 km) in one location within the Terrestrial Survey Area, at the very eastern end, outside of the Haul Road DE (**Figure 10-9** and **Figure 10-10**).

The Stony Hills and Slopes habitat towards the eastern end of the Terrestrial Survey Area, will also provide important foraging and dispersal habitat when adjacent to the Mesa and Breakaway habitat and near water sources (360 Environmental 2021b), such as the Drainage Line/River/Creek (major) habitat. There is only one location where the Stony Hills and Slopes habitat and the Drainage Line/River/Creek (major) habitat occur concurrently in proximity to Mesa and Breakaway habitat (i.e. within 1 km) within the Terrestrial Survey Area, and that is at the very eastern end of the Haul Road, outside of the Haul Road DE.

Based on the Significant Impact Guidelines (DoE 2013) and the results of the terrestrial fauna survey (360 Environmental 2021b), the Mesa and Breakaway habitat would be considered critical habitat as it contains potential breeding habitat, and the Stony Hills and Slopes habitat and Drainage Line/River/Creek (major) habitat could also represent habitat critical to the species' survival when adjacent to Mesa and Breakaway habitat and in proximity to watercourses, as it provides potentially important foraging and dispersal habitat. None of these habitats occur within the Haul Road DE.

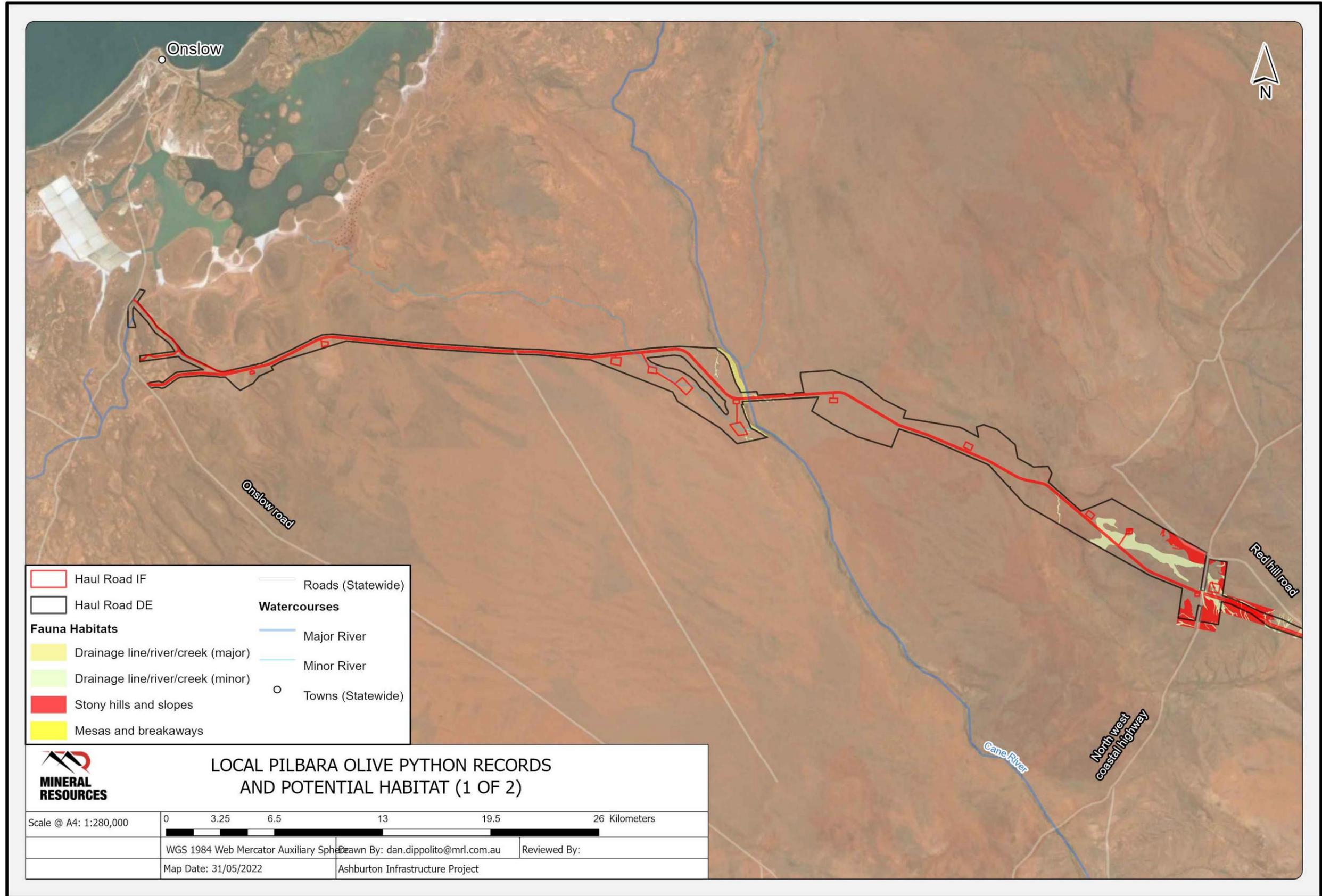


Figure 10-9: Pilbara Olive Python Records and Potential Habitats (1 of 2)

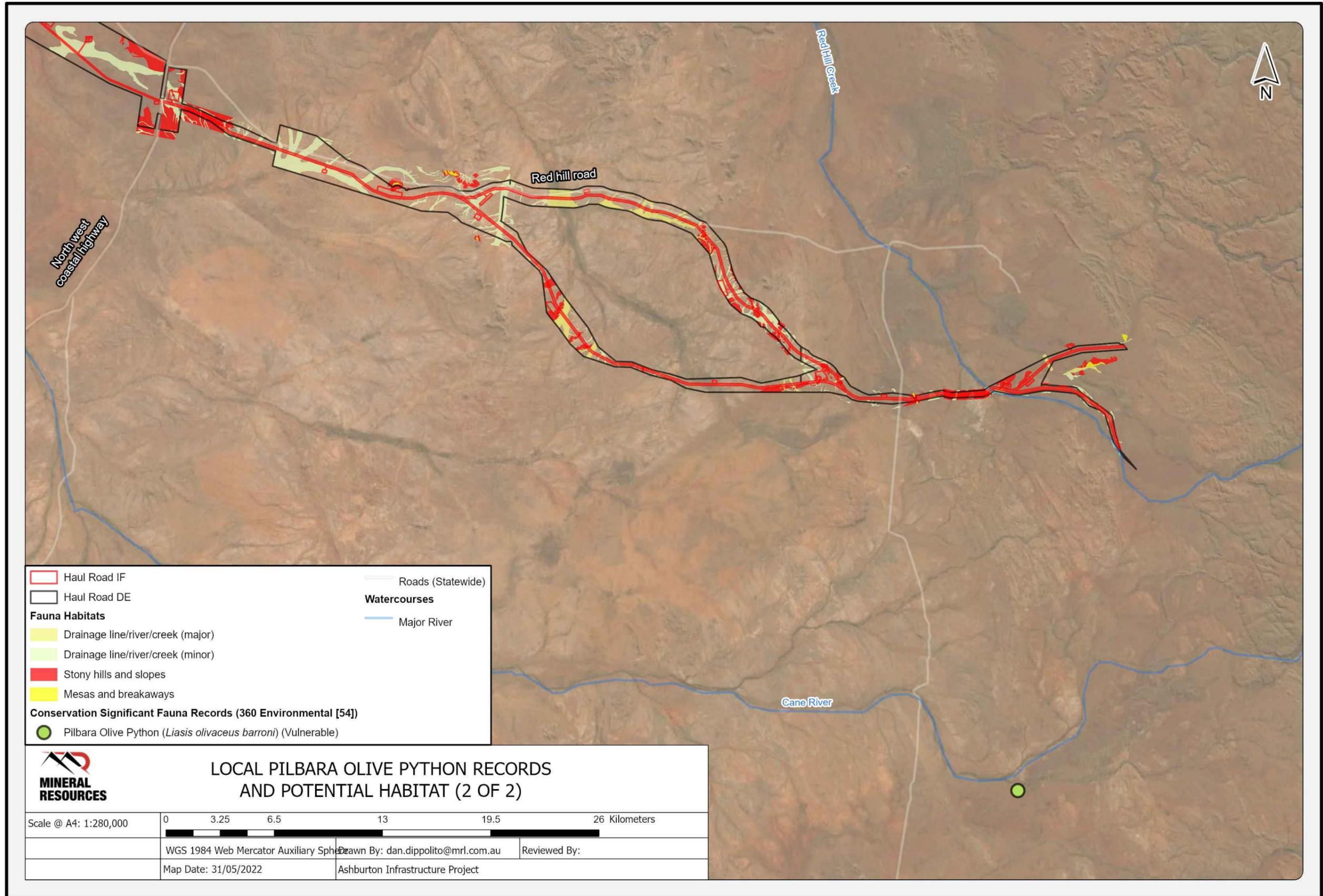


Figure 10-10: Pilbara Olive Python Records and Potential Habitats (2 of 2)

10.3.3.5 Grey Falcon

The Grey Falcon (*Falco hypoleucos*) is listed as Vulnerable under the EPBC Act and BC Act.

Relevant Policy and Guidance

There is no approved Recovery Plan for this species; however, the following key policy and guidance documents relevant to this species are:

- Approved Conservation Advice *Falco hypoleucos* Grey Falcon (TSSC 2020);
- Threat abatement plan for predation by feral cats (DoE 2015b); and
- Threat Abatement Plan for Predation by the European Red Fox (DEWHA 2008a).

Collectively, these documents describe the key threats for the species, detail the recovery objectives and define habitat critical to the survival of the Grey Falcon.

Habitat and Distribution

This species occurs in low densities across arid and semi-arid parts of Australia, including WA (TSSC 2020).

The Grey Falcon hunts in habitats ranging from wooded drainage systems to open spinifex plains. It has been observed in Acacia shrublands near tree-lined creeks and rivers and frequents tussock grassland and open woodland (TSSC 2020). The species utilise abandoned nests of other birds, usually in tall trees along drainage lines and waterholes.

There is an Approved Conservation Advice document for the species (TSSC 2020); however, there is no recovery plan in place. The Conservation Advice outlines key threats for the species but does not define habitat critical to the species' survival or important populations. Critical habitat for the Grey Falcon has been based on the definition in the Significant Impact Guidelines "for activities such as foraging, breeding, roosting or dispersal" (DoE 2013).

There are currently 152 known records of the Grey Falcon throughout Western Australia (DBCA 2007-2021). It is estimated that there are approximately 500 pairs of Grey Falcon within Australia (BirdLife International 2021b).

Occurrence in the Terrestrial Survey Area

No individuals were recorded or were observed within the Haul Road DE. The nearest record was recorded 4 km and 7 km east of the Haul Road DE in 2015 (360 Environmental 2021b).

Habitat in the Terrestrial Survey Area

There is suitable habitat within the Haul Road DE, in the Drainage Line/River/Creek (major and minor) habitat. The Grey Falcon may utilise tall Eucalypt trees to nest in within Drainage Line/River/Creek (major and minor habitat), albeit these large trees are of low density. The other habitats within the Haul Road DE provide foraging habitat for the species. The species is unlikely to depend on the fauna habitats within the Haul Road DE for its survival as all Haul Road DE habitats extend beyond the haul road and are widespread in the local area 360 Environmental 2021b).

10.3.3.6 Western Pebble-mound Mouse

The Western Pebble-mound Mouse (*Pseudomys chapmani*) is listed as Priority 4 by DBCA.

Relevant Policy and Guidance

There are no statutory documents, policy or guidance relevant to this species.

Habitat and Distribution

The Western Pebble-mound Mouse is a burrowing and mound-building species that is endemic to the Pilbara region of WA. This species has been recorded extensively throughout the region, usually in association with elevated terrain often vegetated by hard spinifex (360 Environmental 2021b; Ford and Johnson 2007). Populations

of this species are also known to be widespread more broadly throughout the ranges of the central and southern Pilbara region.

There are no statutory documents, policy or guidance relevant to this species.

There are currently 1,229 records of the species throughout the Pilbara (DBCA 2007-2021).

Occurrence in the Terrestrial Survey Area

One Pebble-mound Mouse mound was recorded in Stony Plain habitat, approximately 300 m outside the Haul Road DE (**Figure 10-3**; 360 Environmental 2021b). The mound recorded did not exhibit an access hole, indicating that the mound is currently inactive. Given this record within the Terrestrial Survey Area and the occurrence of suitable habitat, the Western Pebble-mound Mouse has a high likelihood of occurring within the Haul Road DE (360 Environmental 2021b).

10.3.3.7 Long-tailed Dunnart

The Long-tailed Dunnart (*Sminthopsis longicaudata*) is listed as Priority 4 by DBCA).

Relevant Policy and Guidance

There are no statutory documents, policy or guidance relevant to this species.

Habitat and Distribution

The Long-tailed Dunnart is a nocturnal marsupial that is endemic to Australia. The species is distributed from the Pilbara and adjacent upper Gascoyne Region, east to the central Northern Territory and within South Australia, and is typically found in rocky, rugged habitats (360 Environmental 2022a). Once considered rare, the species is now considered to be relatively widespread and common, however restricted to a specific habitat (McKenzie, Woinarski and Burbidge 2016).

Occurrence in the Terrestrial Survey Area

One Long-tailed Dunnart was recorded within Stony Hills and Slopes habitat within the Haul Road DE (360 Environmental 2022a). Previous surveys have recorded one individual approximately 48 km southeast of Red Hill Station within *Triodia* sp. hummock grassland.

Habitat in the Terrestrial Survey Area

Suitable habitat for the species within the Haul Road DE includes Stony Hills and Slopes and Stony Plain habitat for foraging, dispersal and shelter. Each of the habitat types extend beyond the Haul Road and are widespread in the local area (360 Environmental 2022a).

10.3.3.8 Short-tailed Mouse

The Short-tailed Mouse (*Leggadina lakedownensis*) is listed as Priority 4 by DBCA.

Relevant Policy and Guidance

There are no statutory documents, policy or guidance relevant to this species.

Habitat and Distribution

The Short-tailed Mouse has a broad distribution across the majority of northern Australia and is known to occur on sandy soils and cracking clays in Western Australia (360 Environmental 2021b; DBCA 2000). The species is sparsely distributed across known scattered populations in Australia, and little information about the species' biology is known (360 Environmental 2021b).

There are no statutory documents, policy or guidance relevant to this species.

Historical records of the species show that stony hummock grassland is the preferred habitat (Van Dyck and Strahan 2008). However, recent database searches indicate the species occur within Tidal Flats and Claypan

habitat, with 56 records occurring within 1 km of the PPA's Port and two records near the western end of the Haul Road DE, 1.6 km north and 5 km west respectively (360 Environmental 2021b). Suitable habitat within the Haul Road DE includes Tidal Flats, Claypans, Plains and Stony Plains as they provide valuable shelter (e.g., termite mounds, which are widespread and abundant within the broader Terrestrial Survey Area and Pilbara region) (360 Environmental 2021b). Given the proximity of the nearby records and the occurrence of suitable habitat, the Short-tailed Mouse has a high likelihood of occurring within the Haul Road DE (360 Environmental 2021b).

10.3.3.9 Peregrine Falcon

The Peregrine Falcon (*Falco peregrinus*) is listed under Schedule 7 of the BC Act as 'other specially protected fauna'.

Relevant Policy and Guidance

There are no statutory documents, policy or guidance relevant to this species.

Habitat and Distribution

This species is widespread across Australia but specifically requires cliffs, rocky outcrops or large tree hollows for nesting, preferably near a water source (DotEE 2019b). It is a relatively uncommon species, with approximately 1,526 known records of the species within Western Australia (Barret et al. 2003; DBCA 2007-2021).

There are no statutory documents, policy or guidance relevant to this species.

The species has not been recorded within the Haul Road DE, but records exist approximately 8 km south and 13 km southeast (Rapallo 2012a, 2012b and 360 Environmental 2021b).

All the fauna habitats recorded in the Haul Road DE provide suitable foraging habitat for the species. The Drainage Line/River/Creek and Stony Hills and Slopes habitat types potentially provide suitable breeding habitats (360 Environmental 2021b). However, given the species-wide distribution and habitat requirements, it is unlikely to solely rely on any of the habitats present within the Haul Road DE (360 Environmental 2021b).

10.3.3.10 Waterbirds

Thirty-five shorebirds/wetlands birds listed as under the EPBC Act are considered to potentially interact with the Proposal based on their habitat preferences (**Table 10-5**; BCE 2022).

Relevant Policy and Guidance

- Shorebirds and seabirds of the Pilbara Coast and Islands (DBCA 2017);
- EPBC Act Policy Statement 3.21– Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebird Species (DotEE 2017d);
- Interim Report: Prototype Standard - Migratory Species (DAWE 2020);
- National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DotEE 2020);
- Marine Bioregional Plan for the North-west Marine Region (DSEWPaC 2012a);
- Conservation Advice *Limosa lapponica menzbieri* Bar-tailed godwit (northern Siberian) (TSSC 2016d);
- Approved Conservation Advice for *Sternula nereis* (Fairy Tern) (DSEWPaC 2011c);
- Approved Conservation Advice for *Rostratula australis* (Australian Painted Snipe) (DSEWPaC 2013);
- Conservation Advice: *Charadrius mongolus* Lesser Sand Plover (TSSC 2016c);
- Conservation Advice: *Charadrius leschenaultii* Greater Sand Plover (TSSC 2016b);
- Conservation Advice: *Calidris ferruginea* Curlew Sandpiper (DoE 2015d);

- Conservation Advice: *Numenius madagascariensis* Eastern Curlew (DoE 2015e);
- Conservation Advice: *Calidris tenuirostris* Great Knot (TSSC 2016a);
- Conservation Advice: *Calidris canutus* Red Knot (TSSC 2016g);
- Commonwealth Listing Advice on *Sterna albifrons sinensis* (Little Tern (Wester Pacific)) (TSSC 2002);
- Commonwealth Listing Advice on *Sternula nereis* (Fairy Tern) (TSSC 2011); and
- Commonwealth Listing Advice on *Rostratula australis* (Australian Painted Snipe) (TSSC 2013).

Occurrence and Interaction with the Proposal

The BirdLife Australia's Migratory Shorebird Monitoring Program contains data from a suite of sites from Onslow to approximately 100 km to the south-west along the mainland coast and near-coastal islands. These records include, but extent beyond the Onslow Shorebird area and Onslow Estuarine Tidal flat (**Figure 10-11**). Despite the Onslow area being included in regular surveys carried out for this program, the abundance of waterbirds was found to be low within 15-20 km of the Proposal as shown in **Figure 10-12** (number of waterbirds counted) and **Figure 10-13** (number of species recorded).

The nearest important concentrations of waterbirds recorded on the coastline are about 100 km to the west-south-west, at the top of Exmouth Gulf (BCE 2022). These high counts were typically associated with the northernmost tidal flats of the Exmouth Gulf, with some sites having high counts of more than 2,000 birds and over 20 species, potentially making them sites of national significance (BCE 2022). Within the region, only Barrow Island, about 100 km to the north-north-west, has been identified as of international importance for waterbirds. Based on count data from 2005 and 2006, Barrow Island qualifies as an internationally important site for supporting >1% of the flyway populations of the Red-necked Stint, Grey-tailed Tattler, Ruddy Turnstone and Greater Sand Plover (BCE 2022).

The highest abundance of waterbirds in proximity to the Proposal was Beadon Point (referred to herein as Onslow Town Beach) which is 12 km from the Port (Site 6 on **Figure 10-12**). This site may occasionally meet the criteria for nationally important habitat given species richness (>15 species), and it also had one record that meets the criteria of international important habitat for abundance of a single species (Common Tern), and one nationally important count of the Fairy Tern and Caspian Tern (BCE 2022). Counts from claypans and upper tidal flats near the western end of the Haul Road DE were mostly of ducks and other waterbirds that are not migratory or otherwise listed under the BC Act or EPBC Act (BCE 2022). However, there was one record of approximately 2,000 small shorebirds (presumably a migratory species) in an area where upper tidal flats appeared to merge with claypans approximately 2 km from the Port, and 10 km from the western end of the Haul Road DE (Site 1 on **Figure 10-11**).

Based on the available data, there is low usage of the beach surrounding the Port, and this area has been highly modified through construction of the Ashburton Port. The highest waterbird counts within 15 km of the Proposal are on the Onslow Town Beach. Similarly, the level of usage of the Claypans and upper Tidal Flats within the Haul Road DE appears to be low and very intermittent. Based on the desktop assessment, the Proposal is away from areas where waterbirds are known to aggregate, which is considered to be almost certainly due to the environment types present (discussed further in **Section 10.3.4**) (BCE 2022).

The Vertebrate Fauna and Short-Range Endemic Invertebrate Fauna Assessment conducted by 360 Environmental (2021b) identified two environments within the Haul Road DE that may support waterbirds upon inundation: tidal flats and claypans. Tidal flats are a widespread and dominant landscape component in the Onslow region (DPLH 2021). The tidal flats within the Haul Road DE are distant from the coastline and experience infrequent to rare tidal inundation frequency (<0.01%; **Figure 10-11**) associated with extreme tidal, rainfall and floor events. Vegetation is scarce and typically consists of scattered samphire shrubs. Waterbirds have been observed in or near this habitat but are unlikely to regularly utilise or be otherwise dependent on this habitat (BCE 2022).

The nature of the claypans habitat is different from the Tidal Flats, as they are small, slight depressions that are typically not connected to the intertidal areas and instead fill with rainwater that can persist for periods of time following heavy rainfall events, most likely from cyclonic events in summer (BCE 2022). They are widespread in the area and may be interconnected during extreme flood events. When these claypans are inundated, they may

contain suitable prey items for shorebirds (and other waterbirds) at least occasionally. Based on this, the usage of the Claypan and upper Tidal Flat habitat within the Haul Road DE is considered low for waterbirds (BCE 2022).

10.3.4 Haul Road Development Envelope Fauna Habitats

The following information focuses on the Haul Road DE as all habitat clearing associated with the Proposal is in this area.

Nine broad habitat types (excluding cleared areas) have been identified in the Haul Road DE (360 Environmental 2021b), including:

- Claypan;
- Drainage Line/River/Creek (major);
- Drainage Line/River/Creek (minor);
- Mulga Woodland;
- Plain;
- Sand Dunes and Swales;
- Stony Hills and Slopes;
- Stony Plain; and
- Tidal Flats.

Another habitat type, Mesas and Breakaway, was identified in the Terrestrial Survey Area; however, the Haul Road DE was specifically modified to exclude it. The Mesas and Breakaway habitat is considered a high-value habitat. It provides denning, shelter, roosting, and dispersal habitat for Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat, and Pilbara Olive Python. The Proposal has been specifically designed to avoid this habitat, with an average buffer of 50 m (and a minimum of 2.5 m in one location) applied from the Haul Road DE to the mapped boundary of this habitat type.

The Drainage Line/River/Creek (major) fauna habitat has the most value to conservation significant fauna and overall fauna assemblages of the habitats recorded within the Haul Road DE. This habitat type is associated with three drainage lines along Cane River, Warramboe Creek and Red Hill Creek. This habitat provides continuous corridors of vegetation cover that allow fauna to traverse large distances. The overstorey vegetation within this habitat provides nesting and foraging habitats for birds, including conservation significant taxa, such as the Grey Falcon. The Drainage Line/River/Creek (major) habitats also provides potential foraging and dispersal habitat (ecological connectivity through the landscape) for several conservation significant fauna including Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Pilbara Olive Python (360 Environmental 2021b, see **Table 10-6**).

The Drainage Line/River/Creek (minor) habitat is more extensively represented within the region and provides habitat to conservation significant fauna and overall fauna assemblages of the habitats within the Haul Road DE albeit less than major drainage lines. This habitat type has a lower presence of gullying and water erosion, permanent or semi-permanent pooling of water and typically has smaller trees than major drainage lines (360 Environmental 2021b). The Stony Hills and Slopes habitat provides important dispersal and foraging habitat for MNES species, particularly when adjacent to Mesas and Breakaway habitat and drainage lines. Stony Hills and Slopes habitat frequently connect the Mesas/Breakaway habitat to the Drainage Line/River/Creek (major and minor) habitat.

The upper Tidal Flats which are present in the western-most portion of the Haul Road DE experience infrequent inundation and for much of the time are dry flats with scattered samphire shrubs. They may also be separated from tidal influence by the evaporation ponds of Onslow Salt. The Tidal Flat habitat present in the Haul Road DE is dry and dusty with no evidence of inundation. This suggests that the upper Tidal Flats are dry most of the time and may only be inundated a few times a year during peak spring tides or as a result of heavy rainfall.

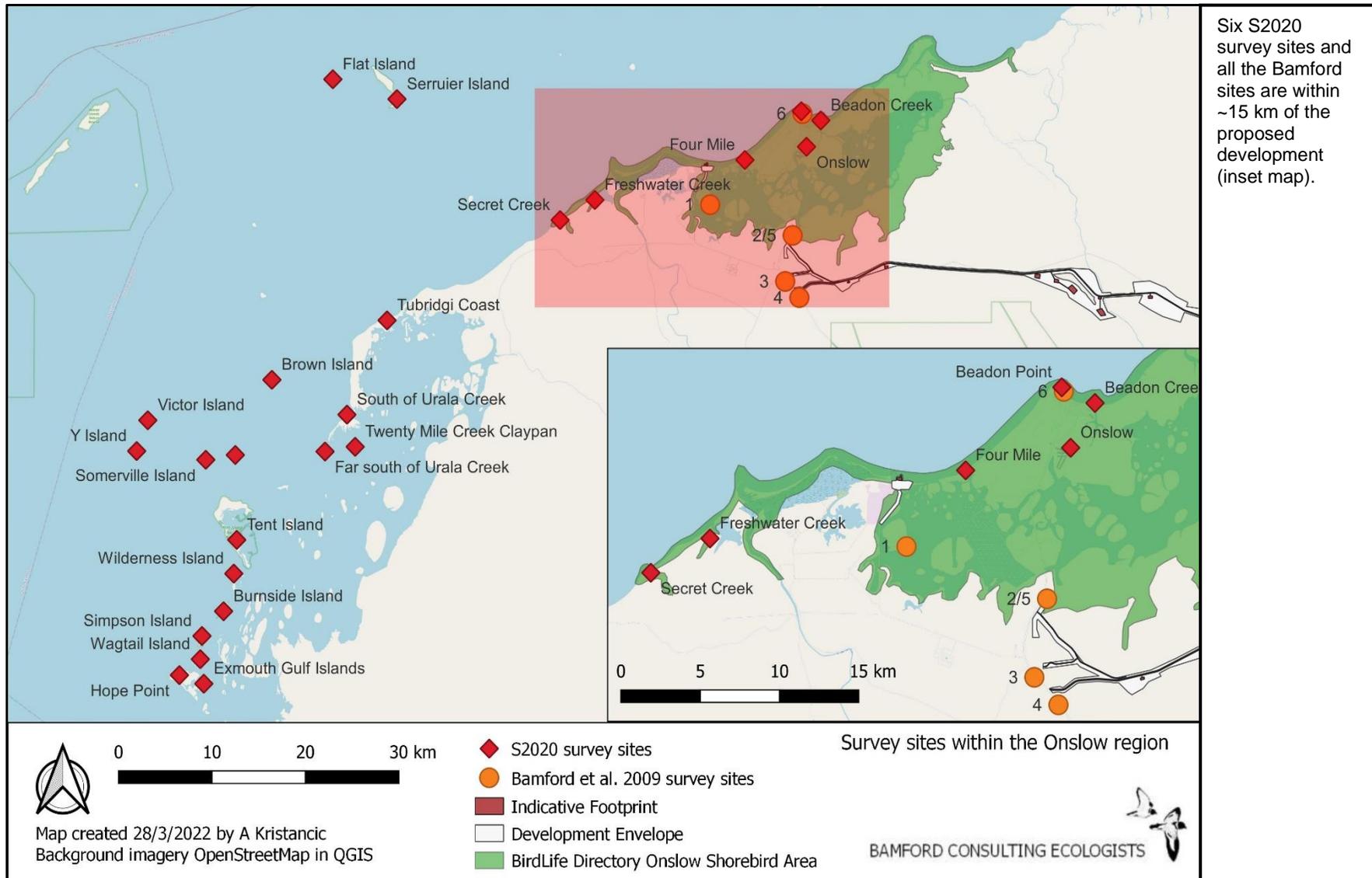


Figure 10-11: S2020 and Bamford et al. (2009) Survey Sites in the Onslow Area (BCE 2022)

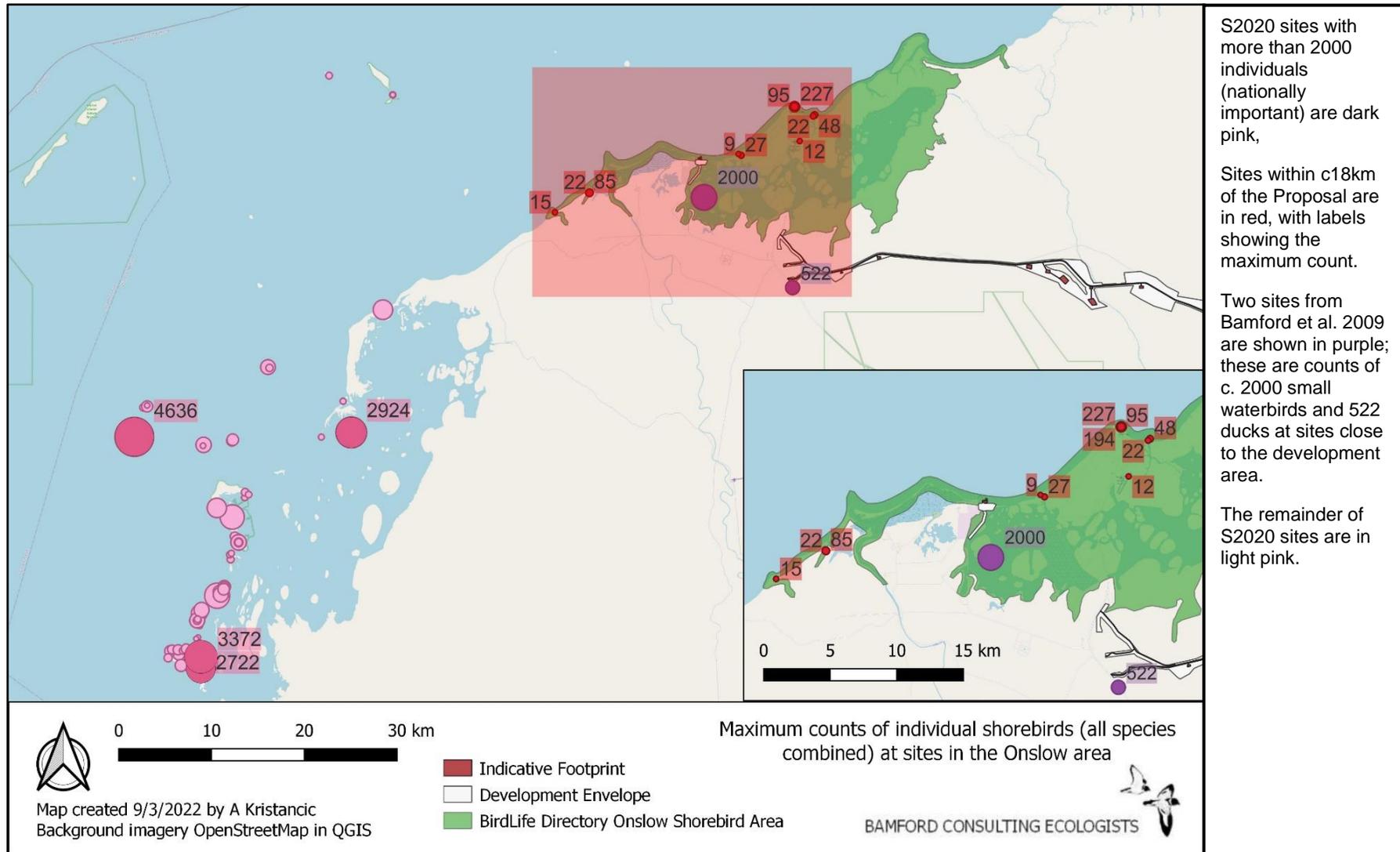


Figure 10-12: Maximum Counts of Individual Shorebirds (all Species Combined) at Sites in the Onslow Area

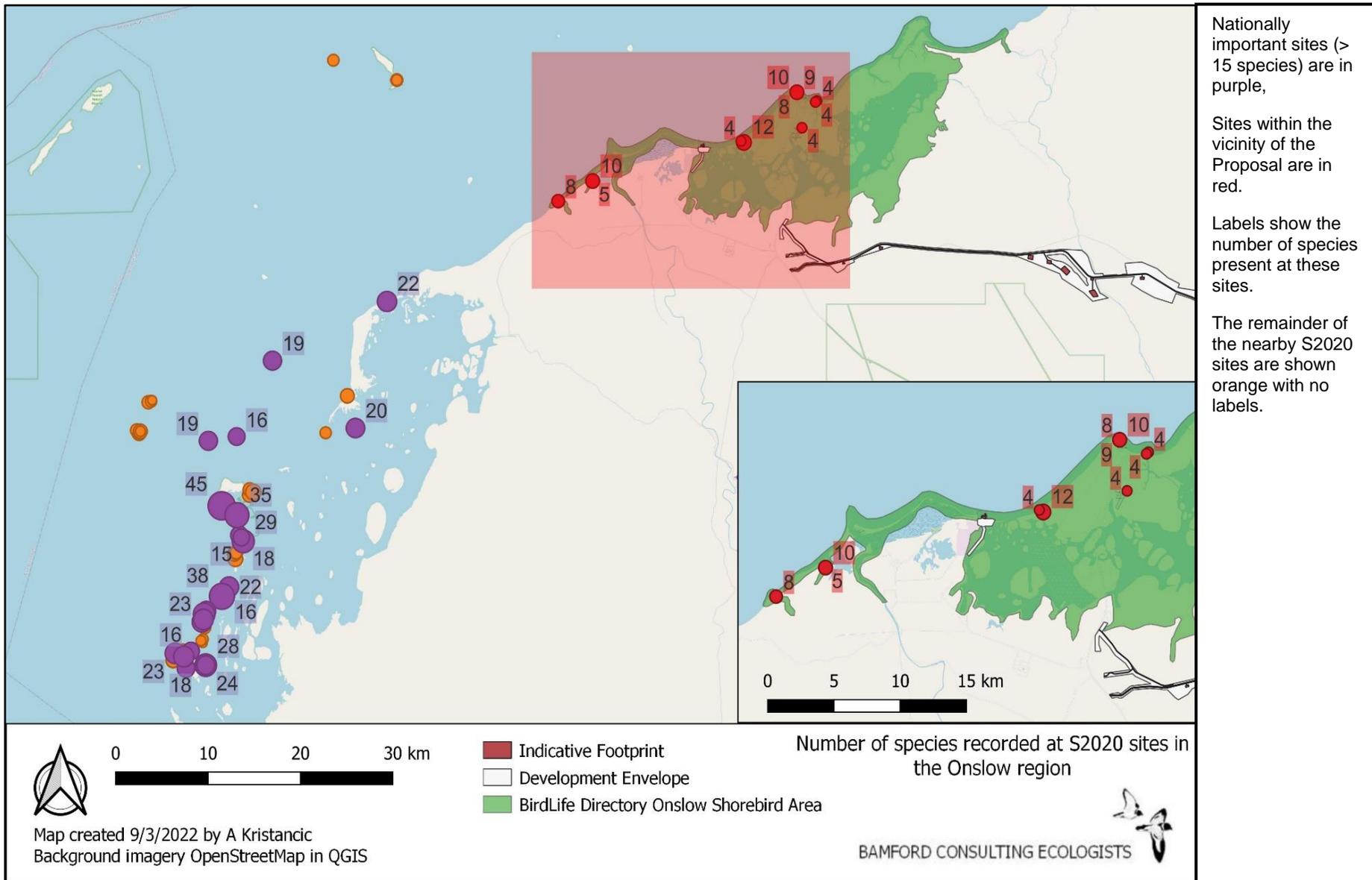


Figure 10-13: Number of Species Recorded at Sites within the Greater Onslow Area (BCE 2022)

Water may not persist for long and will tend to drain as the tide falls. Conservation significant shorebirds/waterbirds are therefore unlikely to rely on this habitat for survival (BCE 2022).

The Claypan habitats are slight depressions that fill with water; probably as a result of heavy rainfall (most likely cyclonic events in summer). When these claypans are flooded they may contain suitable prey items that may support waterbirds at least occasionally (BCE 022). However, when these claypans flood, similar such claypans in the region are also likely to be extensively flooded and therefore this habitat is not limiting (BCE 2022).

The Plains, Stony Plains, and Sand Dune and Swales habitats contain fewer microhabitat opportunities and provide less value to most conservation significant fauna taxa and overall fauna assemblages than the aforementioned habitats (360 Environmental 2021b). The Mulga Woodland habitat contains abundant peeling bark and woody debris, which is likely to provide ample habitat opportunities for small reptiles; however, understory vegetation is very sparse. These habitats provide foraging and dispersal habitat to MNES species. However, these habitats are widespread in the region, and the fauna species are not likely to rely on these habitat types for survival. They have therefore been classified as other (below high value). Further description of these habitats is presented below in **Table 10-9** and shown in **Figure 10-14** to **Figure 10-23**.

Habitat condition varied throughout the Haul Road DE, with the most prolific disturbance being cattle grazing and trampling. The Drainage Line/River/Creek (minor and major) habitats were noted to have been extensively degraded by cattle. Other disturbances included historical clearing for roads, infrastructure and access tracks, weeds, frequent burning, and rubbish (360 Environmental 2021b).

Table 10-9: Fauna Habitat Types in the Haul Road DE

Habitat Type	Description	Potential Value to Fauna Species	Nature of Occurrence*	Extent in Haul Road DE (ha)
Drainage Line/River/Creek (major)	<p>Dense overstorey vegetation is made up primarily of <i>Eucalyptus</i> sp. and <i>Corymbia</i> sp. Ground cover was typically <i>Triodia</i> hummock grassland or tussock grassland on substrates ranging from sand to sandy clay, with various river stones. Major drainage lines had a greater presence of gullying and water pooling, permanent and semi-permanent pooling of water and larger hollow-bearing <i>Eucalypts</i>.</p> <p>Many drainage lines, rivers, and creeks will be seasonally inundated.</p> <p>Cattle have extensively degraded this habitat in many areas.</p> <p>The overstorey vegetation provides valuable nesting and foraging habitat for birds, including the Grey Falcon and Peregrine Falcon.</p> <p>Key microhabitats include woody debris, leaf litter, peeling bark, hollow trees and logs, and hummocks grasslands that provide refuge, shelter, and foraging opportunities for a wide variety of fauna species.</p>	Northern Quoll	May provide regular foraging and dispersal habitat (particularly when within 1 km of Mesa and Breakaway habitat).	561
		Ghost Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal habitat (east of NWCH).	
		Pilbara Leaf-nosed Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal (east of NWCH).	
		Pilbara Olive Python	May provide foraging and dispersal habitat adjacent to mesa and breakaway habitat.	
		Grey Falcon	May provide nesting and breeding habitat.	
Drainage Line/ Creek (minor)	<p>Dense overstorey vegetation comprises tall <i>Acacia</i> spp., occasionally with <i>Eucalyptus</i> sp. and <i>Corymbia</i> sp. Ground cover is typically <i>Triodia</i> hummock grassland or tussock grassland on substrates ranging from sand to sandy clay, with many river stones. Minor drainage lines have a lower presence of gullying and water erosion, permanent or semi-permanent pooling of water and typically have smaller trees than major drainage lines.</p> <p>Minor drainage lines may be seasonally inundated.</p> <p>Cattle extensively degraded this habitat in many areas.</p> <p>The overstorey vegetation provides valuable nesting and foraging habitat for birds, including conservation significant taxa such as the Grey Falcon and Peregrine Falcon, albeit less value than major drainage lines due to the lower density of large trees.</p> <p>Key microhabitats include woody debris, leaf litter, peeling bark, hollow trees and logs, and hummock grasslands that provide refuge, shelter, and foraging opportunities for a wide variety of fauna.</p>	Northern Quoll	May provide regular foraging and dispersal habitat (particularly when within 1 km of Mesa and Breakaway habitat).	1,815
		Ghost Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal habitat (east of NWCH).	
		Pilbara Leaf-nosed Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal (east of NWCH).	
		Pilbara Olive Python	May provide occasional foraging and dispersal habitat (to a lesser extent than the major drainage lines).	
		Grey Falcon	May provide occasional nesting and breeding habitat (to a lesser extent than the major drainage lines).	
Stony Hills and Slopes	<p>Often with thin soils over shallow bedrock. Vegetation consists of sparse <i>Triodia</i> hummock grasslands with scattered <i>Corymbia</i> sp., and <i>Acacia</i> sp. Microhabitats include <i>Triodia</i> hummocks which provide shelter for a variety of fauna.</p> <p>When adjacent mesas and breakaway habitat, stony hills and slopes will provide important foraging and dispersal habitat for conservation significant taxa such as the Northern Quoll and, towards the east of the Terrestrial Survey Area near water sources, the Pilbara Olive Python.</p>	Northern Quoll	May provide regular foraging and dispersal habitat (particularly when within 1 km of Mesa and Breakaway habitat).	1,032
		Ghost Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal habitat (east of NWCH).	
		Pilbara Leaf-nosed Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal (east of NWCH).	

Habitat Type	Description	Potential Value to Fauna Species	Nature of Occurrence*	Extent in Haul Road DE (ha)
		Pilbara Olive Python	May provide shelter and foraging habitat when adjacent to a water source, and mesa and breakaway habitat.	
		Long-tailed Dunnart	May provide suitable habitat	
Tidal Flats	The Tidal Flats within the Haul Road DE are distant from the coastline and experience infrequent to rare inundation associated with extreme tidal, rainfall and flood events. Vegetation is scarce and typically consists of scattered samphire shrubs (BCE 2022).	Migratory waterbird species	May provide very occasional foraging habitat.	327
		Short-tailed Mouse	May provide suitable habitat.	
Claypan	Claypans are slight depressions that fill with water, likely as a result of heavy rainfall (BCE 2022). Water can persist in Claypans for weeks or even months. Claypans are occasionally inundated. This habitat is extensively degraded by cattle in area.	Migratory waterbird species	May provide occasional foraging habitat.	11
		Short-tailed Mouse	May provide suitable habitat.	
Mulga Woodland	Mulga (<i>Acacia aptaneura</i>) woodland over a sparse <i>Triodia</i> grassland on a sandy clay plain with crabholes (holes formed by swelling and contracting clay soils). Cattle degradation was observed. The most abundant microhabitats in addition to crabholes were woody debris and peeling bark, which provide important shelter and refuge primarily for small reptiles. However, no conservation significant vertebrate fauna species would rely on this habitat type for their survival.	May provide very occasional habitat for conservation significant species	May provide very occasional habitat for conservation significant species.	206
Plain	<i>Triodia</i> hummock grassland on sandy loam/sandy clay plain with a sparse overstorey of mixed shrubs dominated by <i>Acacia</i> spp. and occasional <i>Corymbia</i> sp. Abundant <i>Triodia</i> hummocks are an important microhabitat feature that provides shelter, refuge, and nesting opportunities for small fauna species. The sandy substrate is suitable for fauna taxa that forage by digging or shelter in burrows.	Short-tailed Mouse	May provide suitable habitat.	
		May provide very occasional habitat for conservation significant species	May provide very occasional habitat for conservation significant species.	5,160
Sand Dunes and Swales	Open <i>Triodia</i> grasslands and low, open <i>Acacia</i> shrublands on a soft sandy substrate are preferred habitats for many burrowing species. Landform comprises alternating dunes and swales. Key microhabitats include termite mounds and hummocks. Cattle degradation was observed.	May provide very occasional habitat for conservation significant species	May provide very occasional habitat for conservation significant species.	527
Stony Plain	<i>Triodia</i> hummock grassland on a stony plain with a sparse overstorey of mixed shrubs dominated by <i>Acacia</i> spp. with occasional <i>Corymbia</i> sp. Abundant <i>Triodia</i> hummocks are an important microhabitat feature that provides shelter and refuge and nesting opportunities for small fauna taxa. However, the stony substrate is the preferred habitat for some reptile and mammal species but may not be suitable for burrowing species requiring sandy substrates. Cattle degradation was observed, with increased degradation occurring east of the Haul Road DE near Red Hill Station.	Northern Quoll	May provide regular dispersal habitat when within 1 km of Mesa and Breakaway habitat.	
		Ghost Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal habitat (east of NWCH).	
		Pilbara Leaf-nosed Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal (east of NWCH).	6,454
		Western Pebble-mound Mouse	May provide suitable habitat.	
		Long-tailed Dunnart	May provide suitable habitat.	

Habitat Type	Description	Potential Value to Fauna Species	Nature of Occurrence*	Extent in Haul Road DE (ha)
		Short-tailed Mouse	May provide suitable habitat.	
Cleared	Areas that have been cleared and do not contain vegetation. These areas do not provide habitat value to fauna species.	Does not provide habitat for fauna.		118
Total*				16,211***

*Source 360 Environmental 2021b.

**Total rounding and GIS projection discrepancies.

*** Actual extent within the DE Haul Road = 16209 ha.

****Nature of that occurrence is based on the numbers of the species that may be present, how often they are present and how they use a location.

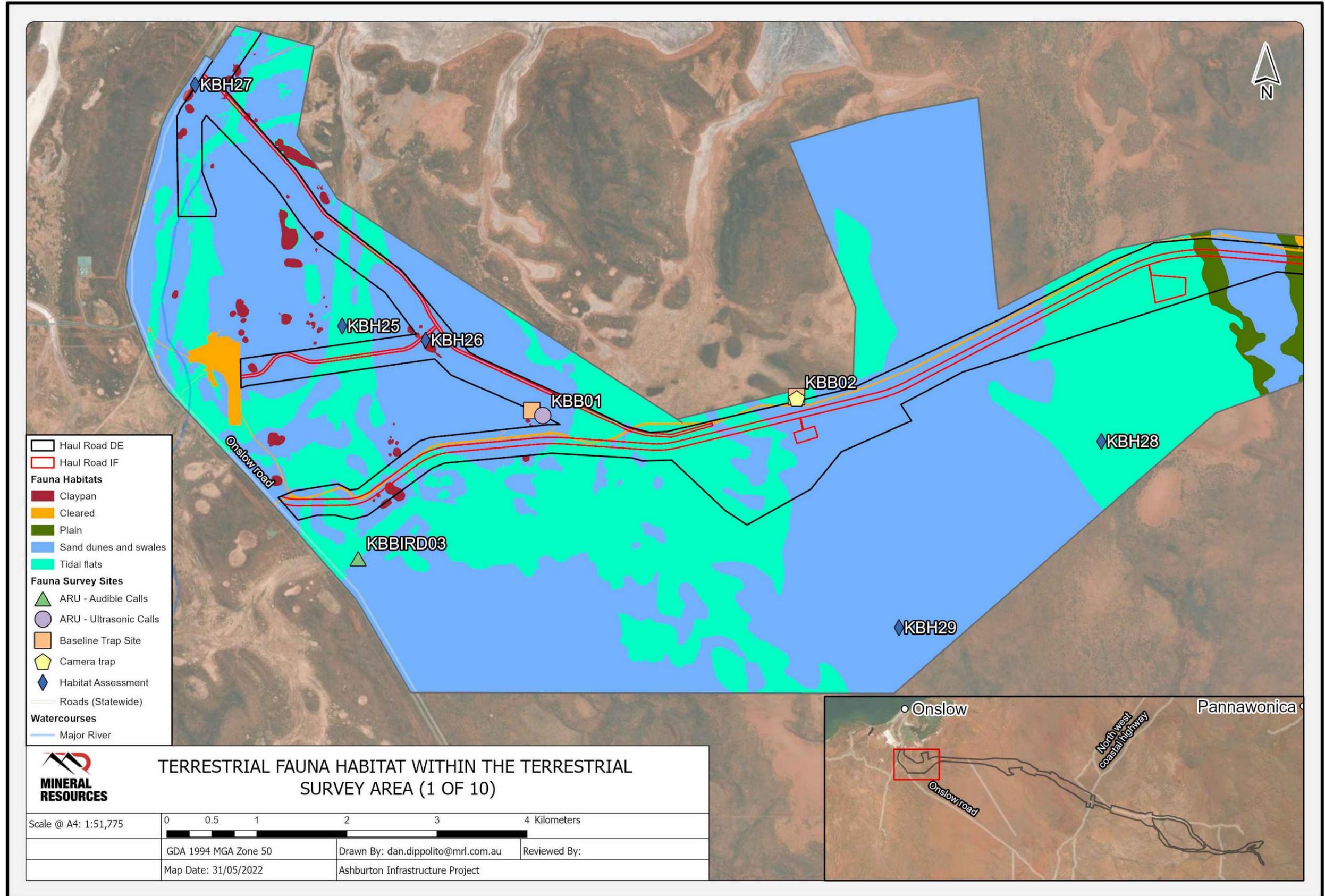


Figure 10-14: Fauna Habitats within the Terrestrial Survey Area (1 of 10)

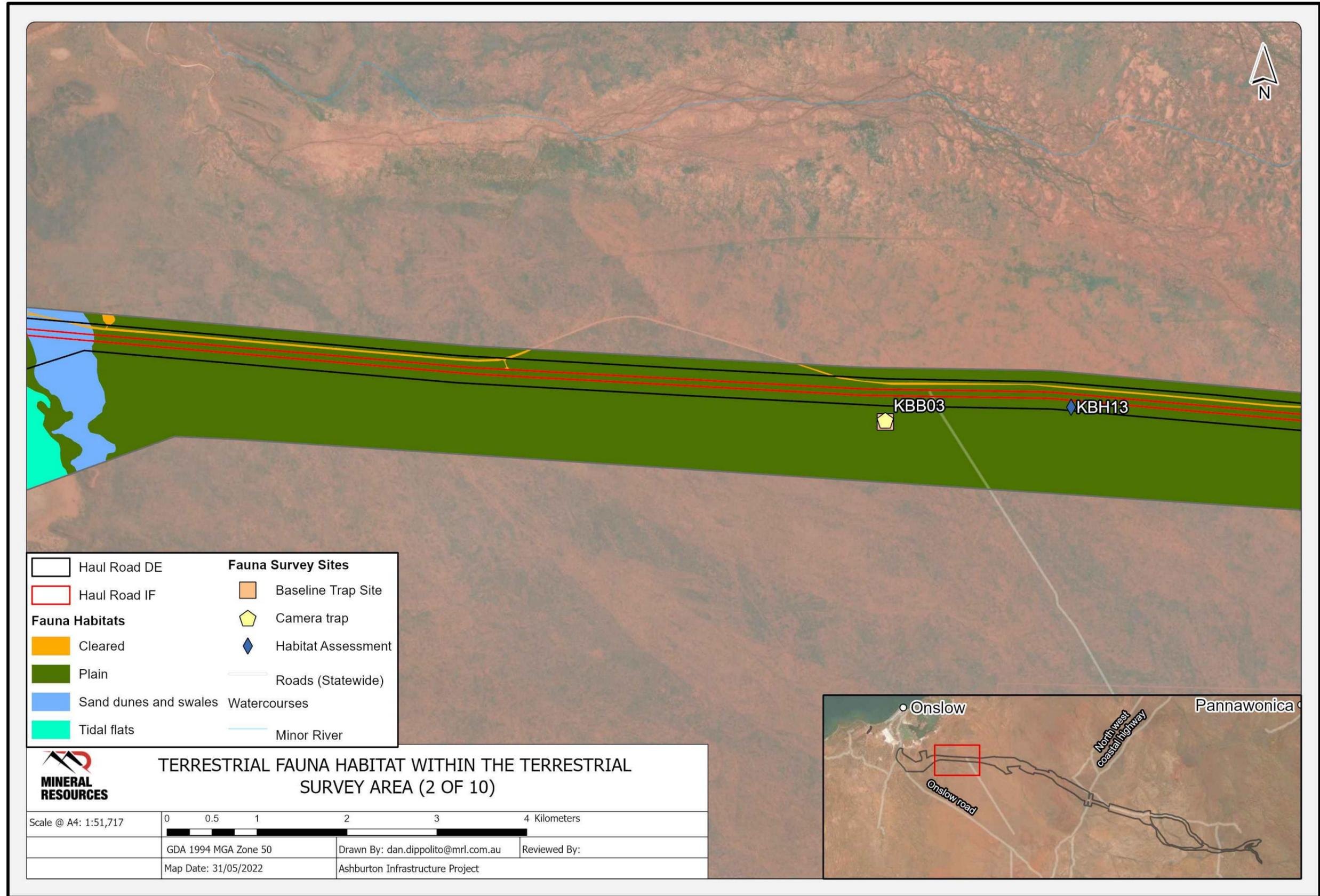


Figure 10-15: Fauna Habitats within the Terrestrial Survey Area (2 of 10)

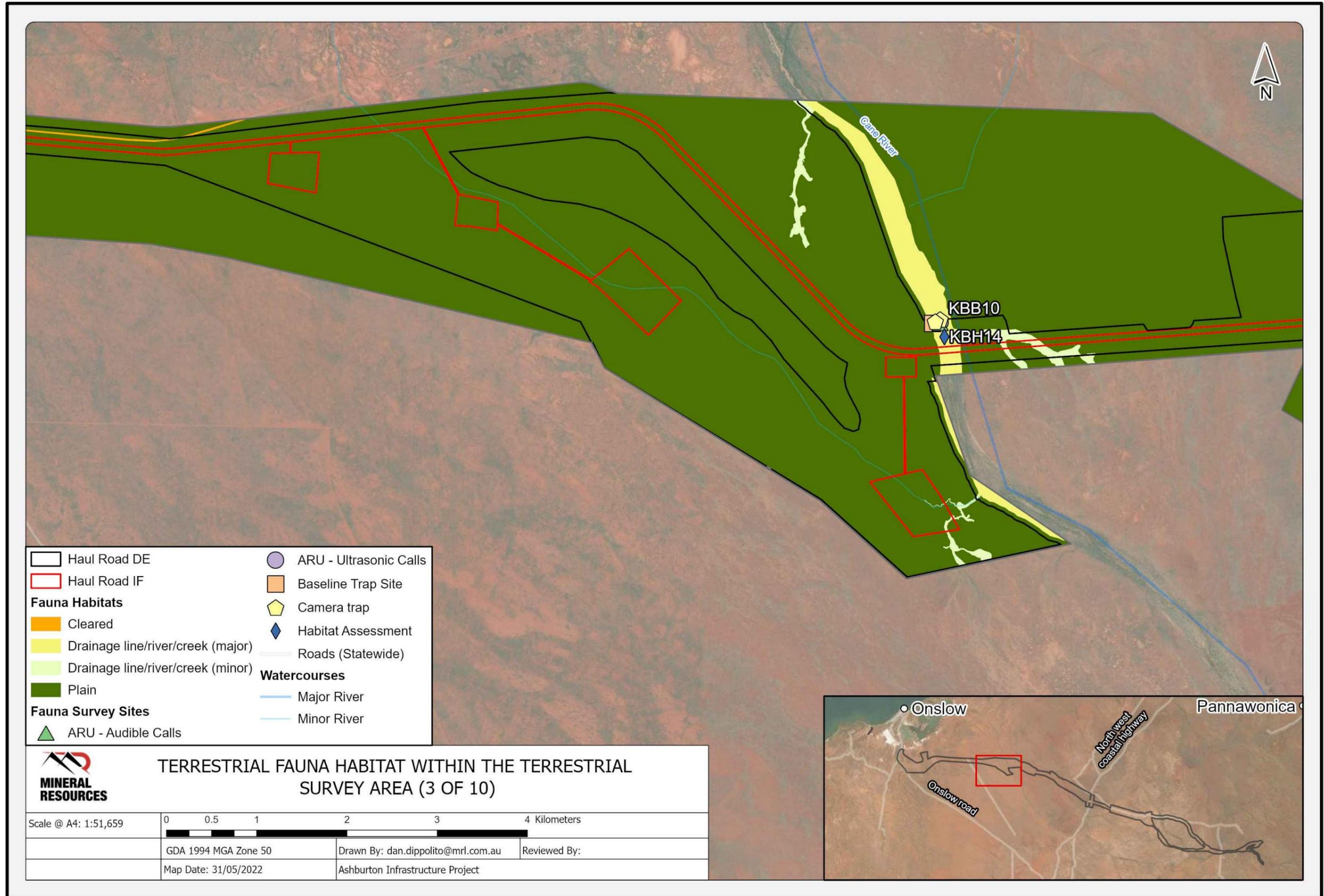


Figure 10-16: Fauna Habitats within the Terrestrial Survey Area (3 of 10)

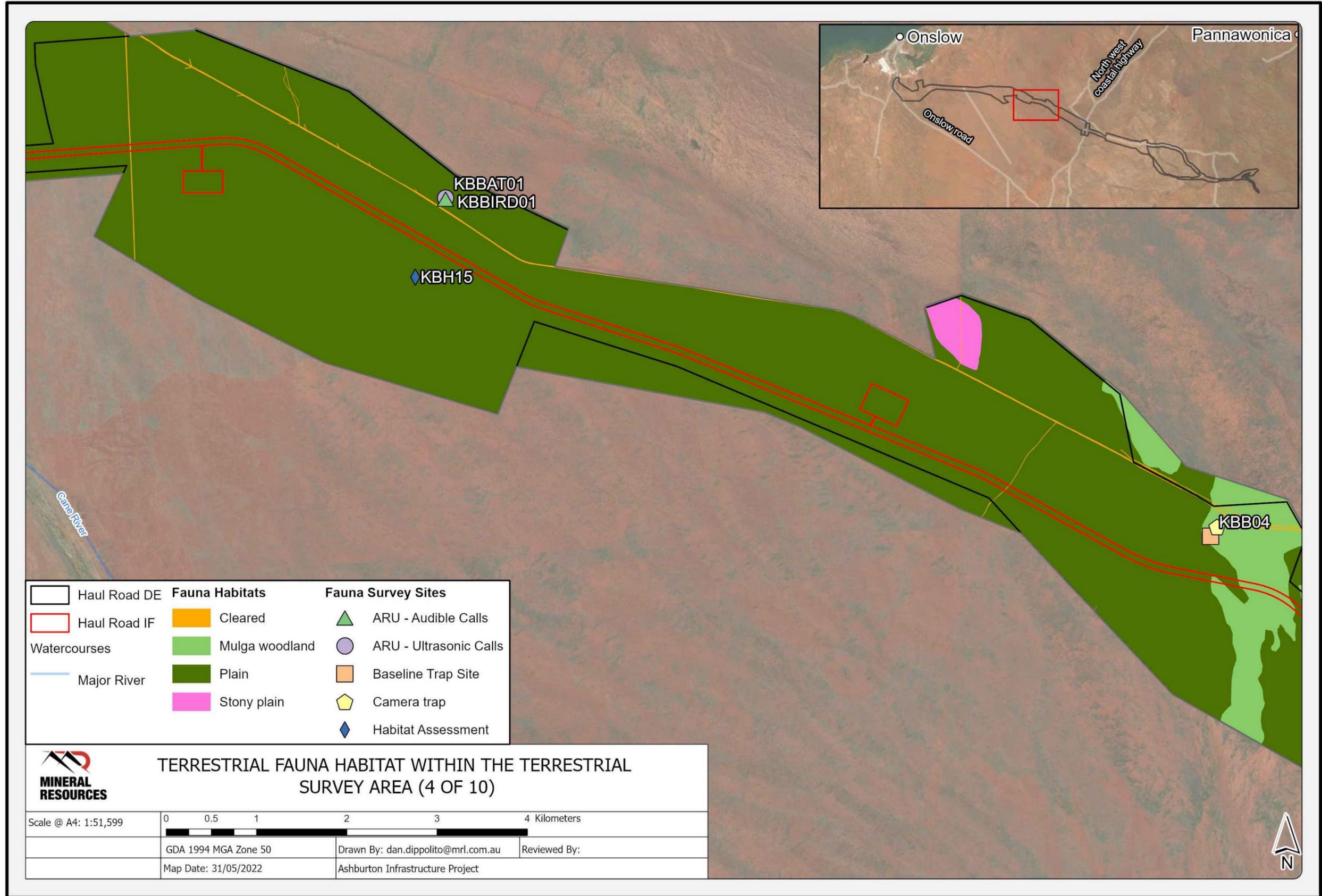


Figure 10-17: Fauna Habitats within the Terrestrial Survey Area (4 of 10)

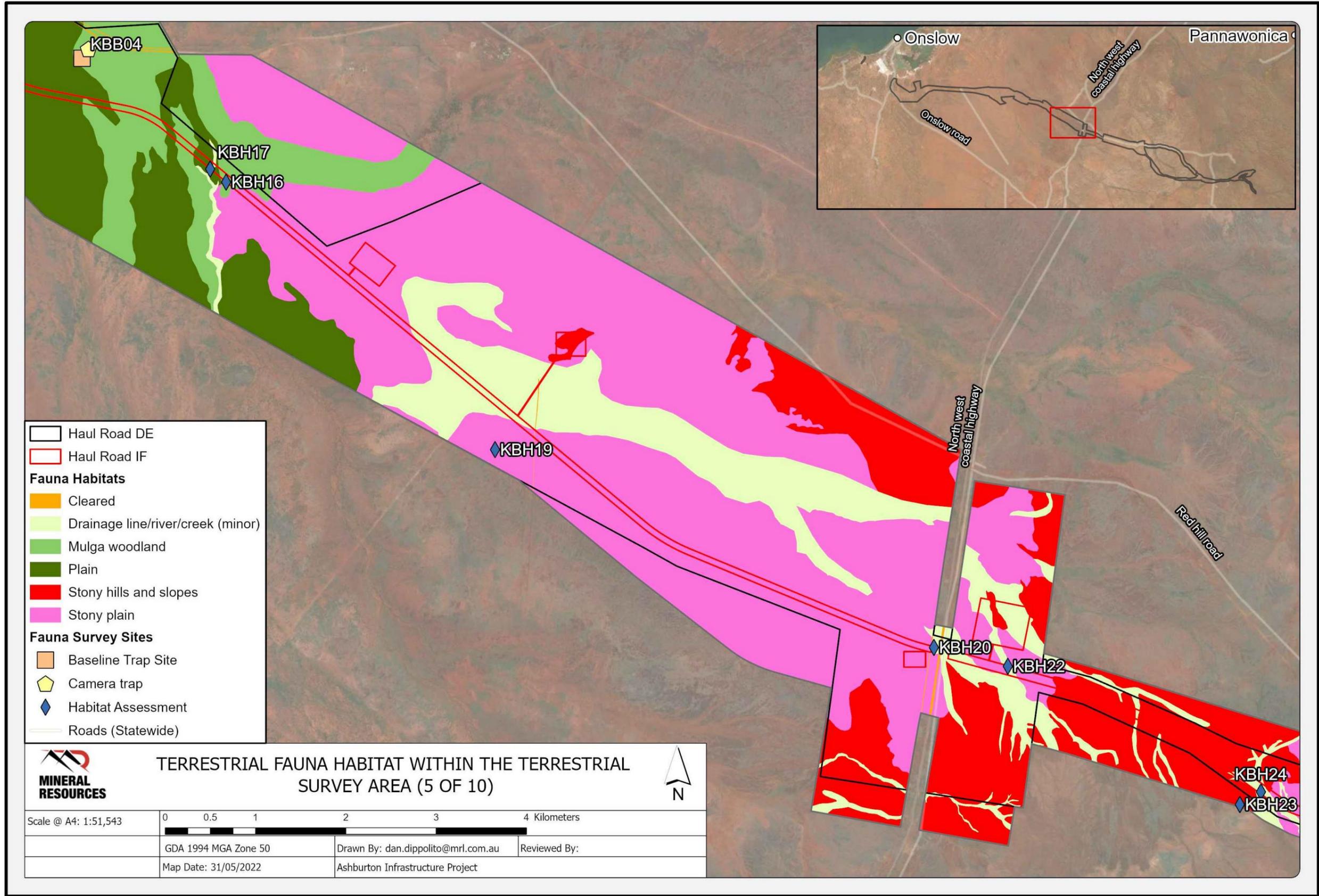


Figure 10-18: Fauna Habitats within the Terrestrial Survey Area (5 of 10)

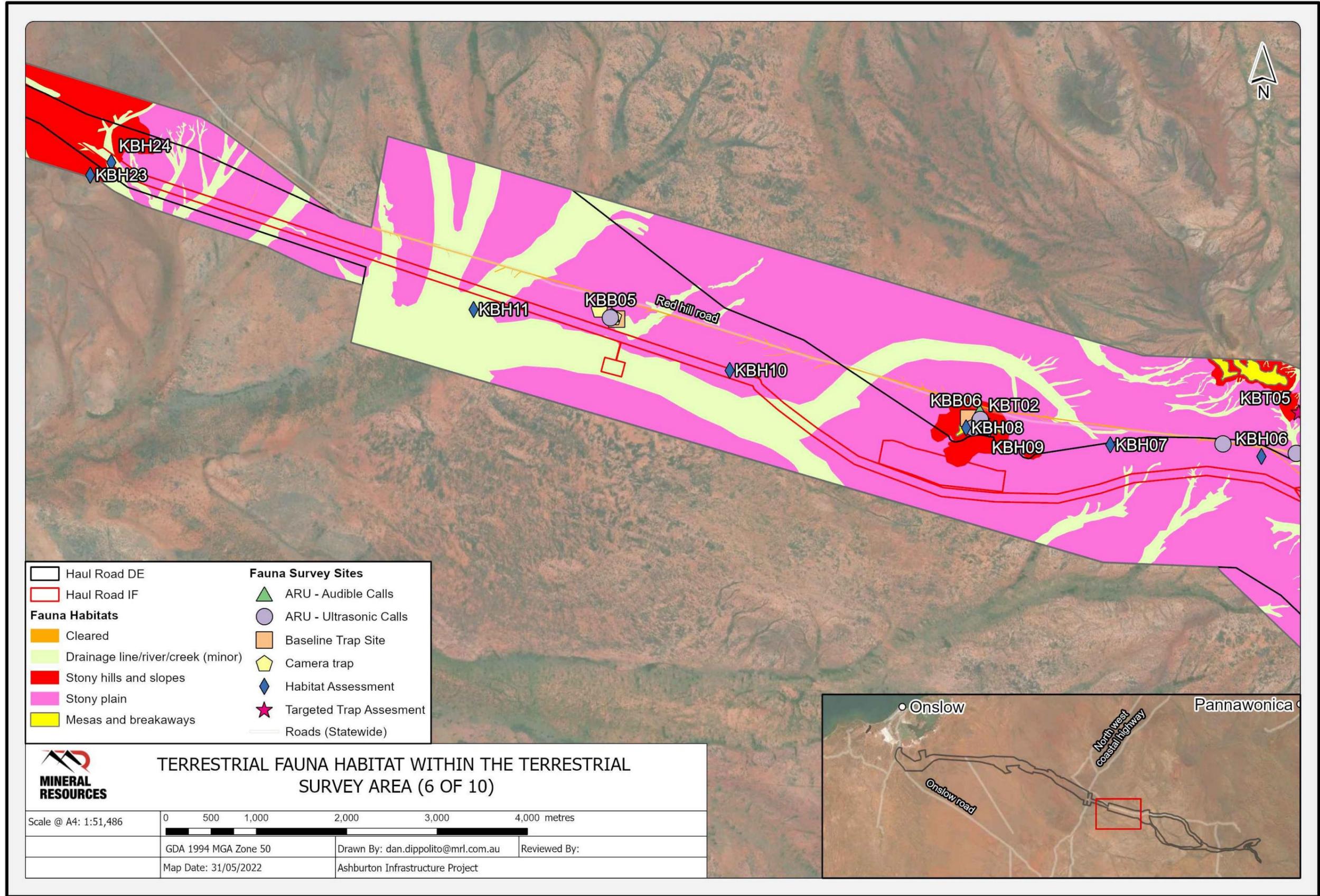


Figure 10-19: Fauna Habitats within the Terrestrial Survey Area (6 of 10)

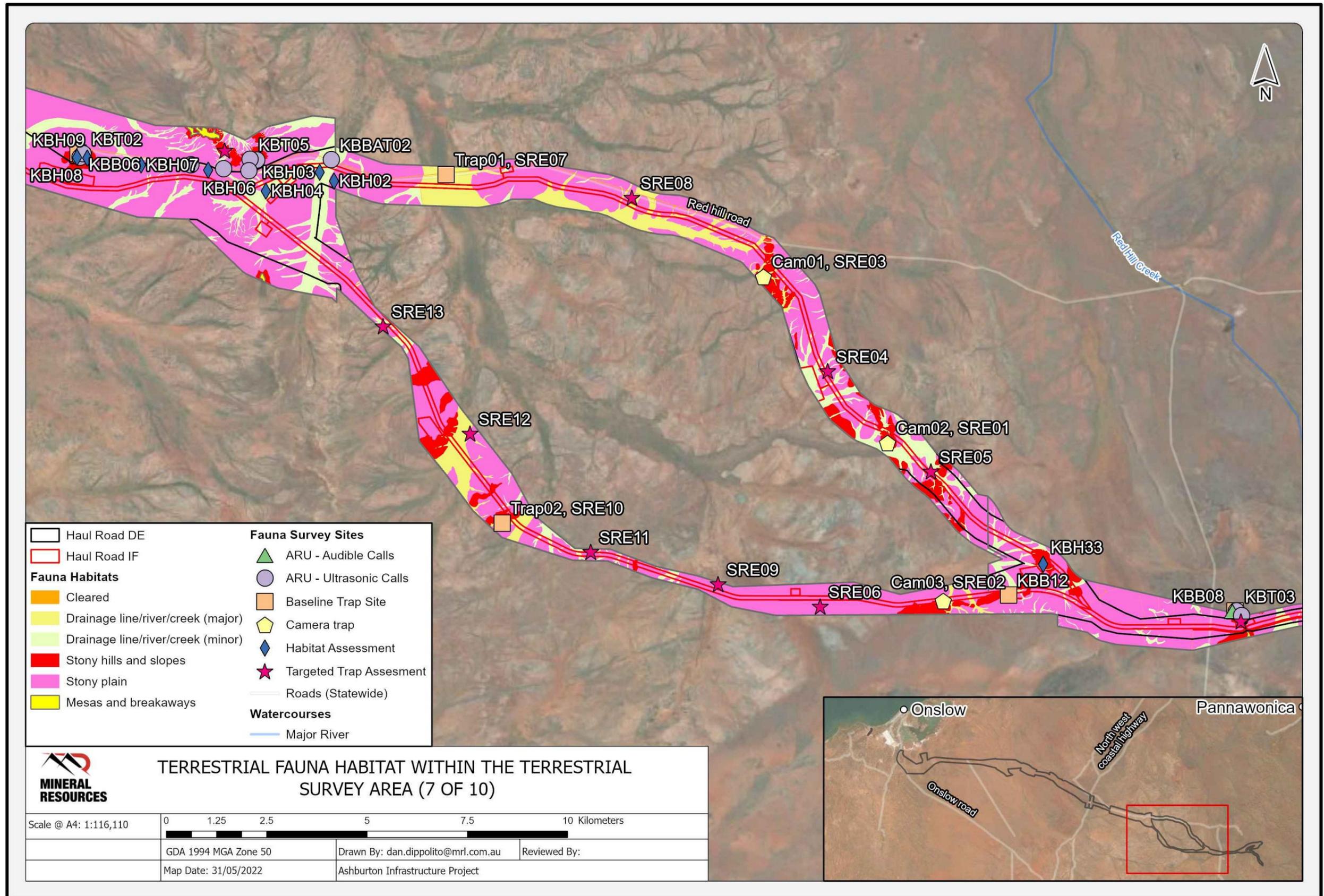


Figure 10-20: Fauna Habitats within the Terrestrial Survey Area (7 of 10)

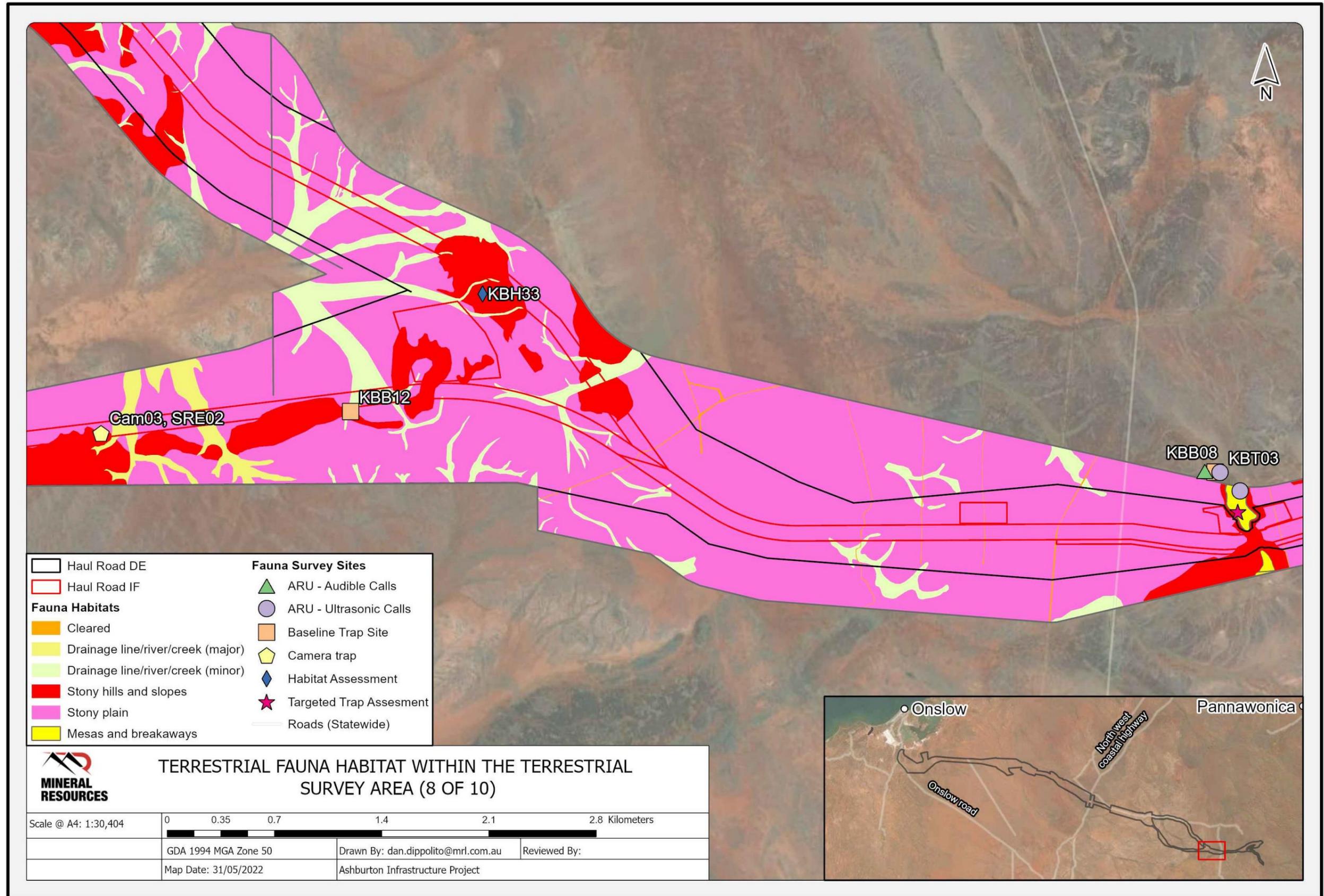


Figure 10-21: Fauna Habitats within the Terrestrial Survey Area (8 of 10)

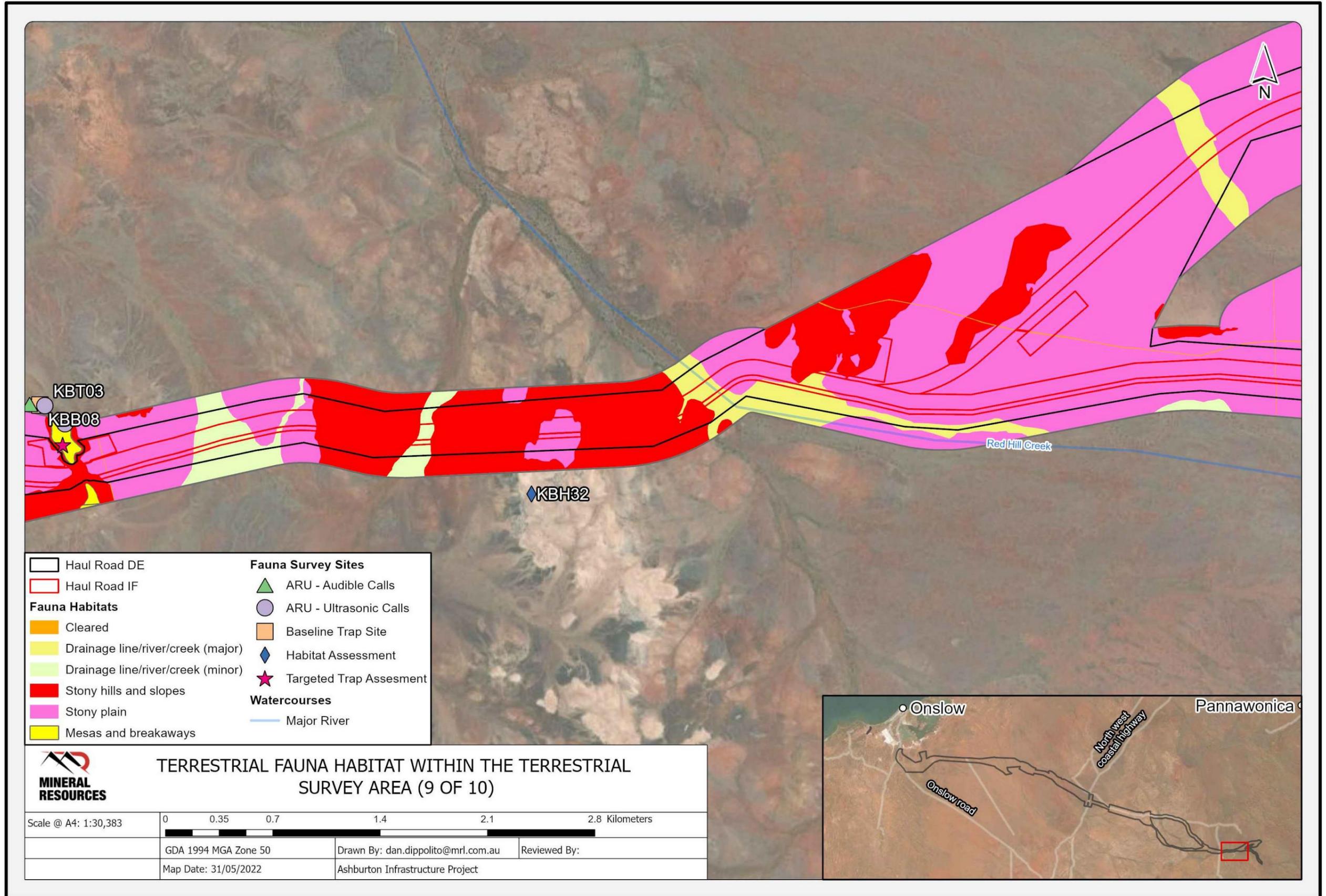


Figure 10-22: Fauna Habitats within the Terrestrial Survey Area (9 of 10)

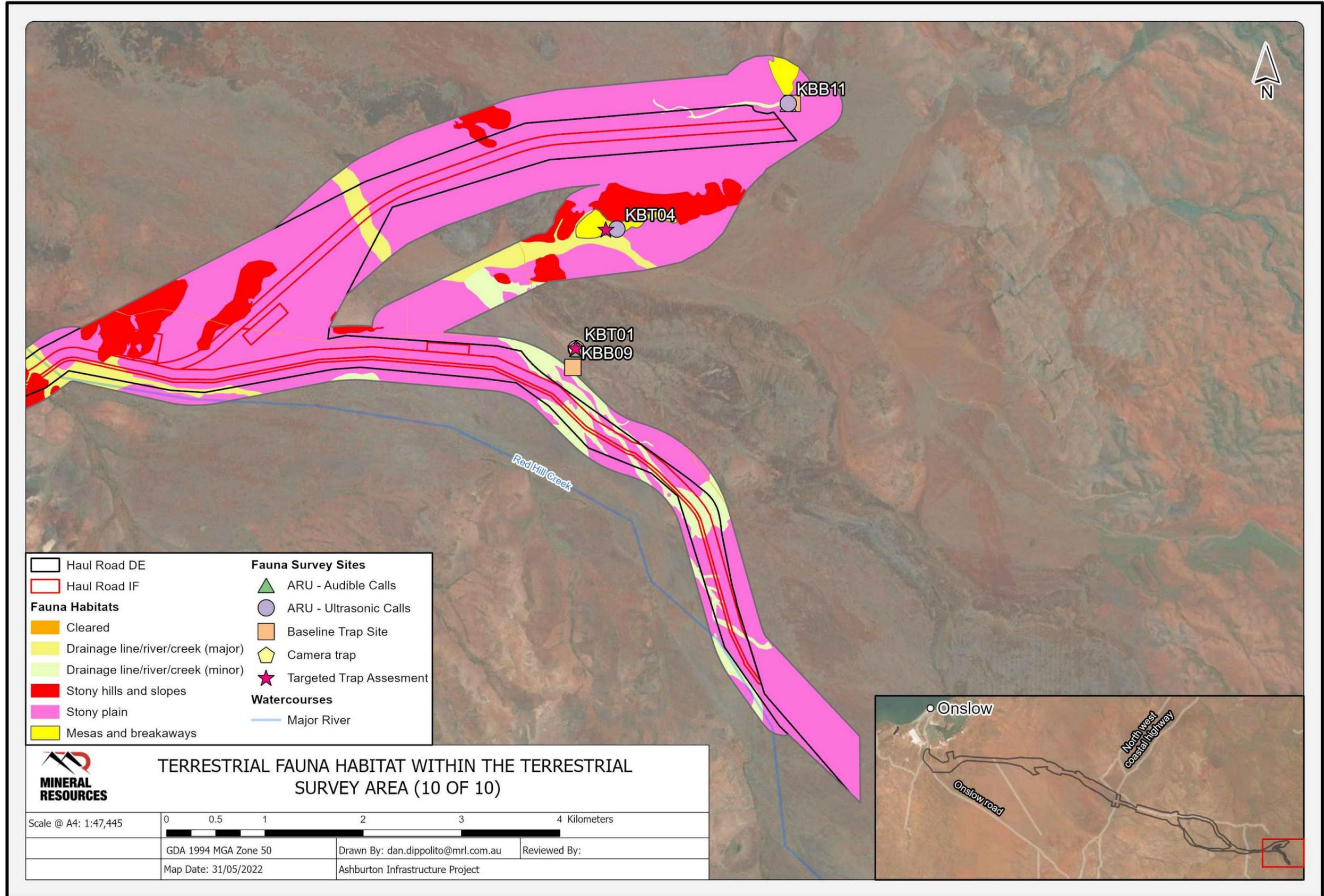


Figure 10-23: Fauna Habitats within the Terrestrial Survey Area (10 of 10)

10.3.5 Landside Development Envelope Fauna Habitats

10.3.5.1 Fauna Habitat

No vegetation or fauna habitat will be cleared within the Landside DE as part of this Proposal, as the initial vegetation clearing, and site development works will be undertaken by PPA through MS1131, which has been amended under s45c of the (WA EP Act). Nevertheless, Terrestrial MNES may use habitat in proximity to the Landside DE.

10.3.6 SRE Invertebrate Fauna

SRE invertebrate fauna are invertebrates that, as a result of evolutionary isolation, have naturally small distributions (below 10,000 km²) and are often characterised by low fecundity, confinement to disjunct habitats and poor dispersal capabilities (Harvey 2002). Some better-known SRE species have been listed under State, or Commonwealth legislation or as Priority species by the DBCA; however, most SRE species have not been listed under legislation, often due to lack of knowledge or paucity of data.

There are no recovery plans or conservation advice for SRE invertebrate fauna. Technical guidance for sampling SREs is available from the EPA: Technical Guidance - Sampling of short-range endemic invertebrate fauna (EPA 2016h). The guidance provides an overview of the current knowledge on SRE invertebrate taxa and sets out the EPA’s current approach to their assessment for development proposals.

An SRE assessment was undertaken by 360 Environmental in 2021b, following the EPA’s Technical Guidance: *Sampling of short-range endemic invertebrate fauna* (EPA 2016h; 360 Environmental 2021b). The two-season survey included the entire Haul Road DE and surrounding areas **Figure 10-24**. The assessment included a desktop review, database searches, likelihood of occurrence assessment, and a two-season targeted SRE survey.

An additional, single season SRE survey was undertaken by 360 Environmental in September/October 2021 (360 Environmental 2022a). This survey was undertaken in the dry season and comprised of active searching and leaf litter sampling for SRE individuals.

10.3.6.1 SRE Fauna Species Occurrence

The SRE surveys recorded 379 individual invertebrate specimens, comprising 29 taxa from five classes, 11 orders and 13 families that can contain SRE taxa (360 Environmental 2021b, 2022). Analysts at the Western Australian Museum or local specialists (360 Environmental 2021b). Criteria used to assess SRE status is defined in **Table 10-10**.

Table 10-10: Short Range Endemic Status Definitions

SRE Status	Criteria
Confirmed	A confirmed SRE species. Known distribution of < 10,000 km ² (Harvey 2002). The taxonomy of the group is well known. The group is well represented in collections or via comprehensive sampling.
Likely	Likely to be an SRE species based upon knowledge of the family/genus, where other closely related species show evidence of short-range endemism. Where habitats containing the specimens show discontinuity within the landscape.
Possible	Based upon existing knowledge of the family/genus, there is a possibility that the species may have a restricted range. Where habitats containing the specimens may show discontinuity within the landscape, possible SRE species may be assigned one of the subcategories below. A. Data deficient. i.e., new species, lack of distribution, taxonomic or collecting knowledge, juvenile specimens, wrong sex for identification. B. Habitat indicators.

SRE Status	Criteria
	C. Morphology indicators. D. Molecular evidence. E. Research and expertise of WAM staff/taxonomic specialists.
Widespread	Not an SRE. Has a wide-ranging distribution > 10,000 km ² .

Of the 29 taxa recorded, two species were considered to represent likely SREs, and eight species were identified as 'possible' SRE species due to a deficiency in data (360 Environmental 2021b, 2022), the likely SRE species include:

- One Philoscid isopod Philoscidae sp. indet. 'Onslow'; and
- One Polydesmid millipede *Antichiropus?* Juvenile.

The eight possible (data deficient) SRE species include:

- One armadillid isopod *Buddelundia* sp. '35/36';
- One centipede *Cryptops* sp. 'Onslow';
- Four Ophiid pseudoscorpions *Beierolpium* sp., and *Indolpium* sp., Ophiidae sp. 1., and Ophiidae sp. 2; and
- Two *Aname* mygalomorph spiders *Aname* sp. 'IS03' and *Aname* sp. 'IS04'.

These species are described in further detail in **Table 10-11** and shown in **Figure 10-24** and **Figure 10-25**.

A further two possible SRE species were identified as potentially occurring from database searches; however, both species were considered to have a low likelihood of occurrence (360 Environmental 2021b):

- Land snail, *Quistrachia* cf. 'Barlee Range' n. sp; and
- Land snail, cf. *Stenomelania denisoniensis*.

No conservation significant invertebrate species were recorded during the field survey or identified in the desktop assessment and database searches (360 Environmental 2021b). The remaining recorded species were all identified as widespread and do not represent confirmed, likely or possible SREs.

Table 10-11: Short Range Endemic Species recorded in the Survey Area

Species	SRE status	Habitat	Recorded within the Haul Road DE
Isopods			
<i>Philosciidae</i> sp. indet. 'Onslow'	<p>Likely</p> <p>The specimens were collected from a single site (KBSRE15). These are undescribed species from an unknown genus. Because <i>Philosciids</i> are not common in the Pilbara, the morphospecies is likely SRE species (Judd 2021 in 360 Environmental 2021b).</p>	Plain	No
<i>Buddelundia</i> sp.'35/36'	<p>Possible</p> <p>These specimens are morphologically similar to those found in the Hamersley Range (<i>Buddelundia</i> 36) and Barrow Island (<i>Buddelundia</i> 35). There was insufficient material recorded in the survey, especially large adults, to allow determination beyond <i>Buddelundia</i> 35/36 (Judd 2021 in 360 Environmental 2021b).</p> <p>The morphospecies recorded during the surveys were relatively widely distributed within the Terrestrial Survey Area. This indicates that it is relatively widespread in multiple habitats and not restricted to the Terrestrial Survey Area. However, given the taxonomic uncertainty, it is considered a possible SRE species.</p>	Drainage Line/River/Creek Mulga Woodland Plain Stony Plain	Yes KBSRE02, KBSRE03 and KBSRE24
Pseudoscorpions			
<i>Beierolpium</i> sp.	<p>Possible</p> <p>Primarily due to the groups being considered data deficient.</p> <p>The morphospecies recorded during the surveys were relatively widely distributed within the Terrestrial Survey Area. This indicates that it is relatively widespread in multiple habitats and not restricted to the Terrestrial Survey Area. However, given the taxonomic uncertainty, it is considered a possible SRE species.</p>	Mesas and Breakaway Stony Plain	No
<i>Indolpium</i> sp.	<p>Possible</p> <p>Primarily due to the groups being considered data deficient.</p> <p>The morphospecies recorded during the surveys were relatively widely distributed within the Terrestrial Survey Area. This indicates that it is relatively widespread in multiple habitats and not restricted to the Terrestrial Survey Area. However, given the taxonomic uncertainty, it is considered a possible SRE species.</p>	Stony Plain Tidal Flats Stony Hills and Slopes	No
<i>Olpiidae</i> sp. 1	<p>Possible</p> <p>Primarily due to the groups being considered data deficient.</p> <p>This species was recorded at multiple locations during the survey (360 Environmental 2022a). This indicates that it is relatively widespread and not restricted to the Red Hill Station survey area. However, given the taxonomic uncertainty, it is considered a possible SRE species.</p>	Stony Plain	Yes SRE 05, SRE09
<i>Olpiidae</i> sp. 2	<p>Possible</p> <p>Primarily due to the groups being considered data deficient.</p> <p>This species was recorded at multiple locations during the survey (360 Environmental 2022a). This indicates that it is relatively widespread and not restricted to the Red Hill Station survey area. However, given the taxonomic uncertainty, it is considered a possible SRE species.</p>	Stony Plain	Yes SRE04

Species	SRE status	Habitat	Recorded within the Haul Road DE
Centipedes and millipedes			
<p><i>Antichiropus?</i> Juvenile</p>	<p>Likely</p> <p>Two juvenile specimens that belong to the genus <i>Antichiropus</i> were recorded from a single site (KBSRE02). Due to their juvenile status, further identification is not possible; however, most <i>Antichiropus</i> species represent SREs. The specimens were recorded in riparian vegetation on a drainage line. The morphospecies is anticipated to occur widely throughout the local region, especially to the north and south of the Terrestrial Survey Area.</p>	<p>Drainage Line/River/Creek (minor)</p>	<p>Yes</p> <p>KBSRE02</p>
<p><i>Cryptops</i> sp. 'Onslow'</p>	<p>Possible</p> <p>Primarily due to the groups being considered data deficient.</p> <p>The morphospecies recorded during the surveys were relatively widely distributed within the Terrestrial Survey Area. This indicates that it is relatively widespread in multiple habitats and not restricted to the Terrestrial Survey Area. However, given the taxonomic uncertainty, it is considered a possible SRE species.</p>	<p>Drainage Line/River/Creek</p> <p>Rocky Hills/Mesa</p> <p>Stony Plain</p>	<p>Yes</p> <p>KBSRE02 and KBSRE012</p>
Myglomorph spiders			
<p><i>Aname</i> sp. 'IS03'</p>	<p>Possible</p> <p>Primarily due to the groups being considered data deficient.</p> <p>The mygalomorph spiders were recorded from drainage lines that are laterally extensive in the landscape and unlikely to be habitat isolates that support local endemism (360 Environmental 2022a).</p>	<p>Drainage Line/River/Creek</p>	<p>Yes</p> <p>SRE08</p>
<p><i>Aname</i> sp. 'IS04'</p>	<p>Possible</p> <p>Primarily due to the groups being considered data deficient.</p> <p>The mygalomorph spiders were recorded from drainage lines that are laterally extensive in the landscape and unlikely to be habitat isolates that support local endemism (360 Environmental 2022a).</p>	<p>Stony Plain</p>	<p>Yes</p> <p>SRE 09</p>

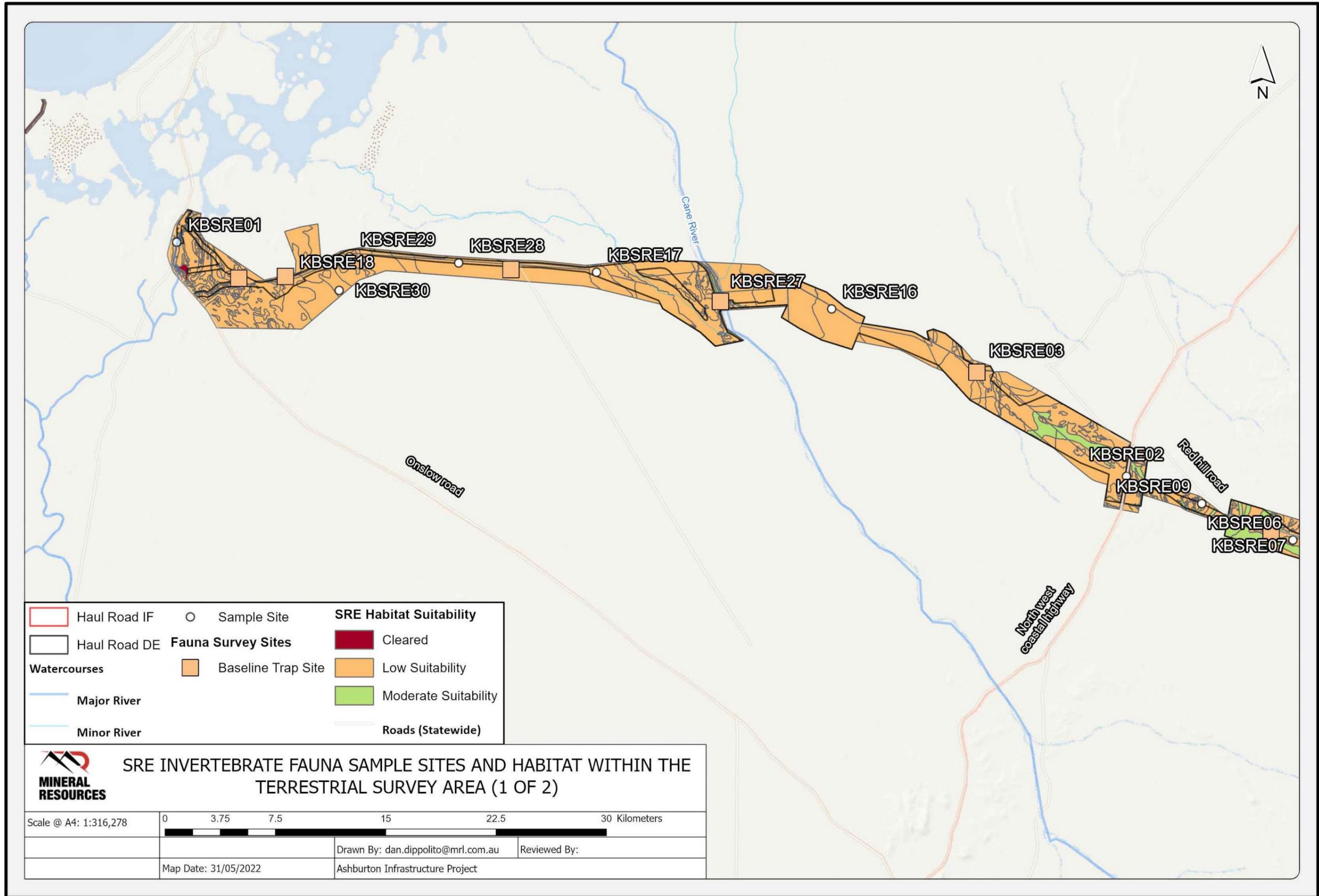


Figure 10-24: Potential SRE Records and Suitable Habitat within the Terrestrial Survey Area (1 of 2)

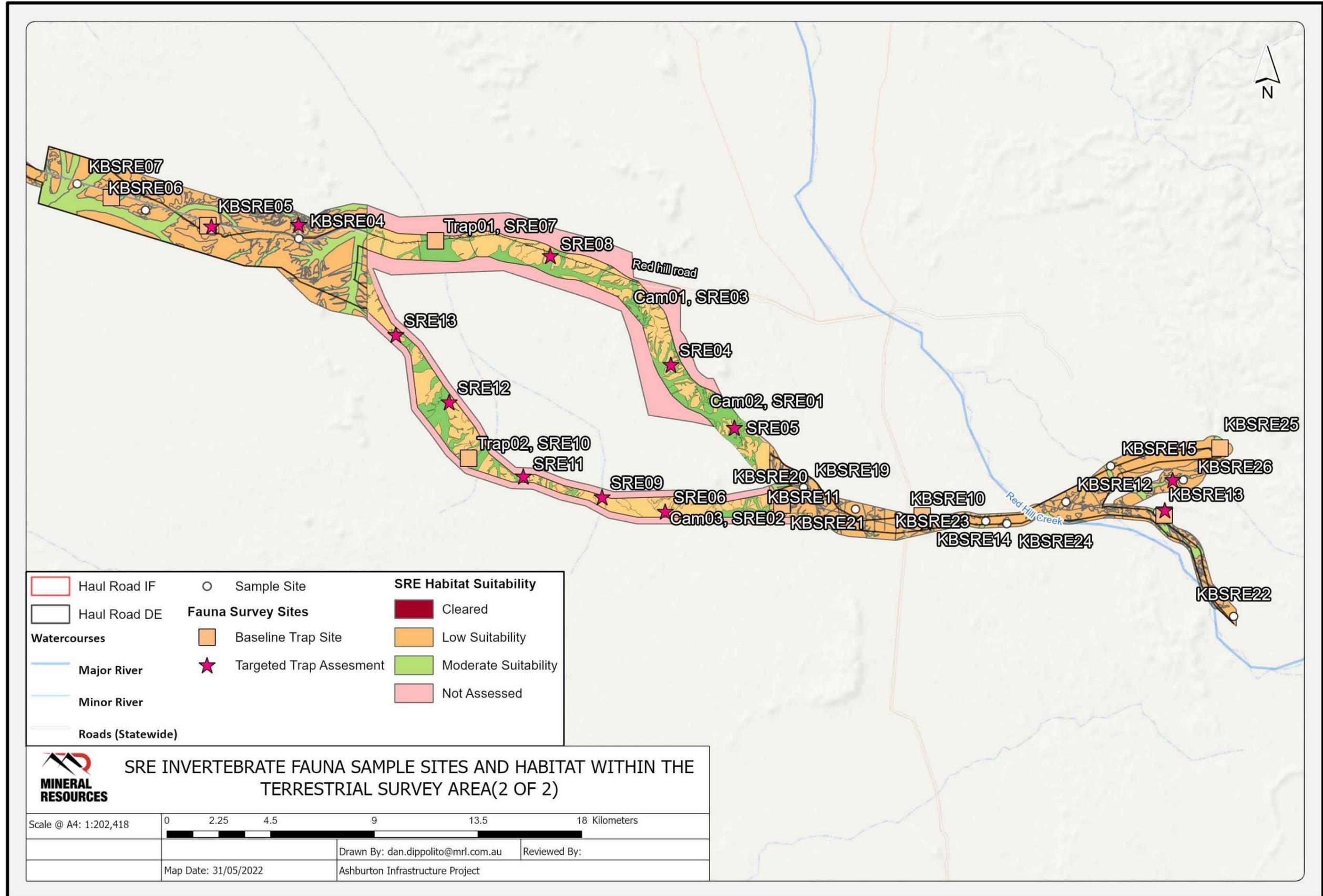


Figure 10-25: Potential SRE Records and Suitable Habitat within the Terrestrial Survey Area (2 of 2)

10.3.6.2 SRE Fauna Habitats

The fauna habitats described and mapped in **Table 10-13** were assessed for their suitability to provide habitat for SRE invertebrate fauna based on several microhabitat features such as southeast facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation, or habitats known to contain SRE species (360 Environmental 2021b; **Table 10-11**).

Most of the habitats identified within the Terrestrial Survey Area (Claypans, Tidal Flats, Stony Plain, Plain, Sand Dunes and Swales and Mulga Woodland) are widespread across the region and are unlikely to provide habitat isolates suitable for SRE invertebrates. Therefore, these habitats are considered to provide low SRE habitat suitability (360 Environmental 2021b).

The Drainage Line/River/Creek and Stony Hills and Slopes habitats are considered to provide moderate SRE habitat suitability. The western edges of drainage lines and the southeast slopes of Stony Hills and Slopes provide some protection from heat and may contain greater moisture within leaf litter accumulations (360 Environmental 2021b). None of the habitats present within the Terrestrial Survey Area have been considered highly suitable for SREs (360 Environmental 2021b).

Table 10-12: Short Range Endemic Habitat Suitability within the Haul Road DE

SRE Fauna Habitat	SRE Habitat Suitability
Drainage Line/River/Creek	Moderate These habitats have a moderate likelihood of containing SRE species as they have at least two microhabitat factors that may support the presence of SRE species such as southeast facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation or habitats known to contain SRE species.
Stony Hills and Slopes	
Claypans	Low These habitats have a low likelihood of containing SRE species as they only provide a single microhabitat factor that may support the presence of SRE species such as southeast facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation or habitats known to contain SRE species.
Tidal Flats	
Stony Plain	
Plain	
Sand Dunes and Swales	
Mulga Woodland	

10.4 Potential Impacts

The Proposal will result in the clearing of fauna habitats within the Haul Road DE. There will be no clearing of fauna habitats within the Landside DE as part of this Proposal; however, there is a minor potential for the operations of the Port to lead to increased dust deposition to surrounding fauna habitat.

Port Landside Development Envelope

No vegetation or fauna habitat will be cleared within the Landside DE as part of this Proposal. However, the operation of the Port may lead to increased dust, light and noise emissions, which may impact fauna species and their habitat (especially migratory bird species).

Based on the air quality modelling completed it is not expected that operational particulate emissions from the Port will have any significant impacts to air quality (ETA 2022). The Proposal has been specifically designed to maximise the suppression and capture of dust emissions at the Port i.e. through the use of covered conveyors, storage sheds and loading and unloading facilities. Mitigation has been incorporated into the Proposal to minimise emissions through ensuring the ore is stockpiled, conveyed and transferred in covered infrastructure at the Port (this is discussed further in **Section 14.2**). As such, the Proponent considers that dust emissions can be appropriately managed in accordance with management procedures and the EPA's objective for Air Quality can be met.

Increased exposure to artificial light due to the construction and operation of the Port may have a detrimental impact on the bird, reptile and mammal species. Artificial light may interfere with activities governed by the length of day or photoperiod, including reproduction, dormancy, foraging and migration (Robert et al. 2015). Lights can disorient flying birds, particularly during migration and cause them to divert from efficient migratory routes or collide with infrastructure (DotEE 2020). In addition, light emissions may attract invertebrates and increase nocturnal species' foraging activities, increasing the risk of interactions with vehicles or machinery. Migratory shorebirds may use less preferable roosting sites to avoid lights and may be exposed to increased predation where the lighting makes them visible at night (DotEE 2020).

Increased noise and vibrations may cause interruptions to feeding and resting behaviour, reduced population densities, nest failure, abandonment of habitat area/roost sites and reduced hunting efficiency (e.g., interference in echolocation for bats) (DotEE 2020).

Due to existing Port operations, light, noise, and vibration emissions are already present in the Landside DE habitats. The Proposal's increase in noise and light emissions will be managed using best practice lighting design and industry standards. As a result of these measures and the light modelling completed, impacts associated with light, noise, and vibration are unlikely to be significant (Pendoley Environmental 2022).

No clearing of habitat will occur in Landside DE for this Proposal, and any impacts from dust, light, noise and vibration are expected to be managed. Therefore, the Proposal is unlikely to significantly impact fauna values within and surrounding the Landside DE and Port. The values in the vicinity of the Landside DE and potential impacts are not discussed further.

Haul Road Development Envelope

The potential direct, indirect and cumulative impacts from development within the Haul Road DE are identified below. The impacts to terrestrial fauna have been calculated based off the worst-case scenario (the southern alignment for the haul road to account for the maximum disturbance to fauna habitat).

For conservation significant values, a maximum impact was developed to provide project flexibility to alter the alignment and supporting infrastructure. It is important to note that the precise location of clearing is to be confirmed once the preferred alignment has been finalised.

The significance of any residual impacts following mitigation are discussed in **Section 10.6**.

10.4.1 Direct Impacts

The Proposal may impact ecologically sensitive features, primarily through vegetation clearance and works associated with establishing the Proposal infrastructure.

The potential direct impacts to fauna species because of the Proposal have been identified as:

- Loss of fauna habitat, including breeding, foraging and dispersal due to clearing along the haul road;
- Fragmentation of fauna habitats, limiting fauna access and movement along the haul road; and
- Fauna mortality or injury.

These impacts may be within or immediately adjacent to the Haul Road DE.

10.4.1.1 Loss of Fauna Habitat, including Breeding, Foraging and Dispersal Habitat due to Clearing

The Proposal will clear up to **1,564 ha** of native vegetation within the Haul Road DE from nine mapped fauna habitat types (**Table 10-13**). The clearing will enable the construction of the haul road and associated infrastructure. This includes approximately 1200 ha of temporary construction areas, such as borrow pits and laydown areas etc. After rehabilitation, the permanent native vegetation clearing as part of the Proposal will be approximately 364 ha.

The Proposed clearing will reduce the available habitat for fauna species known to occur or likely to occur within the Haul Road DE.

Table 10-13 presents the approximate loss of fauna habitat based on the Haul Road IF. However, the Proposal includes flexibility to alter the alignment of the haul road and supporting infrastructure components (Haul Road IF) within the Haul Road DE and this flexibility is also presented in **Table 10-13**. The maximum clearing extent within each fauna habitat unit does not equate to the total clearing extent, as it allows for flexibility in the final footprint. The approach to this flexibility is that strict limits are placed on the highest value habitats, allowing more flexibility for habitats with less value (but still within the authorised clearing limit).

10.4.1.2 Fragmentation of Fauna Habitat, Limiting Fauna Access and Movement

Fragmentation is defined as the process by which contiguous areas of habitat are interrupted or separated into two or more smaller areas, which can result in the following impacts on fauna:

- Altered movement patterns or reduced ability to disperse and recolonise;
- Genetic isolation;
- Increased competition for resources;
- Habitat degradation; and
- Reduced species richness.

Fragmentation of fauna habitats will occur due to the linear infrastructure, including fragmentation of high-value fauna habitats for conservation significant fauna. However, the haul road is unlikely to create a major barrier to fauna dispersal, as the final landform will be a flat sealed road. All the conservation significant fauna species recorded or highly likely to occur in the Haul Road DE will be able to traverse the haul road and continue to utilise habitats on either side.

A non-barbed wire cattle fence will be constructed along the whole length of the haul road to prevent cattle from crossing, except in areas identified where a barbed wire fence is required based on pastoralist feedback. This is an essential element for road safety. The fence will be designed to enable native fauna to pass through and/or above. In particular, space will be maintained underneath the lowest fence strand to allow ground-dwelling wildlife to move under the fence. In addition, in areas where barbed wire fencing is required, suitable mitigation strategies will be implemented to ensure impacts to significant species are minimised. E.g., bat deflectors will be installed in bat foraging habitat.

10.4.1.3 Fauna Mortality and/ or Injury

Activities associated with vegetation clearing or vehicle movements can result in mortality or injury of fauna individuals. During operations, truck movements will occur on a 24-hours, seven days a week basis which can result in mortality or injury of fauna individuals.

The construction phase of the Proposal will occur predominately during daylight hours with a commitment to undertake vegetation clearing during daylight hours within 1 km of Mesa and Breakaway habitat and east of Red Hill Creek, and to ensure that clearing commences from a disturbed edge to an undisturbed area, where practicable, to encourage mobile fauna to naturally relocate into adjacent areas. In addition, vehicle movements during construction will be limited to 60 km/hr in construction, and 40 km/hr within 1 km of Mesa and Breakaway habitat and east of Red Hill Creek.

During operations an average of 275 load movements will be transported along the Haul Road per day, equalling an average of 550 truck movements per day. Vehicle movements along the Haul Road will have speed limits of 80 km/hr at all times. The access road will have limits of 80 km/hr at night to minimise the risk of fauna collision.

Ghost Bats are at risk of entanglement in barbed wire fencing, causing injury or mortality. The Proponent proposes to install a non-barbed wire fence along the Haul Road, barbed wire fencing would only be considered if there is substantial risk from cattle pushing through non-barbed wire fencing or if it is required under third party obligation. If barbed wire is deemed necessary in areas of low to high risk of interaction with Ghost Bats (i.e. east of NWCH), it will be installed with suitable bat deflectors to minimise the risk of collision as detailed in the TEMP (**Appendix H**). Native fauna will be subject to direct impacts associated with mortality from vegetation clearing or vehicle strike, and the loss of some individuals may be unavoidable. The number of individuals affected is expected to be low and not significant in terms of local populations.

An assessment of the potential direct impacts on terrestrial fauna is provided in **Section 10.6.1**.

Table 10-13: Potential Direct Impacts to Terrestrial Fauna Habitats

Habitat Type	Potential conservation significant species	Nature of occurrence****	Indicative Footprint	Maximum clearing within each habitat type*	Total Haul Road DE	Total in Terrestrial Survey Area**	Maximum Habitat Loss in Terrestrial Survey Area	Minimum extent remaining in Terrestrial Survey Area	
			ha	ha	ha	ha	%	ha	%
Claypans	Waterbird species.	May provide occasional foraging habitat.	1	1	11	42	2	41	98
	Short-tailed Mouse	May provide suitable habitat.							
Drainage Line/River/Creek (major)	Northern Quoll	May provide regular foraging and dispersal habitat (particularly when within 1 km of Mesa and Breakaway habitat).	26	42	561	695	6	653	94
	Ghost Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek).							
		May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH).							
		May provide very occasional foraging and dispersal habitat (east of NWCH).							
	Pilbara Leaf-nosed Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek).							
May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH).									
Pilbara Olive Python	May provide foraging and dispersal habitat adjacent to mesa and breakaway habitat.								
Grey Falcon	May provide nesting and breeding habitat.								
Drainage Line/Creek (minor)	Northern Quoll	May provide regular foraging and dispersal habitat (particularly when within 1 km of Mesa and Breakaway habitat).	126	226	1,815	2,257	10	2,031	90
	Ghost Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek).							
		May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH).							
Pilbara Leaf-nosed Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek).								
		May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH).							
		May provide very occasional foraging and dispersal habitat (east of NWCH).							

Habitat Type	Potential conservation significant species	Nature of occurrence****	Indicative Footprint	Maximum clearing within each habitat type*	Total Haul Road DE	Total in Terrestrial Survey Area**	Maximum Habitat Loss in Terrestrial Survey Area	Minimum extent remaining in Terrestrial Survey Area	
			ha	ha	ha	ha	%	ha	%
	Pilbara Olive Python	May provide occasional foraging and dispersal habitat (to a lesser extent than the major drainage lines).							
	Grey Falcon	May provide occasional nesting and breeding habitat (to a lesser extent than the major drainage lines).							
Mulga Woodland	May provide very occasional habitat for conservation significant species.	May provide very occasional habitat for conservation significant species.	9	No habitat-specific limit	207	370	No habitat-specific limit	N/A	N/A
Plain	Short-tailed Mouse	May provide suitable habitat.	444	No habitat-specific limit	5,160	8,224	No habitat-specific limit	N/A	N/A
		May provide very occasional habitat for conservation significant species.							
Sand dunes and Swales	May provide very occasional habitat for conservation significant species.	May provide very occasional habitat for conservation significant species.	69	No habitat-specific limit	528	3,150	No habitat-specific limit	N/A	N/A
Stony Hills and Slopes	Northern Quoll	May provide regular foraging and dispersal habitat (particularly when within 1 km of Mesa and Breakaway habitat).	114	150	1,032	1,499	10	1,349	90
	Ghost Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek).							
		May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH).							
		May provide very occasional foraging and dispersal habitat (east of NWCH).							
	Pilbara Leaf-nosed Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek).							
May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH).									
Pilbara Olive Python	May provide shelter and foraging habitat when adjacent to a water source, and mesa and breakaway habitat.								
Long-tailed Dunnart	May provide suitable habitat.								

Habitat Type	Potential conservation significant species	Nature of occurrence****	Indicative Footprint	Maximum clearing within each habitat type*	Total Haul Road DE	Total in Terrestrial Survey Area**	Maximum Habitat Loss in Terrestrial Survey Area	Minimum extent remaining in Terrestrial Survey Area	
			ha	ha	ha	ha	%	ha	%
Stony Plain	Northern Quoll	May provide regular dispersal habitat when within 1 km of Mesa and Breakaway habitat.	725	No habitat-specific limit	6,455	8,801	No habitat-specific limit	N/A	N/A
	Ghost Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal habitat (east of NWCH).							
	Pilbara Leaf-nosed Bat	May provide regular foraging and dispersal habitat (east of Red Hill Creek). May provide occasional foraging and dispersal habitat (Red Hill Creek – NWCH). May provide very occasional foraging and dispersal (east of NWCH).							
	Western Pebble-mound Mouse	May provide suitable habitat.							
	Long-tailed Dunnart	May provide suitable habitat.							
	Short-tailed Mouse	May provide suitable habitat.							
	Tidal Flats	Waterbird species.							
	Short-tailed Mouse	May provide suitable habitat.							
Cleared	Unlikely to provide habitat for conservation significant species.		4	No limit	118	202	No limit	N/A	N/A
Total***			1,564		16,210	26,993	N/A	25,217	N/A

* Note: the total maximum amount to be cleared would be no more than **1,564** ha

**Area equals 360 Environmental (2021b) Terrestrial Survey Area

***Total discrepancies due to rounding up in calculations

****Nature of that occurrence is based on the numbers of the species that may be present, how often they are present and how they use a location.

10.4.2 Indirect Impacts

The potential indirect impacts associated with the construction of the Proposal on terrestrial vertebrate and SRE invertebrate fauna have been identified as:

- Species disturbance associated with increased dust, noise, vibration or light: and
- A degradation of fauna habitats due to:
 - Introduction or spread of weeds;
 - An increase in feral predators (vertebrate fauna only); and
 - Altered fire regimes.

10.4.2.1 *Species Disturbance Associated with Increased Dust, Noise, Vibration or Light*

Clearing of native vegetation for the construction of the haul road will disturb habitat and species through dust emissions, noise and vibration impacts, as well as light emissions. Best practice design and industry standards will be used to mitigate these impacts as much as practicable, as detailed in the TEMP (**Appendix H**).

Dust emissions during construction will be generated through vegetation clearing and earthwork activities, including vehicle and machinery movements. Once the Proposal has been constructed, the Haul Road and adjacent access roads will be sealed, reducing the risk of increased dust. Maintenance activities along the Haul Road have the potential to create dust, however these activities are expected to be localised to the immediate area of maintenance, and only occur for a short period of time.

Noise and vibration can potentially impact fauna species within proximity of the haul road. Increased noise and vibration (from traffic) can disturb fauna behaviour, increasing avoidance of suitable habitat. No known bat roosts (caves) in the Haul Road DE or Terrestrial Survey Area could be susceptible to vibration effects. During operation, noise and vibrations are expected to remain restricted and temporary along the relatively narrow dimensions of the Haul Road.

Light emissions can disorient flying birds, particularly during migration, and cause them to divert from efficient migratory routes or collide with infrastructure (DotEE 2020). Migratory shorebirds may use less preferable roosting sites to avoid lights and may be exposed to increased predation where the lighting makes them visible at night (DotEE 2020). Artificial lights may interrupt nocturnal foraging for migratory birds and mammals (i.e., attracting invertebrates), which may increase species (Northern Quoll and Bats) interactions with vehicles or machinery.

Where possible, the Proponent will avoid the use of permanent lightening during operation of the Haul Road and considerations will be made throughout the design phase to achieve this. The Proponent consider the use of lighting may be required at non-grade separated crossings (of which none are currently planned) to act as a form of control to alert a vehicle of an approaching vehicle and enable safe vehicle interactions. If non-grade separated crossings are considered necessary throughout the design process, the lights will be temporary in nature, used from dusk to dawn and fitted with motion sensors to ensure light exposure is minimised and only used when necessary.

10.4.2.2 *Habitat Degradation Due to Introduction or Spread of Weeds, Increase in Feral Predators, and Altered Fire Regimes*

Weeds can spread or be introduced to locations due to disturbance from land clearing or vehicle and machinery movement. 18 weed species have been recorded within the Terrestrial Survey Area. Two species, *Parkinsonia aculeata* and *Prosopis pallida* are listed as Declared Pests and WONS (360 Environmental 2021b). The Proponent will undertake a baseline weed survey 100 m either side of the edge of the proposed Haul Road centreline, access tracks and borrow pits prior to construction to determine species presence, extent and cover, particularly around primary vector spread sources (i.e., altered drainage lines, pastoral boundaries, and areas in proximity to the populated regional area of Onslow).

The Proponent will also develop a weed management procedure with particular focus on preventing the introduction of Declared Pests and WoNS following the baseline weed survey, to ensure that weed species' extent and cover do not increase compared to baseline during either construction or operation.

The procedure will include the following as detailed in the TEMP (**Appendix H**):

- Frequency of weed control and monitoring (at least annual; vehicle hygiene;
- Monitoring schedule, including establishment of reference sites; and
- Contingency measures.

Vegetation clearing creates corridors (cleared areas) that enable feral predators (i.e., Cats and Foxes) to move more easily through the landscape. Clearing may force native fauna to move through cleared areas to reach suitable habitats, leaving them susceptible to predation. Linear infrastructure typically increases predator activity as feral Cats and Foxes utilise roads (Robley et al. 2010; Wysong et al. 2020). The haul road is in open terrain and therefore is unlikely to change the access of feral predators significantly.

One species of feral predator, the feral Cat, has previously been recorded in the Haul Road DE and is considered one of the most damaging feral fauna species. Predation by the feral Cat is a threatening process for several conservation significant fauna species, including the Northern Quoll and Pilbara Olive Python (DAWE 2021b). The feral Cat is likely to occur throughout the wider region, making it difficult to control. However, the Proposal is not likely to increase their occurrence or potential threat to fauna species.

Fire may impact fauna via direct contact or indirectly by long-term habitat modification brought about by altered fire frequency and intensity (Woinarski et al., 2013). Values associated with many habitats lie in the mosaic vegetation structures of fire ages. Too frequent, hot, or extensive fires during hot, dry times of the year can eliminate this mosaic and reduce the capacity of these habitats to support diverse assemblages of fauna.

The construction of the Proposal can introduce unplanned fire via vehicle movements or other activities.

Once the Haul Road has been constructed, the risk of the spread of weeds and feral pests is reduced due to the Haul Road and access road being sealed, and no major earthworks or clearing activities proposed.

10.4.2.3 Habitat Degradation Due to Erosion, Sedimentation or Altered Hydrological Regimes

Creeklines within the Pilbara are naturally dry and experience ephemeral flows in response to rainfall events. The installation of infrastructure and development of borrow pits can alter surface water regimes in the Haul Road DE, which could result in degraded fauna habitat.

The Proponent has designed the Haul Road and associated infrastructure to avoid, and where not possible to avoid, minimise impacts to surface water regimes. Proposed engineering controls and water management structures (i.e. culverts, bridges and burrows) will be installed to ensure natural hydrological regimes are maintained for the majority of conditions, but particularly during low (base) and receding flows, and to minimise the degradation of water quality by sedimentation and erosion during construction. Water crossings, and borrow areas within floodplains, will only be excavated when inundation and surface water flows are not present, and all disturbed areas will be stabilised, including rock protection at waterway crossings where flow velocities are likely to exceed 2 m/s, prior to the commencement of the next wet season. Sedimentation controls and onsite sumps will be designed to contain most stormwater runoff onsite, minimising offsite discharge.

Disturbed areas (including borrow pits) will also be progressively rehabilitated in accordance with the Closure Strategy (Appendix I), minimising the area of exposed surfaces.

10.4.3 Cumulative Impacts

The Proposal will contribute to the following cumulative impacts at a regional scale:

- Loss and fragmentation of terrestrial fauna habitats due to clearing; and
- Loss of conservation significant fauna species due to clearing activities.

The projects located within 50 km of the Haul Road DE that have been used to assess cumulative impacts as detailed in **Section 2.3.4** and shown in **Figure 2-26**. There will be no clearing of flora and vegetation in the Landside DE for this Proposal. The clearing from other Projects at the Port (in the vicinity of the Landside DE) will add to existing Port infrastructure impacts. However, flora and Vegetation values will be intact in areas north and south along the Western Australian coastline. Therefore, cumulative impacts have not been considered for the Landside DE.

The assessment and significance of residual impacts associated with cumulative impacts is discussed in **Section 10.6.4**.

10.5 Mitigation

The Proponent has applied the mitigation hierarchy (avoid, minimise and rehabilitate) during the Proposal design to reduce the potential impacts to terrestrial fauna values. Potential impacts have been avoided or minimised through the Haul Road DE and Haul Road IF design. Areas of disturbed land resulting from implementing the Proposal will be progressively rehabilitated to agreed land-use outcomes. Specific mitigation measures have been developed within the TEMP (**Appendix H**) and are summarised in **Table 10-14**.

A number of management plans have been prepared for the Proposal to minimise the potential impacts of project construction and operational activities on terrestrial fauna. The specific management plan that has been prepared that will assist to mitigate potential impacts on terrestrial fauna includes:

- A **Terrestrial Environment Management Plan (TEMP)**: The TEMP has been prepared to detail the mitigation and management measures the Proponent proposes to implement to reduce direct and indirect impacts to surrounding inland waters, flora, vegetation, fauna and social surroundings. The management objectives for the plan relate to specific management objectives on each environmental factor.

Table 10-14: Proposed Mitigation Measures for Terrestrial Fauna

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
<p>Loss of fauna habitat due to clearing activities</p> <p>Clearing will remove up to 1,564 ha of fauna habitats, including up to 418 ha of high-value (Drainage Line/River/Creek and Stony Hills and Slopes) vertebrate fauna habitat (also considered moderate value to SRE invertebrate fauna).</p>	<p>The Proponent has undertaken a redesign of a haul road to avoid direct impacts to Mesas and Breakaway habitat. This includes realigning the corridor to avoid Mesas and Breakaway habitat. The new design has avoided all Mesas and Breakaway habitat is known as Northern Quoll denning habitat, Ghost Bat and Pilbara Leaf-nosed Bat roosting habitat and shelter for Pilbara Olive Python.</p> <p>The proposed clearing has been minimised as far as practicable to reduce the extent of clearing required. The Proponent has revised the Haul Road DE from 25,930 to 16,209 ha.</p> <p>The Proponent will ensure clearing only occurs in approved disturbance areas and will avoid any clearing occurring outside of the Haul Road IF in accordance with the SSDP process outlined in the TEMP (Appendix H).</p> <p>Landform corridors such as drainage lines will remain and maintain connectivity of habitat.</p>	<p>The ground disturbance will be minimised as far as practicable.</p> <p>Clearing will be clearly demarcated in the field.</p> <p>No clearing will occur outside the approved clearing areas.</p> <p>Overpasses and culverts will be installed along the haul road to minimise impact to Drainage Line/River/Creek habitat as far as practical.</p> <p>The construction corridor width has been reduced as practicable in key habitat areas to minimise the impacts on important habitats.</p> <p>Vegetation clearing at creek crossings will be minimised as far as practicable. Water crossings (bridges/overpasses/culverts) will be installed over major rivers and creeks to minimise impacts to Drainage Lines/Rivers/Creeks (major) habitat.</p> <p>Induct relevant personnel and contractors on land disturbance and vegetation clearing management including:</p> <ul style="list-style-type: none"> • Native and conservation significant fauna present in the Project area; • Key protection measures being implemented; • Significant species habitat and “no-go” areas; • Allowable operation times (i.e. no night-time clearing to be undertaken within 1 km of Mesa and Breakaway habitat); • Clearing boundaries; and • Requirements of the site-disturbance procedure (SSDP). 	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I).</p>	<p>Yes</p> <p>Significant impacts are expected for Northern Quoll. Offsets will be provided for the clearing of up to 141 ha of Northern Quoll supporting habitat.</p>
<p>Fragmentation of fauna habitats</p> <p>Clearing will result in fragmentation of fauna habitats; however, it will not present a barrier to fauna movement.</p>	<p>The Proponent has undertaken a redesign of a haul road to avoid direct impacts to Mesas and Breakaway habitat.</p>	<p>Retention of corridors or linkages between habitats to allow fauna to move between different habitats, which may include bridges, culverts and underpasses with fauna crossings and fauna egress structures.</p> <p>Creek crossings will be designed to maintain flows and will minimise disruption to fauna dispersal along these corridors.</p> <p>The majority of the final road design will include a flat sealed road within associated infrastructure, reducing the fragmentation caused by the road.</p> <p>Investigate the use of underpasses and/or overpasses by Northern Quolls and install in high value habitat areas (near Mesa and Breakaway habitat) if they are deemed suitable to allow fauna species to disperse between habitat within the Proposal area. The investigation into the use of underpasses and/or overpasses is discussed further in the TEMP. Cattle underpasses will also be installed, which can also be used by fauna for dispersal. Drainage Line/River/Creek habitat will also remain throughout the Haul Road DE and can be utilized for dispersal.</p>	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Plan (Appendix I).</p>	<p>No</p>

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
Fauna mortality or injury	<p>The Proponent has undertaken a redesign of a haul road to avoid direct impacts to Mesas and Breakaway habitat.</p>	<p>The speed limit of the Haul Road will be limited to 80 km/hr at all times and the access road will be limited to 80 km/hr at night during operation, reducing the risk of collision with nocturnal species.</p> <p>The speed limit of the Haul Road will be limited to 60 km within construction areas, except for within 1 km of Mesa and Breakaway habitat and east of Red Hill Creek which will have a speed limit of 40 km/hr during construction.</p> <p>Signage will be installed in the area where conservation significant fauna is likely to occur (i.e., Mesa and Breakaway habitat and east of Red Hill Creek).</p> <p>Installing and maintaining fencing around landfills, water storage areas and turkeys' nests dams (circular water storage dams) to prevent ground fauna access.</p> <p>Ensuring top edges of trenches and borrow pits are sloped to enable fauna egress.</p> <p>Progressive backfilling of borrow pits and trenches.</p> <p>Inspections of infrastructure by onsite personnel for trapped fauna including any trenches. Open trenches will be checked less than two hours after sunrise and before commencement of any construction to detect and safely remove trapped terrestrial fauna. Any fauna capture, handling and relocation will be conducted in accordance with DBCA Parks and Wildlife Service Standard Operating Procedures, by a trained fauna handler.</p> <p>Construction vehicle movements will occur during daylight, where possible, which will minimise interactions with nocturnal species (Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat). Clearing will be undertaken progressively in one direction where possible, to allow fauna to disperse to other habitats. Clearing will commence, where possible, from a disturbed vegetation edge to an undisturbed area (to encourage mobile fauna to relocate to adjacent areas naturally).</p> <p>Clearing works will be restricted to daylight hours within 1 km of Mesa and Breakaway habitats and east of Red Hill Creek.</p> <p>Prior to clearing within 1 km from Mesa and Breakaway habitat, east of Red Hill Creek and within Drainage Line/River/Creek (minor) a pre-clearance survey will be conducted within 7 days of clearing by a trained fauna handler, in accordance with DBCA Standard Operating Procedures.</p> <p>Engage fauna spotters when working within 1 km of Mesa and Breakaway habitat and within Drainage Line/River/Creek (major). In the event MNES are observed, they will be given the opportunity to move from the work area or will be relocated by a trained fauna handler if the fauna will not move away from the work area.</p> <p>Inspect tall Eucalypt trees in Drainage Line/River/Creek (major and minor) habitat for evidence of Grey Falcon nesting if clearing is proposed to occur during Grey Falcon nesting season (June – November). In the event that active Grey Falcon nesting is observed, the tree will be demarcated and will only be cleared once the next has been vacated. If clearing is necessary prior to vacancy, consultation with DBCA will occur and relocation will be by a trained fauna handler.</p> <p>Install non-barbed wire fencing within areas that have low to high risk (i.e. east of NWCH) of interaction with Pilbara Leaf-nosed Bat and Ghost Bat. Barbed-wire fences will be avoided if possible and only be installed if there is substantial risk from cattle pushing through non-barbed fencing or if it is required under third party obligations. If barbed wire is deemed necessary in areas of low to high risk (i.e., east of NWCH) of interaction with Ghost Bats, it will be installed with suitable bat deflectors to minimise the risk of collision.</p> <p>Investigate the use of underpasses and/or overpasses by Northern Quolls and install in high value habitat areas (near Mesa and Breakaway habitat) if they are deemed suitable to allow fauna species to disperse between habitat within the Proposal area. The investigation into the use of underpasses</p>	Not applicable	No

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
		<p>and/or overpasses is discussed further in the TMNES MP. Cattle underpasses will also be installed, which can also be used by fauna for dispersal.</p> <p>In the event that vertebrate fauna are injured during clearing or construction, the animal shall be taken to an authorized trained wildlife carer, or if not possible, humanely euthanized in accordance with DBCA SOP's.</p> <p>Vehicles, plant, and machinery not required for clearing activities will be restricted to designated roads/access tracks and cleared areas.</p>		
<p>Habitat degradation or species disturbance due to increased dust, noise, vibration or light</p>	<p>The Proponent has undertaken a redesign of a haul road to avoid direct impacts to Mesas and Breakaway habitat.</p>	<p>Management actions to manage dust include:</p> <ul style="list-style-type: none"> • Avoid any high dust emissions works during high wind (e.g., vegetation clearing) and implement additional use of dust management measures (such as water carts and misting sprays) where these works are not avoidable; • Implement dust suppression measures including utilising water carts and misting sprays on unsealed roads and access tracks, cleared areas and at locations of high dust risk during construction. Measures will be implemented where dust is visible and based on predicted meteorological conditions. Water used for dust suppression will be sourced from nearby groundwater bores along the Haul Road alignment; • Where possible, all dust suppression equipment will be operated to ensure that there is no inadvertent saline water impact on adjacent vegetation, and roadside drains will be installed to catch any runoff. Any dust suppression requirements are expected to be limited and localised due to the linear nature of the development, and the progressive nature of construction and rehabilitation; • Utilise dust control strategies at the Port Facility such as bin covers, dust extractors, dust containment enclosures, dump pockets where / when dust is identified as an issue; • Maintain any dust-generating material at the Port facility at Dust Extinction Moisture (DEM) levels (or slightly above to account for evaporative losses); • Vehicle movements at the Port facility are to be in accordance with PPA's Traffic Management Plan (Ashburton) and kept to established roads, flow paths and speed limits; • Temporarily cleared areas will be progressively sealed or rehabilitated reducing the area of bare earth susceptible to dust lift off; • The Haul Road will be sealed to minimise dust emissions during operations. • Implement Port Dust Management Procedure and Land Clearing Procedure; and • Establish community complaints register to log when and the reason for complaints occurring. <p>Management actions to manage noise, vibration and light emissions include:</p> <ul style="list-style-type: none"> • Lighting will be designed to minimise intensity and duration; • Adapt lighting including colour, intensity and timing, including smart control options (i.e., switching off, dimming or flashing); • Lighting will be directed inwards towards the Haul Road to minimise light impacts; • Noise controls will be installed on plant, vehicles and machinery to minimise disturbance to native fauna; • Automatic sensors will be installed on plant and machinery to avoid unnecessary lighting at night; 	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Strategy (Appendix I).</p>	<p>No</p>

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
		<ul style="list-style-type: none"> Clearing activities will be limited to daylight hours within 1 km of Mesa and Breakaway habitats and east of Red Hill Creek to reduce impacts of noise, vibration and light on nocturnal foraging; . No blasting is proposed as part of the Proposal. However, it may be required if hard substrate is encountered. If blasting is required within 300 m of Mesa and Breakaway habitat and during Northern Quoll breeding season (June-December), a pre-blasting survey to determine the presence of Northern Quolls will be undertaken the day prior to blasting as detailed in the TMNES MP; and Where possible, the Proponent will avoid the use of permanent lightening during operation of the Haul Road and considerations will be made throughout the design phase to achieve this. 		
<p>Habitat degradation or species disturbance due to introduction or spread of weeds, increased feral predators or changes in fire regime</p>	<p>The Proponent has undertaken a redesign of a haul road to avoid direct impacts to Mesas and Breakaway habitat.</p>	<p>Weed and hygiene control measures will be implemented within the Haul Road DE and areas around the clearing front, including the inspection of all vehicles and machinery prior to entering or exiting the site during construction and operation.</p> <p>The Proponent will undertake a baseline weed survey 100 m either side of the edge of the proposed Haul Road centerline, access tracks and borrow pits, prior construction footprint prior to construction to determine species presence, extent and cover, particularly around primary vector spread sources (i.e., altered drainage lines, pastoral boundaries, and areas in proximity to the populated regional area of Onslow.</p> <p>Weed monitoring will be undertaken annually during construction and two years post-construction following rainfall in summer/autumn.</p> <p>Biennially during operation in areas containing WoNs and/ or high risk areas within Redhill Station and Pedemulla Station until the Proponent demonstrates that there has been no spread or increase of WoNs and/or high risk areas within Red Hill Station and Pedumulla Station.</p> <p>Weed surveys will also be undertaken prior to rehabilitation to inform post rehabilitation and closure monitoring.</p> <p>The Proponent will develop a weed management procedure with particular focus on Declared Pests and WoNS following establishment of baseline weed presence, to ensure that weed species' extent and cover do not increase compared to baseline. The procedure will include:</p> <ul style="list-style-type: none"> Frequency and type of weed control (spraying and/or manual removal) and monitoring; Monitoring of schedule, including establishment of reference sites; and Contingency measures. <p>The Proponent will implement a TEMP (Appendix H) which will detail triggers and thresholds and completion targets to ensure the objective of no new weed species are introduced to the Haul Road DE. The MP will also include monitoring and management actions for feral predators.</p> <p>The Proponent will locate the temporary construction camp, near NWCH, over 13 km from any Mesa and Breakaway and Drainage line/river/creek (major) habitat. To minimise the risk of attracting feral animals to high value habitats.</p> <p>Ensure all wastes are managed and stored appropriately to prevent attraction of feral pest species to the Haul Road DE.</p> <p>Fire prevention measures (and control measures, should a fire break out) will be in place. This will increase the capacity for fire management in the wider area through the presence of fire-fighting equipment, trained personnel, and fire access.</p>	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Strategy (Appendix I).</p> <p>Upon completion of construction, only those weed species already present within the Haul Road DE and/or within local undisturbed areas, will be present within rehabilitated areas.</p>	<p>No</p>

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset required?
<p>Habitat degradation due to erosion, sedimentation or altered hydrological regimes</p>	<p>The Proponent has undertaken a redesign of a haul road to avoid direct impacts to Mesas and Breakaway habitat.</p> <p>The Proponent has designed the Haul Road and associated infrastructure to avoid, and where not possible, minimise impacts to surface water regimes.</p> <p>Proposed engineering controls and water management structures (i.e., culverts) will be installed to ensure natural hydrological regimes are maintained, particularly low flows and receding flows.</p> <p>Construction activities will target earthmoving activities for when inundation and surface water flows are not present and also to avoid periods of extreme high tides.</p>	<p>Water management structure will be designed to minimise the degradation of water quality by sedimentation, erosion or chemical pollutants.</p> <p>Culverts and other crossings will be regularly inspected (i.e., annually or after flood events, whichever is more frequent) to ensure flows are unobstructed).</p> <p>Water crossings, and borrow areas within floodplains, will only be excavated when inundation and surface water flows are not present, and all disturbed areas will be stabilized, including rock protection at waterway crossings where flow velocities are likely to exceed 2 m/s, prior to the commencement of the wet season.</p> <p>Sedimentation controls and onsite sumps will be designed to contain most stormwater runoff from site, minimizing offsite discharge.</p> <p>Disturbed areas (including borrow pits) will also be progressively rehabilitated in accordance with the Closure Strategy (Appendix I), minimizing the area of exposed surfaces.</p> <p>Water levels in intertidal areas and claypans up and downgradient of the Haul Road will be monitored to ensure objectives are achieved, as the per the TEMP (Appendix H).</p>	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Strategy (Appendix I).</p>	<p>No</p>

10.6 Assessment and Significance of Residual Impacts

10.6.1 Direct Impacts

10.6.1.1 Loss of Fauna Habitat due to Clearing

The Proposal will result in the clearing of up to **1,564 ha** of terrestrial fauna habitats within the Haul Road DE (**Table 10-13**). This includes approximately 1,200 ha of temporary construction areas such as borrow pits and laydown areas etc. The temporary construction areas will be progressively rehabilitated during construction. The rehabilitation of temporary disturbance areas will be undertaken in accordance with Closure Strategy (**Appendix I**). After rehabilitation, the permanent native vegetation clearing as part of the Proposal will be approximately 364 ha.

Of the nine fauna habitat types within the Haul Road DE, 14,646 ha (~90%) of the fauna habitat will remain in the Haul Road DE and 25,217 ha ~(93%) of fauna habitat remaining in the Terrestrial Survey Area (**Table 10-13**). The highest value habitat type (Mesas and Breakaway) has been entirely avoided through refinements to the Haul Road DE.

Given that the Haul Road IF is flexible, the specific clearing amounts within each fauna habitat may change slightly. The impact assessment allows for flexibility, and the calculations provided throughout this section addresses the maximum impact that could occur within the Proposal's definition. The actual clearing is likely to be less than assessed. None of the fauna habitats are restricted, and all extend beyond the Haul Road DE. Therefore, regardless of where in the Haul Road DE the final footprint is implemented (within the authorised extent limit), the impact on these fauna habitats from the Proposal's implementation is not considered significant.

The Drainage Line/River/Creek (major and minor) and Stony Hills and Slopes fauna habitat types are considered high value (**Table 10-9**). They provide habitat for conservation significant species, including MNES such as Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Western Pebble-mound Mouse, Long-tailed Dunnart, Grey Falcon and the Peregrine Falcon. It also provides a moderately suitable habitat for SRE invertebrate fauna (360 Environmental 2021b). Completely avoiding creek line crossings is impossible for a linear infrastructure project. Impacts on these habitats (Drainage Line/ River/Creeks (major and minor)) have been minimised as far as practicable.

Up to 268 ha of high-value Drainage Line/River/Creek (major and minor) and 150 ha of Stony Hills and Slopes fauna habitat will be cleared. The direct impacts are described in **Table 10-13**.

No habitats in the Haul Road DE are considered as important habitats for waterbirds (Section 10.3.2.2 and 10.3.3.10). The Proposal will clear up to 69 ha of Tidal Flat and 1 ha of Claypan habitat, both of which may be occasionally used by waterbirds for foraging (such as every one or two years for the intertidal areas and less so for the claypans) although only at low levels (BCE 2022). Neither of these habitats are restricted to the Haul Road DE. There is approximately 1,716 ha of Tidal Flats and 41 ha of Claypan habitat within the Terrestrial Survey Area (**Table 10-13**). Impacts on the remaining fauna habitats are **unlikely** to be significant given the small amount to be cleared and the widespread nature of the remaining habitats.

10.6.1.2 Fragmentation of Fauna Habitats, Limiting Fauna Access and Movement

The placement of linear infrastructure, and associated fragmentation, has the potential to create a partial barrier to fauna dispersal; however, given that the final design of the haul road is largely flat, and the high mobility of most the fauna species considered highly likely to occur (i.e., Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat), and the construction corridor will be reduced by progressive rehabilitation, further reducing long term fragmentation, the Proposal is **unlikely** to create a barrier to movement.

To further facilitate the dispersal of significant fauna species (e.g. Northern Quoll) between habitats, the Proponent will investigate the use of underpasses and/or overpasses by Northern Quolls and install in high value habitat areas (near Mesa and Breakaway habitat) if they are deemed suitable to allow MNES species to disperse between habitats within the Proposal area. The investigation into the use of underpasses and/or overpasses is discussed further in the TEMP. Cattle underpasses will also be installed, which can also be used by fauna for dispersal. Drainage Line/River/Creek habitat will also remain throughout the Haul Road DE and can be utilised for dispersal.

A plain wire cattle fence will be constructed along the whole length of the haul road to prevent cattle from crossing. The Proponent will ensure that the fence is wildlife-friendly (not barbed-wired). The Northern Quoll, Ghost Bat and Pilbara Olive Python will pass through the fence, whilst the Pilbara Leaf-nosed Bat and Grey Falcon will fly over it.

Bridges will also be built across the major rivers and creeks within the Haul Road DE, assisting to minimise the fragmentation of habitat. Drainage Line/River/Creek habitat will remain throughout the Haul Road DE and be utilised for dispersal.

The presence of habitat outside the Haul Road DE reduces the significance of fragmentation to fauna species. Large, connected fauna habitat areas will remain and will be available for dispersal and foraging. As a result, impacts associated with fragmentation are **unlikely** to be significant and are not discussed further.

10.6.1.3 Fauna Mortality or Injury

The loss of native fauna individuals due to vegetation clearing and/or vehicle strikes will be unavoidable. This includes individuals of conservation significance. However, most of the fauna species recorded or considered highly likely to occur within the Haul Road DE are mobile and can move to adjacent habitats. Suitable habitats extend beyond the Haul Road DE, which will continue to provide habitat for displaced fauna species.

Clearing activities will be concise in nature, limited to an approximately twelve-month period and clearing will occur progressively. Furthermore, clearing will be restricted to daylight hours within 1 km of Mesa and Breakaway habitat and east of Red Hill Creek. Pre-clearance surveys will be undertaken prior to clearing within 1 km of Mesa and Breakaway habitat, east of Red Hill Creek and within Drainage Line/River/Creek (major). Fauna observers and spotters will also be engaged when working within 1 km of Mesa and Breakaway habitat and within Drainage Line/River/Creek (major). In the event any significant fauna species are observed, they will be given the opportunity to move from the work area or will be relocated by an experienced fauna handler in consultation with the DBCA as required. Therefore, impacts associated with loss of individuals from vegetation clearing and/or vehicle strike are **unlikely** to be significant and are not discussed further.

The cattle fence along the haul road is **unlikely** to cause injury or death to Ghost Bats and Pilbara Leaf-nosed Bats due to entanglement in the fence because the fence will be non-barbed wire. As detailed in the TEMP, barbed wire fencing would only be considered if there is substantial risk from cattle pushing through non-barbed wire fencing or if it is required under third party obligation. If barbed wire is deemed necessary, it will be installed with suitable bat deflectors in areas likely to have low to high interaction with bats to minimise the risk of collision.

During operation vehicle movements along the Haul Road will have speed limits of 80 km/hr at all times. The access road will have limits of 80 km/hr at night to minimise the risk of collision. Signage will also be installed within 1 km of Mesa and Breakaway habitat and east of Red Hill Creek to inform drivers of the potential occurrence of conservation significant fauna species and that posted speed limits must not be exceeded.

The TEMP (**Appendix H**) also includes a monitoring program in higher risk collision areas (such as near Mesa and Breakaway habitat and east of Red Hill Creek) during operation. If the fence or vehicle movements are seen to be causing significant injury or mortality, contingency actions will be implemented, which could include further driver education, signage, installing reflectors on the fence and reducing speed limits at night in high risk areas.

In the event of fauna mortality and injury, the impact will be limited to an individual and will not result in population-wide impacts. As a result, the potential impacts on conservation significant fauna from interactions with vehicles, machinery and earthworks are **not significant**. They will not affect the conservation status of any of the species present.

10.6.2 Indirect Impacts

10.6.2.1 Species Disturbance Associated with Increased Dust, Noise or Light

Clearing of native vegetation for the construction of the haul road will disturb habitat and species through dust emissions, noise and vibration impacts, as well as light emissions.

Dust emissions during construction will be generated through vegetation clearing and earthwork activities, including vehicle and machinery movements. These activities will be concise, limited to an approximately twelve-month

period, and clearing will occur progressively. In addition, temporarily cleared areas will be progressively rehabilitated in accordance with the Closure Strategy (**Appendix I**), minimising the area of exposed surfaces. As such, dust and particulate deposition is expected to be minimal and localised to immediately adjacent vegetation. Once the Proposal has been constructed, the Haul Road and adjacent access roads will be sealed, reducing the risk of increased dust. Maintenance activities along the Haul Road are expected to be localised to the immediate area of maintenance, and only occur for a short period of time. Dust suppression techniques, such as misting sprays, will be frequently used during construction and during maintenance activities. These measures will ensure that excessive dust from construction and operation is minimised. If higher dust levels occur during construction, it will be a short period, as the total construction period is expected to be less than one year.

Even with some potentially elevated dust levels during the short-term construction timeframe, the fauna species (likely to occur in the Haul Road DE) are adapted to the dusty Pilbara climate, and dust emissions will **not** result in permanent changes to fauna habitat.

Noise and vibration can potentially impact fauna species within proximity of the haul road. There are no known bat maternal/diurnal roosts (caves) within the Haul Road DE or Terrestrial Survey Area. All potential roosting habitat (i.e. Mesa and Breakaway habitat) has been excluded from the Haul Road DE. In addition to this, night-time clearing activities will not occur within 1 km of Mesa and Breakaway habitats and east of Red Hill Creek to avoid noise, vibration and light emissions interrupting nocturnal foraging for conservation significant species.

There is no blasting proposed as part of this action; however, if hard substrates are identified that are not able to be split with standard machinery, small-scale blasting may be required. If required, blasts are expected to be brief, sporadic and localised to a small area, and therefore are not expected to result in vibration impacts beyond the Haul Road DE or any sustained noise impacts. In the event that individuals are disturbed, it is likely that avoidance behaviour would be temporary. If required blasting is required within 300 m of Mesa and Breakaway habitat and during Northern Quoll breeding season (June – December) a targeted survey to determine the presence of Northern Quolls will be undertaken as detailed in the TEMP (**Appendix H**).

During operation, noise and vibrations are expected to remain restricted and temporary along the relatively narrow dimensions of the Haul Road.

Night-time activities during construction will be **minimised** to reduce light impacts, and lighting, where required, will be directed towards the sealed Haul Road using target asymmetrical distribution to illuminate specific areas of need. All lights will be mounted at a height as low as possible and will only use the minimum number and intensity of lights needed to provide safe and secure illumination.

Where possible, MinRes will avoid the use of permanent lightening during operation of the Haul Road and considerations will be made throughout the design phase to achieve this. The Proponent consider the use of lighting may be required at non-grade separated crossings (of which none are currently planned) to act as a form of control to alert a vehicle of an approaching vehicle and enable safe vehicle interactions. If non-grade crossings are considered necessary throughout the design process, lights will be temporary in nature, used from dusk to dawn and fitted with motion sensors to ensure light exposure is minimised and only used when necessary.

10.6.2.2 Habitat Degradation due to Introduction or Spread of Weeds, Increase in Feral Predators and Altered Fire Regimes

The Proponent has established weed and hygiene management measures to reduce the risk of spreading existing weeds, or new weeds being introduced, into the Haul Road DE during construction and operation. Weed control measures will be implemented within the DE and in areas around the clearing front. The Proponent will undertake targeted control of the two declared weed species, *Parkinsonia aculeata* and *Prosopis pallida*, already present in the Haul Road DE, to avoid spreading this existing weed into new and uninfested areas.

Any impacts are predicted to be localised to disturbed areas and will not impact the habitat of fauna in the local area.

One species of feral predator has previously been recorded in the Haul Road DE. The feral Cat is one of the most damaging feral fauna species. The feral Cat is likely to occur throughout the wider region, making it difficult to

control. However, the Proposal is **not** likely to increase their occurrence or potential threat to fauna species. Mitigation measures are detailed in **Section 10.5**.

Fire prevention measures (and control measures, should a fire break out) will be in place. This will also increase the capacity for fire management in the wider area through fire-fighting equipment, trained personnel and fire access. If a fire does occur, fire response procedures and equipment will ensure that the fire outbreak is kept to a minimum and effectively controlled. Therefore, the Proposal is **not** considered likely to increase fire regimes. The potential impact of unplanned fires will be mitigated by implementing management measures as detailed in **Section 10.5**.

10.6.2.3 Habitat Degradation due to Erosion, Sedimentation or Altered Hydrological Regimes

The installation of infrastructure and development of borrow pits can alter surface water regimes in the Haul Road DE, which could result in altered or degraded fauna habitat. Tidal Flats and Claypans are both most productive when inundated and therefore any changes to the frequency and duration of inundation could impact the occasional foraging habitat value of these areas for waterbirds. The risk of habitat degradation due to erosion, sedimentation or altered hydrological regimes is considered low from the construction of the Landside facility as no clearing and earthworks are proposed in this area as part of the Proposal.

Construction activities for both the Landside facility and the Haul Road will be short term, limited to approximately twelve months, and therefore over a shorter timeframe in the small portion of the Haul Road that intersects with the Tidal Flats and Claypan habitats. In addition, clearing and construction works within the Haul Road DE, including the excavation of borrow pits, will not occur when these habitats are inundated, and all disturbed areas will be stabilised prior to the commencement of the next wet season.

Sedimentation controls and onsite sumps will be designed to contain most stormwater runoff within the Haul Road and Landside DE construction footprint. Disturbed areas within the Haul Road DE (including borrow pits) will be progressively rehabilitated in accordance with the Closure Strategy (**Appendix I**), minimising the area of exposed surfaces. Sediment controls will be reviewed during site inspections and / or after significant rainfall.

Based on the above, it is unlikely for **significant impacts on fauna habitats to occur due to changes to hydrological regimes, erosion or sedimentation**. Further mitigation measures are summarised in **Section 11.5** and detailed within the TEMP (**Appendix H**).

The Tidal Flats habitat within the Haul Road DE are considered to be upper tidal flats that are dry most of the time and may only be inundated a few times a year during peak spring tides or as a result of heavy rainfall. The nature of the Claypan habitat is different from the Tidal Flats, as they are slight depressions that fill with rainwater that can persist for a period of time following heavy rainfall events, most likely cyclonic events in summer (BCE 2022). Tidal Flats and claypans are both most productive when inundated and therefore any changes to the frequency and duration of inundation could impact the occasional foraging habitat value of these areas for waterbirds.

The proponent has designed the Proposal to avoid secondary impacts to fauna habitat as a result of changes to hydrological regimes and the ecological functions that they support. Inundation modelling (BG&E 2021b, Appendix FF) of the area has been used to inform the design and placement of culverts beneath the proposed Haul Road to achieve the ideal outcome of no discernible change in inundation levels, particularly for low flows including 1:1 year events. Based on the above, once controls have been implemented, the impacts of habitat degradation due to erosion, sedimentation or altered hydrological regimes will not be significant.

Once the Haul Road is construction, the proponent will also monitor rainfall and water levels (including tidal) at selected locations within intertidal and claypan habitats adjacent to the Haul Road (noting that the claypans are rainfall-dependent and not typically connected to the intertidal regime). In the unlikely event that influences are detected and that may be sufficient to result in secondary impacts to important ecological functions, additional drainage controls will be installed. These measures are described in the TEMP (**Appendix H**).

10.6.3 Conservation Significant Fauna

Waterbirds and species with a medium likelihood of occurring in **Table 10-5** are not assessed in detail, as they are likely to only occur on an occasional basis, are not solely reliant on any of the habitats present within the Haul Road DE, and/or are not known from the nearby area.

The 35 waterbirds that are considered to possibly interact with the Proposal are considered to occasionally or very occasionally use the Tidal Flat and Claypan habitats present within the Terrestrial Survey Area. Neither of these habitats present within the Haul Road DE are considered important for the waterbird species, given their rare inundation and widespread availability (BCE 2022). As such, **no** significant impacts are expected for any of the waterbird species, and they are therefore not discussed further.

Maryan's Keeled Slider is generally found in coastal dunes between Onslow and Barradale, where widespread habitats occur. The closest record of the Northern Brushtail Possum occurs approximately 37 km from the Haul Road DE, with only a few scattered records of the species within the Pilbara.

Based on the above, none of the waterbirds or conservation significant fauna species considered to have a medium likelihood of occurrence would solely depend on any of the habitats present within the Haul Road DE or Terrestrial Survey Area. As such, impacts to these species are expected to be **negligible** and not discussed further.

The assessment of impacts to conservation significant fauna species considered to be highly likely to occur is detailed below.

10.6.3.1 Northern Quoll

A total of at least 18 individual Northern Quolls have been recorded within the Terrestrial Survey Area (refer to **Section 10.3.3.1; Figure 10-5**). This includes a population located within the mesas at site KTB03, where a female with young was also recorded, indicating that breeding occurs. The Proposal design has avoided all potential Northern Quoll denning habitat (Mesa and Breakaway habitat), with an average buffer from these areas to the Haul Road DE of 50 m and a minimum of 2.5 m in one location. This means that even with flexibility regarding the final footprint, disturbance of the highest value habitat has been avoided.

Following the application of avoidance and mitigation measures, the Proponent considers that the Proposal will potentially have a significant impact to Northern Quoll, as a result of the clearing of habitats that is likely to constitute supporting habitat. As per the Commonwealth listing advice (TSSC 2005) and the National Recovery Plan (Hill and Ward 2010) suitable foraging and dispersal habitat within the upper home range of the Northern Quoll (rounded up to 1 km) is considered to be supporting habitat. Approximately 117.4 ha of native vegetation occurs within the Haul Road IF that could be considered supporting habitat within 1 km of the Mesa/Breakaway habitat type, this consists of 4.1 ha of Stony Hills and Slopes habitat and 3.8 ha of Drainage Line/Creek (minor) habitat and 109.4 ha of Stony Plain habitat, which is considered of low value to Northern Quoll (**Table 10-9 and Figure 10-5**). To enable project flexibility, the total clearing of supporting habitat within 1 km of the Mesa and Breakaway habitat has been increased 20% to a maximum of 141 ha. Offsets are proposed for this potential residual impact (**Section 15**).

10.6.3.2 Pilbara Leaf-nosed Bat

Pilbara Leaf-nosed Bats were recorded at five sites within the Terrestrial Survey Area but outside the Haul Road DE, most of which consisted of individual foraging calls (360 Environmental 2021b). The species is likely to utilise the Haul Road DE for foraging but is unlikely to roost within the Haul Road DE as there are no deep caves that offer the necessary microclimate for diurnal or maternity roosts.

Based on Bat Call's *A review of Pilbara leaf-nosed bat ecology, threats and survey requirements* (Bat Call 2021b) Category 1, 2 and 3 caves are considered critical habitat. None of these habitats occur within 12 km of the Haul Road DE. Therefore, there is no critical habitat within or adjacent to the Haul Road DE. In addition to this, the Haul Road DE avoids all Mesas and Breakaway habitat within the Terrestrial Survey Area.

There is a large known roost site located at Cane River approximately 12 km south east of the Terrestrial Survey Area, and an inferred roost at Mungarathoona Creek, approximately 17 km north of the eastern end of the

Terrestrial Survey Area (Bat Call 2021b). Therefore the foraging habitat east of Red Hill Creek is considered supporting habitat for this roost, given this species known foraging range of 20 km. The Proposal will only be clearing approximately 213 ha within 20 km of these roost, equating to 0.2% of the potentially available foraging habitat within its foraging range (approximately 125 000 ha).

Therefore, potential impacts associated with vegetation clearing are **unlikely** to represent a significant impact on the Pilbara Leaf-nosed Bat.

10.6.3.3 Ghost Bat

A small number of Ghost Bat calls were detected within the Terrestrial Survey Area, consistent with foraging (360 Environmental 2021b). Based on Bat Call's *A review of ghost bat ecology, threats and survey requirements* (Bat Call 2021a) Category 1 and 2 caves, and Category 3 caves when adjacent to Category 2 caves are considered critical habitat for Ghost Bats. None of these habitats considered to occur within 5 km of the Haul Road DE. Therefore, there is no critical habitat within or adjacent to the Haul Road DE.

All Haul Road DE habitats can provide occasional foraging and dispersal capacity for the Ghost Bat, but habitats within 10-12 km of Category 1 and 2 roosts are considered to have a high foraging value for this species. Approximately 213 ha of native vegetation will be cleared in proximity to known roosts (i.e., native vegetation east of Red Hill Creek). However, given the large foraging range of this species (approximately 45 000 ha around each roost), the negligible (0.5%) loss of the foraging range around these roosts and the widespread nature of the fauna habitat proposed to be cleared, clearing for the Proposal is unlikely to significantly impact the species.

Furthermore, following the application of the mitigation measures including clearing activities only occurring during daylight hours east of Red Hill Creek, reduced speed limits during operation, installation of a non barbed wire fence along the Haul Road, the Proposal is **not** expected to result in a significant impact on the Ghost Bat.

10.6.3.4 Pilbara Olive Python

During recent surveys, the Pilbara Olive Python was not recorded within the Haul Road DE. It was recorded approximately 20 km south, adjacent to Drainage Line/River/Creek habitat that extends into the Haul Road DE. It is considered highly likely to occur within the Haul Road DE.

Based on the Significant Impact Guidelines (DoE 2013) the Drainage Line/River/Creek habitat and Stony Hills and Slopes could represent habitat critical to the species' survival when adjacent to Mesa and Breakaway habitat and in proximity to water sources, as it provides potentially important foraging and dispersal habitat. However, taking into consideration the local context, specifically that these habitats are not likely to contain breeding habitat and that they will be avoided, the large home range of this species (450 ha), no nearby records, scats or tracks and the amount of habitat remaining in the region, the **habitat within the Haul Road DE is not considered habitat critical to the survival of this species**. Furthermore, following the application of avoidance and mitigation measures including pre-clearance surveys, fauna spotters during clearing, reduced speed limits during operation and construction, and the rehabilitation of approximately 1200 ha of temporarily cleared areas, the Proponent considers that the Proposal **is unlikely to result in a significant residual impact to Pilbara Olive Python**.

10.6.3.5 Grey Falcon

Even with Proposal flexibility, the alignment of linear infrastructure will minimise impact to Grey Falcon breeding habitat. The Proposal will result in the clearing of up to 268 ha of Drainage Line/River/Creek habitat (major and minor), representing potential breeding habitat for the Grey Falcon (**Table 10-13**). The Grey Falcon may utilise all the fauna habitats within the Haul Road DE for foraging. At least 2,684 ha (91%) of suitable breeding habitat will remain in the Terrestrial Survey Area.

Given the species ability to utilise a wide range of habitats for foraging and the amount of breeding habitat that will remain throughout the Terrestrial Survey Area, impacts associated with clearing are **unlikely** to be significant for this species.

10.6.3.6 Western Pebble-mound Mouse

One Pebble-mound Mouse mound was recorded during recent surveys, located outside the Haul Road DE and Terrestrial Survey Area.

The Proposal will clear approximately 725 ha of Stony Plain habitat, suitable for the Western Pebble-mound Mouse (**Table 10-13**). Given that the Haul Road DE footprint is flexible, the specific clearing amounts within this habitat may change slightly. This habitat type is one of the most widespread fauna habitats within the Haul Road DE (6,455 ha) and Terrestrial Survey Area (8,801 ha). Approximately 8,076 ha (92%) will remain in the Terrestrial Survey Area (**Table 10-13**). This fauna habitat is not restricted and extends well beyond the Haul Road DE. Therefore, regardless of where the final footprint is implemented in the Haul Road DE (within the authorised extent limit), the Proposal's implementation's impact is not considered significant on this habitat.

Given the extent of suitable habitat remaining in both the Haul Road DE and Terrestrial Survey Area and the lack of species records within the area, the loss of suitable Western Pebble-mound Mouse habitat is **unlikely** to be significant for the species.

10.6.3.7 Long-tailed Dunnart

One Long-tailed Dunnart was recorded within the Haul Road DE at camera trap Cam03 during the recent survey (360 Environmental 2022a).

The Proposal will result in the clearing of approximately 875 ha of habitat for the Long-tailed Dunnart, including 725 ha of Stony Hills and Slopes and 150 ha of Stony Plains habitat (**Table 10-13**). Approximately 3,695 ha of these habitats will remain within the Terrestrial Survey Area. These habitat types are not limited and extend outside of the Haul Road DE. Therefore, regardless of where the final footprint is implemented in the Haul Road DE (within the authorised extent limit), the Proposal's impact is not considered significant on these habitats.

Given the extent of suitable habitat remaining in both the Haul Road DE and Terrestrial Survey Area, the loss of suitable Long-tailed Dunnart habitat is **unlikely** to be significant for the species.

10.6.3.8 Short-tailed Mouse

The Proposal will directly impact approximately 1,239 ha of suitable habitat for the Short-tailed Mouse within the Haul Road DE, including (**Table 10-13**):

- Claypans (1 ha);
- Tidal Flats (69 ha);
- Plains (444 ha); and
- Stony Plains (725 ha).

Even with Proposal flexibility, none of these habitat types are limited, and all extend outside of the Haul Road DE. Therefore, regardless of where the final footprint is implemented in the Haul Road DE (within the authorised extent limit), the Proposal's implementation's impact is not considered significant on these habitats. As such, the loss of suitable Short-tailed Mouse habitat is **unlikely** to be significant for the species.

10.6.3.9 Peregrine Falcon

The Peregrine Falcon will potentially utilise all habitats within the Haul Road DE and Terrestrial Survey Area for hunting and Drainage Line/River/Creek (major) habitat for breeding.

Even with Proposal flexibility, the alignment of linear infrastructure will minimise impact to Peregrine Falcon breeding habitat. The Proposal will directly impact a maximum of 42 ha (8%) of (Drainage Line /River/Creek (major)) representing suitable breeding habitat for the Peregrine Falcon, within the Haul Road DE. Given the species ability to utilise a wide range of habitats for foraging, impacts to foraging habitat for this species is not considered significant. At least 653 ha (94%) of suitable breeding habitat will remain in the Terrestrial Survey Area (**Table 10-13**).

Given the extent of suitable breeding habitat remaining and the species' ability to utilise a wide variety of habitats, the loss of a suitable Peregrine Falcon habitat is **unlikely** to be significant for the species.

10.6.3.10 SRE Invertebrate Fauna

One likely species (*Antichiropus?* Juvenile) and six possible species (*Buddelundia* sp.'35/36' and *Cryptops* sp. 'Onslow'); *Aname* sp. 'IS03'; *Aname* sp. 'IS04'; *Olpiidae* sp. 1; and *Olpiidae* sp. 2) were recorded in the Haul Road DE. The other three species recorded were only recorded within the Terrestrial Survey Area (and not in a direct impact area).

Buddelundia sp.'35/36' and *Cryptops* sp. 'Onslow' were recorded in multiple habitats within the Haul Road DE. Given their occurrence in multiple habitats, they are less likely to be restricted to one habitat type. Impacts to these SRE species are therefore **unlikely** to be significant.

Both *Aname* sp. 'IS03' and *Aname* sp. 'IS04' were recorded from drainage lines which are laterally extensive in the landscape and are unlikely to be habitat isolates that support endemism (360 Environmental 2022a). Impacts to these potential SRE species are therefore **unlikely** to be significant.

Both *Olpiidae* sp. 1 and *Olpiidae* sp. 2 were recorded at multiple locations and are therefore considered likely to be more widely distributed than the current surveys could determine (360 Environmental 2022a). Impacts to these potential SRE species are therefore **unlikely** to be significant.

Antichiropus? Juvenile is a singleton and was only recorded from one habitat type: Drainage Line/River/Creek (refer to **Section 10.3.6.1**). Impacts on this fauna habitat are described in **Section 10.3.5.1** and are **unlikely** to be significant given the extent of the habitat remaining in the Haul Road DE and Terrestrial Survey Area.

Antichiropus? Juvenile may be directly lost due to mortality associated with vegetation clearing. However, whilst this species has been identified as a likely SREs, they occur in a widespread habitat that extends beyond the boundaries of the Haul Road DE.

Therefore, while some individuals may unavoidably be lost, given the extent of moderately suitable SRE habitats (Drainage Line/River/Creek and Stony Hills and Slopes) remaining in the Terrestrial Survey Area 4,033 ha (91%), impacts to SRE invertebrate fauna are **unlikely** to be significant.

10.6.4 Cumulative Impacts

Potential cumulative impacts of the Proposal to terrestrial fauna relate to the clearing of fauna habitat and the loss of individuals associated with mortality from vegetation clearing and/or vehicle/machinery strike.

10.6.4.1 Loss and Fragmentation of Terrestrial Fauna Habitats due to Clearing

Clearing of vegetation for the construction and operation of the Proposal will result in the loss of fauna habitat within the Haul Road DE. However, this Proposal is a linear infrastructure project and impacts only a small portion of fauna habitat at any one location. The surrounding fauna habitat will be retained.

Detailed habitat mapping has been completed for the Haul Road DE. However, it is not available for the Carnarvon and Pilbara bioregions more broadly. Projects described in **Section 2.3.4** that we have been able to obtain detailed habitat mapping include:

- MRWA Warrirda Road Corridor Project; and
- MinRes' Onslow Camp Dunes Project.

The MRWA Warrirda Road Corridor Project area was by Spectrum (2021). A comparison of habitat types mapped in the Haul Road DE and the MRWA Warrirda Road Corridor Project has been undertaken by 360 Environmental (2021c). The MRWA Project will add to the linear infrastructure in the western extent of this Proposal providing access to the Port. The habitat types within the Onslow Camp Dunes Project were surveyed as part of the 360 Environmental (2021b) Terrestrial Survey Area undertaken for this Proposal. The MRWA Warrirda Road Corridor Project and Onslow Camp Dunes Project will directly lose habitats that will be impacted as part of this Proposal.

Table 10-15 shows the cumulative impact of habitat loss to specific habitat types. Based on the above-predicted impacts, clearing will not exceed 8% of the known extent of each habitat type mapped (**Table 10-15**; 360 Environmental 2021b and Spectrum 2021). Furthermore, the potential cumulative impact on specific fauna habitats is considered to be a small proportion of the surveyed extent of these habitats, as they extend beyond the Terrestrial Survey Area. As a result, this cumulative impact is **not** considered significant.

Detailed habitat mapping and meaningful Land system data is not publicly available for the remainder of the projects described in **Section 2.3.4**. The cumulative impacts from vegetation clearing within the bioregions (**Section 9.6.3.1**) are considered to have an affinity to fauna habitats, and therefore have been utilised to identify and assess the potential quantitative cumulative habitat loss for the remaining existing and reasonably foreseeable projects in the regions. The predicted extents of impacts to each bioregion from the Proposal, existing and reasonably foreseeable projects are provided in **Table 9-18** and shows the Proposal will have a **negligible** impact on the region.

10.6.4.2 . Loss of Conservation Significant Fauna Species due to Clearing Activities

All conservation significant fauna species that are highly likely to occur within the Haul Road DE will potentially be affected by cumulative impacts from existing or foreseeable future projects in the wider region (**Table 10-15**). The Bungaroo South, Onslow Rare Earth and WPIOP Stage 1 and Stage 2 Projects are likely to be the most relevant to conservation significant fauna species. These projects also impact Northern Quoll, Pilbara Olive Python, Pilbara Leaf-nosed Bat and migratory species (**Table 10-16**). However, it is impossible to quantify the cumulative extent of habitat loss, which satisfies the specific habitat requirements for each species, as this data is not available.

Given the extent of fauna habitat that will remain within the Terrestrial Survey Area (i.e., up to 25,429 ha, 5,721 ha represents high-value fauna habitat; **Table 10-15**) and the linear nature of the Proposal, cumulative impacts to fauna habitats and conservation significant fauna species associated with the Proposal are **unlikely** to be significant.

Table 10-15: Cumulative Impacts on Fauna Habitats

Habitat type within this Proposal	Approximately extent to be cleared (ha)	Habitat within Warririda Road	Approximate extent to be cleared (ha)	Habitat within Onslow Camp Dunes	Approximate extent to be cleared (ha)	Total approximate clearing (ha)	% of loss of known extent*
Sand Dunes and Swales	69	Sand Dunes (D1)	77	Sand Dunes and Swales	73	400	6%
		Sand Plains (DL1, P1a, P1b, P2)	181				
Tidal Flats	70	Tecticornia shrubland (C1)	16	Tidal Flats	30	145	8%
Claypans		Tidal Mudflats and Claypans (C2)	27	Claypans	2		

*Known extent includes this Proposal plus Warririda Road and Onslow Camp Terrestrial Survey Area together

Table 10-16: Conservation Significant Fauna potentially impacted by other Projects

Conservation Significant Fauna	Existing Projects										Reasonably Foreseeable Projects		
	Bungaroo South	Macedon Domestic Gas Plant	Wheatstone LNG Project	Ashburton Salt Project	Onslow Water Infrastructure Upgrade Project	Onslow Resource's Ashburton River Sand and Shingle Excavation	Onslow Marine Support Base Stage 2 Capital Dredging	Onslow Seawater Desalination Plant	West Pilbara Iron Ore Project Stage 1 and Stage 2	Pilbara Regional Waste Management Facility	Warririda Road	PPA's Eastern Port Precinct	Hastings Onslow Rare Earth
Northern Quoll	✓	X	X	X	X	X	X	X	X	X	X	X	✓
Pilbara Leaf-nosed Bat	✓	X	X	X	X	X	X	X	✓	X	X	X	X
Ghost Bat	X	X	X	X	X	X	X	X	✓	X	X	X	X
Western Pebble-mound Mouse	✓	X	✓	X	✓	X	X	X	✓	X	X	X	X
Pilbara Olive Python	✓	X	X	X	X	X	X	X	X	X	✓	✓	✓
Grey Falcon	X	X	X	X	X	X	X	X	X	X	X	X	X
Short-tailed Mouse	X	X	X	X	✓	X	X	X	X	X	X	X	X
Long-tailed Dunnart	X	X	X	X	X	X	X	✓	X	X	X	X	✓
Peregrine Falcon	X	X	X	X	✓	X	✓	X	X	X	X	X	X
Migratory species/waterbirds	X	X	X	✓	X	X	X	X	X	X	✓	✓	✓

10.7 Environmental Outcomes

Based on the assessment of potential impacts and proposed mitigation measures to protect environmental values associated with terrestrial fauna, the Proponent considers that the EPA objective for this factor can be met.

The predicted outcomes for terrestrial fauna are summarised in **Table 10-17** below.

10.7.1 Fauna Habitats

The key fauna habitat values and predicted outcome for those values include:

- The Proposal will result in the clearing of up to 1,564 ha of terrestrial fauna habitat. This represents 6% of the fauna habitats within the Terrestrial Survey Area. This includes approximately 1200 ha of temporary construction areas such as borrow bits and laydown areas etc. After rehabilitation, the permanent native vegetation clearing as part of the Proposal will be approximately 364 ha.
- The Proposal will result in the clearing of up to 141 ha of foraging and dispersal habitat considered supporting habitat for the Northern Quoll;
- The Proposal will result in the clearing maximum of 418 ha of high-value foraging and dispersal fauna habitat (Drainage Line/River/Creek (major and minor and Stony Hills and Slopes) within the Haul Road DE;
- No caves or permanent/semi-permanent pools were identified within the Haul Road DE or Terrestrial Survey Area;
- All of the fauna habitats recorded within the Haul Road DE are widely distributed throughout the Terrestrial Survey Area and region;
- No clearing of habitat critical to the survival of the Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon or Migratory waterbird species due to the application of the mitigation hierarchy (avoid, minimise and rehabilitate);
- Occasional injury and/or mortality of fauna individuals during clearing activities, construction and operation of the Proposal, with this risk being effectively mitigated through the use of fauna spotters, progressive clearing, non barbed wire fencing and speed limits; and
- The degradation of habitat from the spread of weeds, dust deposition and increased risk of fire will be effectively managed within the Haul Road DE by standard weed, dust and fire management measures.

The Proposal will result in residual impacts for the Northern Quoll (**Table 10-17**) and offsets are proposed for the clearing of supporting habitat for this species. Significant impacts to fauna habitats and therefore, the risks associated with the implementation of this Proposal is **not considered to be significant** for other conservation significant fauna species associated with the Proposal.

10.7.2 Conservation Significant Species and SRE Invertebrates

The Proposal is considered **likely** to result in residual impacts to the Northern Quoll resulting from the clearing of supporting habitat. The Proposal is **unlikely** to result in any significant residual impacts to other conservation significant species and the significant residual impacts to any potential SREs or SRE habitats is **considered to be low** based on the findings detailed in **Table 10-17** below.

Table 10-17: Environmental Values and Outcomes for Terrestrial Fauna

Value	Records of habitat/species within Haul Road DE
Northern Quoll	<ul style="list-style-type: none"> The majority of Northern Quoll records occurred outside the Haul Road DE. The Proposal has been designed to avoid all Mesas and Breakaway habitats, providing Northern Quoll denning, foraging and dispersal habitat. The Proposal will result in the clearing of a maximum of 141 ha of foraging and dispersal habitat within 1 km of potential denning habitat, which is considered supporting habitat. This clearing is considered a significant residual impact. Offsets are proposed for the clearing of supporting habitat (Section 15.2.1). Indirect impacts to Northern Quoll are expected to be negligible.
Pilbara Leaf-nosed Bat	<ul style="list-style-type: none"> Only one record of the Pilbara Leaf-nosed Bat is within the Haul Road DE. The Proposal has been designed to avoid all Mesas and Breakaway habitat, which provides high-value (potential roosting and foraging) habitat for Pilbara Leaf-nosed Bat. The Proposal will result in the clearing of a maximum of 213 ha of supporting habitat Pilbara Leaf-nosed Bat habitat (0.2% of the available supporting habitat, based on a 125,000 ha foraging range). No critical habitat (diurnal or maternity roosts) occur within either the Haul Road DE or Terrestrial Survey Area. The risk of collision with fencing will be minimised through the installation of a non-barbed wire fence. No significant impacts to Pilbara Leaf-nosed Bat due to habitat clearing, fragmentation or direct mortality of individuals are expected. Indirect impacts to Pilbara Leaf-nosed Bat are expected to be negligible.
Ghost Bat	<ul style="list-style-type: none"> No individual records of Ghost Bat within the Haul Road DE. The Ghost Bat was recorded at three locations outside the Haul Road DE, consistent with foraging individuals. The Proposal will result in the clearing of 213 ha of supporting habitat for the Ghost Bat (0.5% of the available supporting habitat, based on a 45,000 ha foraging range). No critical habitat, including diurnal or maternity roosts occur within either the Haul Road DE or Terrestrial Survey Area. No significant impacts to Ghost Bat due to habitat clearing, fragmentation or direct mortality of individuals are expected. Indirect impacts to Ghost Bat are expected to be negligible.
Pilbara Olive Python	<ul style="list-style-type: none"> There are no records of Pilbara Olive Python within the Haul Road DE (the closest record 20 km south). The Proposal will not result in the clearing of any important foraging and dispersal habitat for the Pilbara Olive Python (i.e., Stony hills and slopes and Drainage link/River/Creek (major) habitat in proximity to Mesa and Breakaway habitat). There are no significant water pools within the Haul Road DE or Terrestrial Survey Area that may be critical habitats for the Pilbara Olive Python. No significant impacts to Pilbara Olive Python due to habitat clearing, fragmentation or direct mortality of individuals are expected. Indirect impacts to Pilbara Olive Python are expected to be negligible.
Grey Falcon	<ul style="list-style-type: none"> There are no records of Grey Falcon within the Haul Road DE. The Grey Falcon may utilise all the fauna habitats within the Haul Road DE for foraging. The Proposal will result in clearing up to 268 ha of Drainage Line/River/Creek (major and minor) habitat, representing potential breeding habitat for the Grey Falcon (this equates to 8% of the suitable breeding habitat within the Terrestrial Survey Area). No significant impacts to Grey Falcon due to habitat clearing, fragmentation or direct mortality of individuals are expected. Indirect impacts to Grey Falcon are expected to be negligible.
Western Pebble-mound Mouse	<ul style="list-style-type: none"> There are no records of Western Pebble-mound Mouse within the Haul Road DE; the closest record is 299 m away. The Proposal will result in clearing approximately 725 ha of suitable (Stony Plain habitat) for the Western Pebble-mound Mouse. This fauna habitat is not restricted and extends well beyond the Haul Road DE. Approximately 8,076 ha (92%) of Western Pebble-mound Mouse (Stony Plain) habitat will remain in the Terrestrial Survey Area. No significant impacts to Western Pebble-mound Mouse due to habitat clearing, fragmentation or direct mortality of individuals are expected. Indirect impacts to Western Pebble-mound Mouse are expected to be negligible.

Value	Records of habitat/species within Haul Road DE
Long-tailed Dunnart	<ul style="list-style-type: none"> • There is one record of the Long-tailed Dunnart at Red Hill Station within the Haul Road DE. • The Proposal will result in the clearing of approximately 875 ha of suitable habitat (Stony Plain and Stony Hills and Slopes) for the Long-tailed Dunnart. • These fauna habitats are not restricted and extend well beyond the Haul Road DE. • Approximately 3,695 ha (81%) of suitable habitat (Stony Hills and Slopes and Stony Plain habitat) for the Long-tailed Dunnart will remain within the Terrestrial Survey Area. • No significant impacts to Long-tailed Dunnart due to habitat clearing, fragmentation or direct mortality of individuals are expected. • Indirect impacts to Long-tailed Dunnart are expected to be negligible.
Short-tailed Mouse	<ul style="list-style-type: none"> • There are no records of Short-tailed Mouse within the Haul Road DE. • The Proposal will result in clearing up to 1,239 ha of suitable habitat (Claypans, Tidal Flats, Plains and Stony Plains) for the Short-tailed Mouse. • This fauna habitat is not restricted and extends well beyond the Haul Road DE. • Even with project flexibility, none of these habitat types are limited, and all extend outside of the Haul Road DE. • No significant impacts to Short-tailed Mouse due to habitat clearing, fragmentation or direct mortality of individuals are expected. • Indirect impacts to Short-tailed Mouse are expected to be negligible.
Peregrine Falcon	<ul style="list-style-type: none"> • There are no records of Peregrine Falcon within the Haul Road DE. • The species is capable of utilising a wide variety of habitats. • The Proposal will result in clearing up to 42 ha of suitable breeding habitat (Drainage Line/River/Creek (major)) for the Peregrine Falcon. • No significant impacts to Peregrine Falcon due to habitat clearing, fragmentation or direct mortality of individuals are expected. • Indirect impacts to Peregrine Falcon are expected to be negligible.
Migratory wetland/waterbirds species	<ul style="list-style-type: none"> • 35 listed waterbirds are considered to possibly interact with the Proposal. • No important habitat for listed waterbirds occurs within the Proposal area, or within 10 km of the Proposal. • Suitable habitat for waterbirds will continue to be available in the Haul Road DE, Terrestrial Survey Area and region. • The utilisation of the Tidal Flat and Claypan habitats within the Haul Road DE is considered low and this is likely attributed to intermittent inundation and the widespread nature of these environments. • No significant impacts to Migratory listed wetland/water birds due to habitat clearing, fragmentation or direct mortality of individuals are expected.
SRE invertebrate fauna	<ul style="list-style-type: none"> • The Proposal will directly impact up to 418 ha of moderately suitable SRE habitat (Drainage Line/River/Creek and Stony Hills and Slopes). This represents 9% of moderately suitable habitat available throughout the Terrestrial Survey Area. • The two likely SRE species (<i>Philoscidae</i> sp. indet. 'Onslow' and <i>Antichiropus?</i> Juvenile) were recorded within widespread and not restricted habitats. Only one was recorded within the Haul Road DE. • Indirect impacts to SRE invertebrate fauna are expected to be negligible. • No significant impacts on SRE species or habitat, given the avoidance of key habitat features and minimal impact on key habitat types.

10.7.3 Summary of the Predicted Outcomes

The key predicted outcomes for the Terrestrial Fauna values outlined above are:

- Clearing of supporting habitat for Northern Quoll is a likely **significant residual impact** and offsets are proposed;
- **No significant impacts** to local populations of any other conservation significant species, given the retention of key habitat features in areas outside those to be disturbed and minimal impacts to each key habitat type;
- **No effect on the conservation status** of priority species (including species of elevated conservation significance); and
- There are **no significant impacts** on SRE species or habitat, given the avoidance of key habitat features and minimal impact on key habitat types.

After the mitigation hierarchy has been applied (**Table 10-14**) including avoidance of direct impacts to key habitat (Mesa and Breakaway habitat), the Proponent considers that the Proposal can be managed to meet the EPA's objective for Terrestrial Fauna.

The loss of habitat is unlikely to cause a loss of biological diversity at the local or regional scale, and the ecological integrity of the area surrounding the Haul Road DE is expected to be maintained.

11. INLAND WATERS

11.1 EPA Objective

The EPA's objective for the factor Inland Waters is to: *'maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected'* (EPA 2020e).

11.2 Policy and Guidance

The relevant policy and guidance considered in the assessment of the Inland Waters factor are considered in **Table 11-1**.

Table 11-1: Policy and Guidance for Inland Waters

Policy / Guidance	Considerations
Environmental Factor Guideline: Inland Waters (EPA 2018)	The information provided in this chapter addresses the considerations for environmental impact assessment listed in this document.
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)	This guidance has been used in consideration of surface water management and the setting of appropriate targets for water quality.
Water Quality Protection Note No. 44: Roads Near Sensitive Water Resources (DOW 2006)	This guidance has been used in consideration of design and management of the Proposal to avoid and minimise impacts to water quality.
Water Quality Protection Note No. 52: Storm water Management at Industrial Sites (DOW 2010)	
WA Water in Mining Guideline (DOW 2013a)	This guidance has been considered in the planning and design of the Proposal and water management measures to mitigate impacts to groundwater and surface water resources.
Pilbara Groundwater Allocation Plan (DOW 2013b)	This document has been used in consideration of groundwater management.
Identification and investigation of acid sulfate soils and acidic landscapes (DER 2015a)	This guidance has been used in consideration of setting appropriate mitigation measures for areas potentially containing acid sulfate soils.
Cane River Water Reserve Drinking Water Resource Protection Review (DoW 2016);	This information provided in this document has been considered in the preparation of this RSD.
Ashburton North Strategic Industrial Area – Local Water Management Strategy (BG&E 2012b)	This information provided in this document has been used to inform the receiving environment for the Proposal.
Improvement Scheme No. 1 (and amendments): Ashburton North Strategic Industrial Area (WAPC 2019)	This information provided in this document has been considered in the preparation of this RSD.

11.3 Receiving Environment

11.3.1 Environmental Surveys

Study and survey findings relevant to the Proposal are summarised in **Table 11-2**.

Table 11-2: Studies for Inland Waters

Study	Survey / Study Effort	Key Findings
Wheatstone Project Groundwater Studies (URS 2010a).	Survey area: Chevron Wheatstone Project (includes the Port Landside DE) Type: Hydrogeological assessment Timing: 2010	The URS report describes the hydrogeology of the area underlying and surrounding the Chevron Wheatstone Project, which includes the proposed port operations (Port Landside DE). The report concluded that the site is generally underlain by a shallow, saline to hypersaline, slightly alkaline groundwater table. The study, along with other references in this table, has been used to inform the receiving environment description and the subsequent environmental impact assessment.
Wheatstone Project Baseline Soil Quality and Landforms Assessment (URS 2011b)	Survey area: Chevron Wheatstone Project (includes the Port Landside DE) Type: Baseline soil quality and landforms assessment Timing: 2009	The URS report describes the landforms and soils (including acid sulfate soils, ASS) of the area underlying and surrounding the Chevron Wheatstone Project, which includes the proposed port operations (Port Landside DE). The study, along with other references in this table, has been used to inform the receiving environment description and the subsequent environmental impact assessment.
Wheatstone Development Plan (Chevron 2012)	Survey area: Wheatstone Gas Project (to be constructed within the ANSIA) Type: Development Plan Timing: 2012	The Wheatstone Development Plan describes the onshore components of the Wheatstone Gas Project, to be constructed in the ANSIA. The document includes detailed information on environmental and social risks associated with the onshore developments and the management strategies that will apply to mitigate those risks. The Proponent has reviewed the document as context to support the development of their own site development strategies.
Environmental Assessment Report Ashburton North Strategic Industrial Area Improvement Scheme (RPS 2015)	Survey area: ANSIA Type: Environmental assessment report Timing: 2015	The 2015 assessment report uses existing studies and site surveys to describe the baseline environment, and to set out the planning mechanisms to ensure future developments are designed and implemented in a manner consistent with EPA objectives. The report provides useful information on the existing environment within which the landside port operations will be situated. Where relevant, this information is used to support the receiving environment description in the following section.
Ashburton Haul Road Surface Water Flow Assessment (Water Technology 2020) (Appendix DD)	Survey area: Haul Road hydrology Type: Desktop study of hydrological conditions Timing: 2020	Desktop study of hydrological conditions for the Proposal to develop a conceptual understanding of the surface water risks and inform engineering decisions. Locations of up to 20 potential crossings have been identified, as well as preliminary discharge estimates and flood mitigation measures provided.
Onslow Iron Project Port Flood Assessment (BG&E 2021a). (Appendix FF)	Survey area: Landside DE Type: Desktop flood assessment and modelling Timing: 2021	Flood assessment including a desktop review and model development for the Landside DE, which sits within an established industrial area (the Ashburton North Strategic Industrial Area, ANSIA). Study included reviewing design reports of existing infrastructure in the area, and modelling of pre and post development scenarios to ensure built infrastructure remained safe and to determine final design criteria. A minimum pad height for bulk earthworks was determined to be 4.8 mAHD, allowing for combined storm events and sea level rise. This is 0.3 m higher than the existing ANSIA Planning Scheme requirement. Sea walls of varying heights have been included in the design to account for instantaneous wave run-up and overtopping. Surrounding facilities and key roads will not be impacted by the greater pad height.
Onslow Road to North West Coastal Highway Section Waterways Assessment Approach and Baseline Results (BG&E 2021b) (Appendix FF)	Survey area: Haul Road DE to NWCH Type: Waterways investigation and modelling Timing: 2021	The study describes the preliminary waterways investigation (using 2D TUFLOW modelling) for the proposed haul road design from Onslow Road to the NWCH (Figure 11-2). Key findings are: <ul style="list-style-type: none"> • A large proportion of the area is characterised by sheetflow drainage (including intertidal areas) and there are several areas of sustained ponding due to flows trapped in depressions (claypans) and around dunes; accordingly, culverts will be required along the haul road where it traverses these areas; • At Peedamulla, the proposed crossing is a combination of multiple culverts and floodways where there are localised high points, and the design minimises the risk of changing the sheet flow regime for the dependent vegetation downstream of the crossing; and • At Cane River, where there is a well-defined channel profile, a bridge/series of culverts will be required to span the river.
North West Coastal Highway to Kens Bore Section Waterways Assessment Approach and Baseline Results (BG&E 2021c)	Survey area: Haul Road DE, eastern section Type: Waterways investigation and modelling Timing: 2021	The study describes the preliminary waterways investigation (using regional methods and 2D TUFLOW modelling) for the proposed haul road design from NWCH 60 km to Kens Bore. In this area the two largest creeks are Red Hill Creek at another unnamed creek approximately 15 km east of NWCH. Two alignments were considered in the assessment, and these informed the Haul Road DE and road design.
Ashburton Haul Road – Groundwater Investigation: Background and phase 1 drilling plan (SRK Consulting 2021) (Appendix GG)	Survey area: Haul Road DE Type: Groundwater desktop review Timing: 2021	To support an investigative drilling program to identify and confirm groundwater supplies for road construction, SRK conducted a baseline desktop review of the groundwater environment and resources along the proposed haul road. Key findings have been used to inform the description of the receiving environment. The Phase 1 drilling plan (approvals pending) identified up to nine different drilling targets along the various sections of the proposed haul road, with the results of the program being used to inform a detailed hydrogeological review, as required to support a groundwater abstraction licence through the RIWI Act.

11.3.2 Port Landside DE

Surface Hydrology

The Landside DE is located largely within the controlled drainage network of the ANSIA. Apart from areas along the access road, the DE has been previously filled and protected to provide a stable, dry development area.

Site drainage is controlled in accordance with the Local Water Management Strategy (LWMS) (BG&E 2012b) that has been approved by DWER (WAPC 2019), with strong emphases placed on ensuring industrial contaminants do not escape into the natural environment and that drainage best management practices (BMPs) are utilised.

Flood modelling conducted by BG&E (2021a) confirms that the Port Landside DE may be subject to combined surface water flood and storm surges and the minimum pad height has been increased to 4.8 mAHD accordingly.

Hydrogeology

The hydrogeology and groundwater of the Port and Landside DE have been described previously as part of the proposed development of the Wheatstone Project and the ANSIA generally:

- ANSIA Local Water Management Strategy (BG&E 2012b); and
- Wheatstone Project Ground Studies (URS 2010a).

The studies indicate that the site is underlain by a shallow (~1m) groundwater table that is strongly influenced by nearby seawater. The groundwater is not suitable for potable or industrial use, being brackish to hypersaline, near neutral to slightly alkaline, and with comparatively high dissolved metal concentrations; some of which exceed the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018).

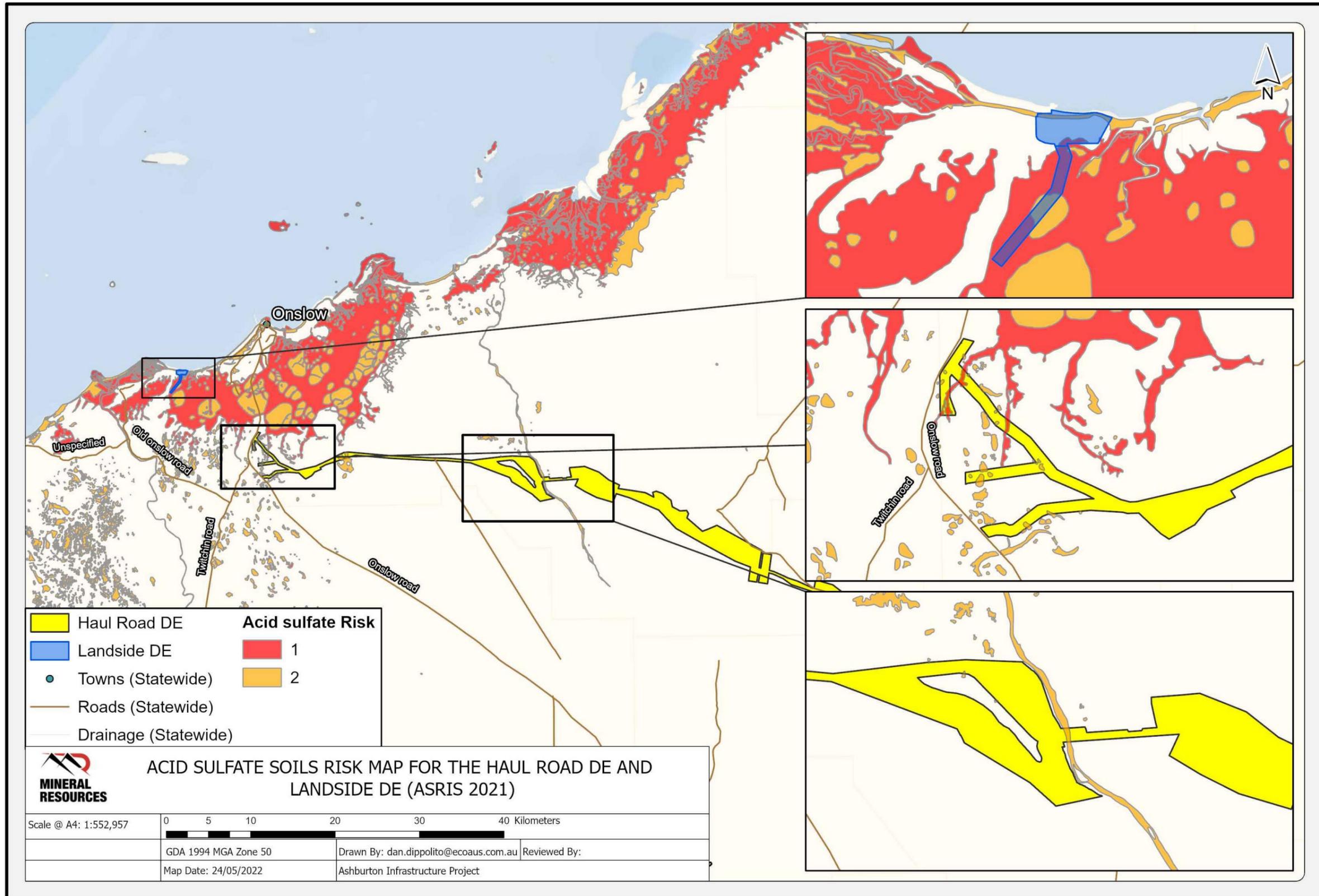
Groundwater flows are generally upwards, indicating discharge from underlying regional formations into the water table zone (which is itself strongly influenced by local topography).

Acid Sulfate Soils (ASS)

The landforms and soils within the Landside DE have been described previously as part of the proposed development of the Wheatstone Project and the ANSIA generally:

- Wheatstone Project Baseline Soil Quality and Landforms Assessment (URS 2011b); and
- Environmental Assessment Report Ashburton North Strategic Industrial Area Improvement Scheme (RPS 2015)

These studies show that the surface of the Port Landside DE consists entirely of coastal dunes made up of calcareous sands and rock. While URS (2011b) and RPS (2015) both concluded that while the majority of the ANSIA has no ASS mapped across it, the drainage lines are mapped as having high ASS risk. URS (2011b) did identify instances of ASS buried between 0.2 and 3.5m below natural ground level, associated with intertidal flats, tidal creeks and mangrove swamps. Importantly, the Port Landside DE is not located on top of, or immediately adjacent to any of these landform features (**Figure 11-1**).



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Figure 11-1: Acid Sulfate Soils Risk Map for the Haul Road DE and Landside DE (ASRIS 2021)

11.3.3 Haul Road DE

Surface Hydrology

The Haul Road DE is located within the Pilbara Surface Water Area, a Surface Water Proclaimed Area under the RIWI Act. Over its approximate 125 km extent, the Haul Road DE traverses four regional catchments (**Figure 11-2**) and intersects 20 watercourses, three of which on occasion carry significant flows (Water Technology 2020). Watercourses within the Haul Road DE (**Figure 11-2**) are typical of those in the Pilbara being ephemeral in nature and flow as a result of upstream rainfall events. The three significant watercourses, as identified and studied in greater detail by BG&E (2021b) are:

- Cane River (**Plate 1**);
- Peedamulla Creek; and
- Red Hill Creek.

In addition to these three watercourses, the Warrambo Creek may also carry significant flows on occasion, but the watercourse is braided within the Haul Road DE and is made up of two to three smaller channels (BG&E 2021b).

The western-most portion of the Haul Road (extending approximately 11-12 km from Onslow Rd) traverses intertidal flats and claypans that are occasionally inundated to a minor degree. Between this intertidal area and the boundary of the Cane River catchment to the east, the Haul Road DE crosses approximately 13 km of poorly drained sheetflow zone (**Figure 11-2**) (Water Technology 2020).

Extensive ecological surveys found no instances of permanent or semi-permanent pools within the Haul Road DE (360 Environmental 2021a).

Watercourses within the Haul Road DE are typical of those in the Pilbara being ephemeral in nature and flow as a result of upstream rainfall events.

One streamflow gauge has been installed on the Cane River (Tooluna, Station No: 707005), 28 km upstream from where it is crossed by the Haul Road DE (**Figure 11-2**) and has been operational since 1986. The flow record shows a predominantly dry regime with peak flood depths of up to 4 m, however, typically flood levels range between 0 – 2.5 m (DWER 2021a). No monitored flow data were available for Peedamulla (braided system) or Red Hill Creek.

The western-most portion of the Haul Road DE (extending approximately 11-12 km from Onslow Road) is of very low relief and includes intertidal areas that are sufficiently elevated (>4.0 mAHD) and a sufficient distance from the shoreline (10 – 18 km) that they are likely to only experience tidal inundation during extreme tidal events, such as storm surges (<0.01% tidal inundation frequency; **Figure 11-3**). The claypans (playas) in this area range in size from 0.1 ha to 2 ha and are not typically connected to the tidal regime due to their elevation, but are instead reliant on sufficiently large rainfall events, or when the nearby Cane River floods (**Figure 11-4**). Although no inundation records exist for the claypans, biological surveys of the claypans (360 Environmental 2021a) identified recent evidence of aquatic macroinvertebrates, providing an indication that the claypans are inundated for sufficient periods for such lifeforms to establish, albeit only occasionally after large rainfall events.

The surface water flow assessment undertaken by Water Technology (2020) for the Haul Road DE included modelling of regional flood frequency estimates for 20, 10, 5, 2 and 1 Annual Exceedance Probabilities (AEP). The assessment was further refined by BG&E (2021b) and used to inform the basis for the placement and sizing of culverts through the sheetflow drainage areas.

Extensive ecological surveys found no instances of permanent or semi-permanent pools within the Haul Road DE (360 Environmental 2021a).

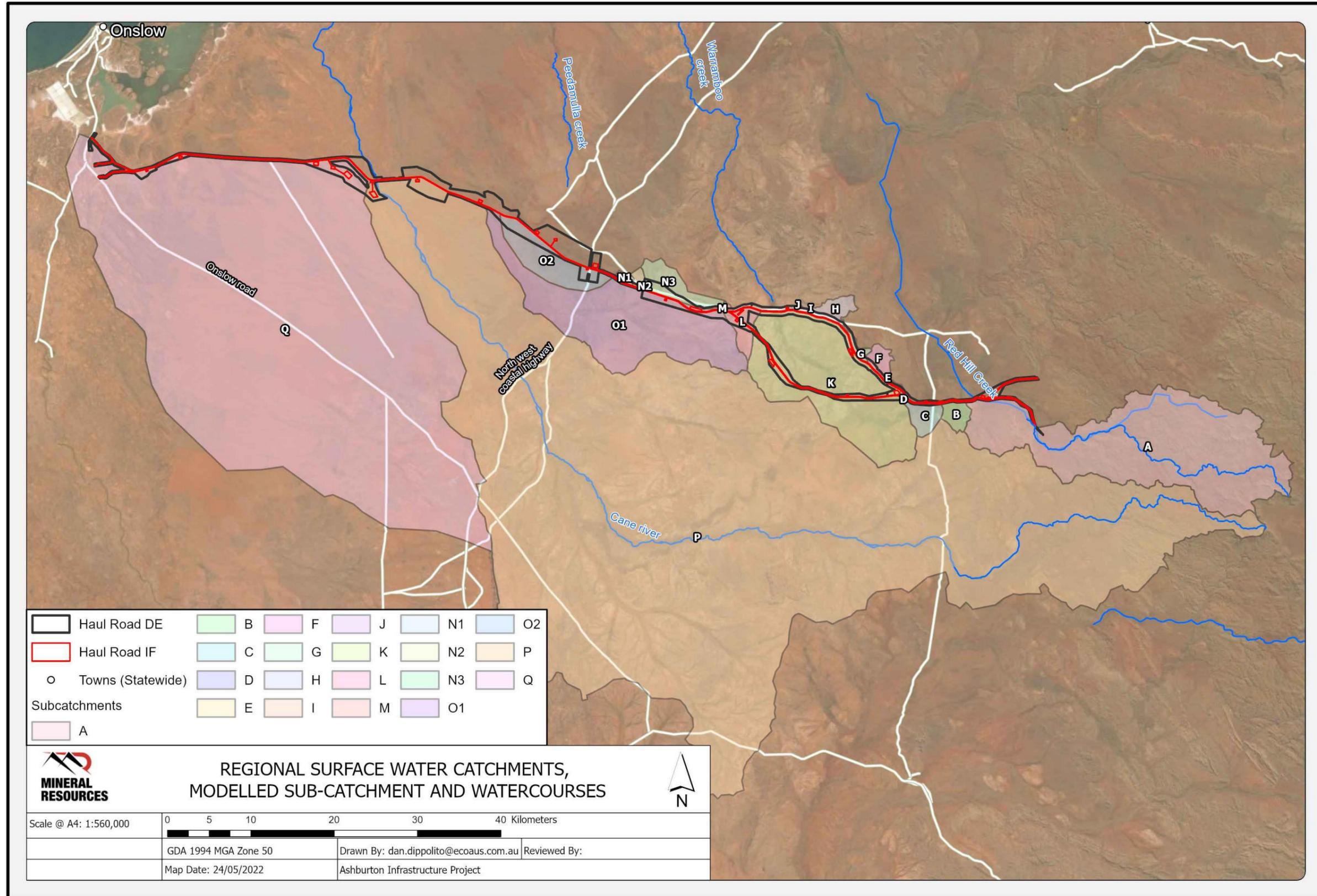
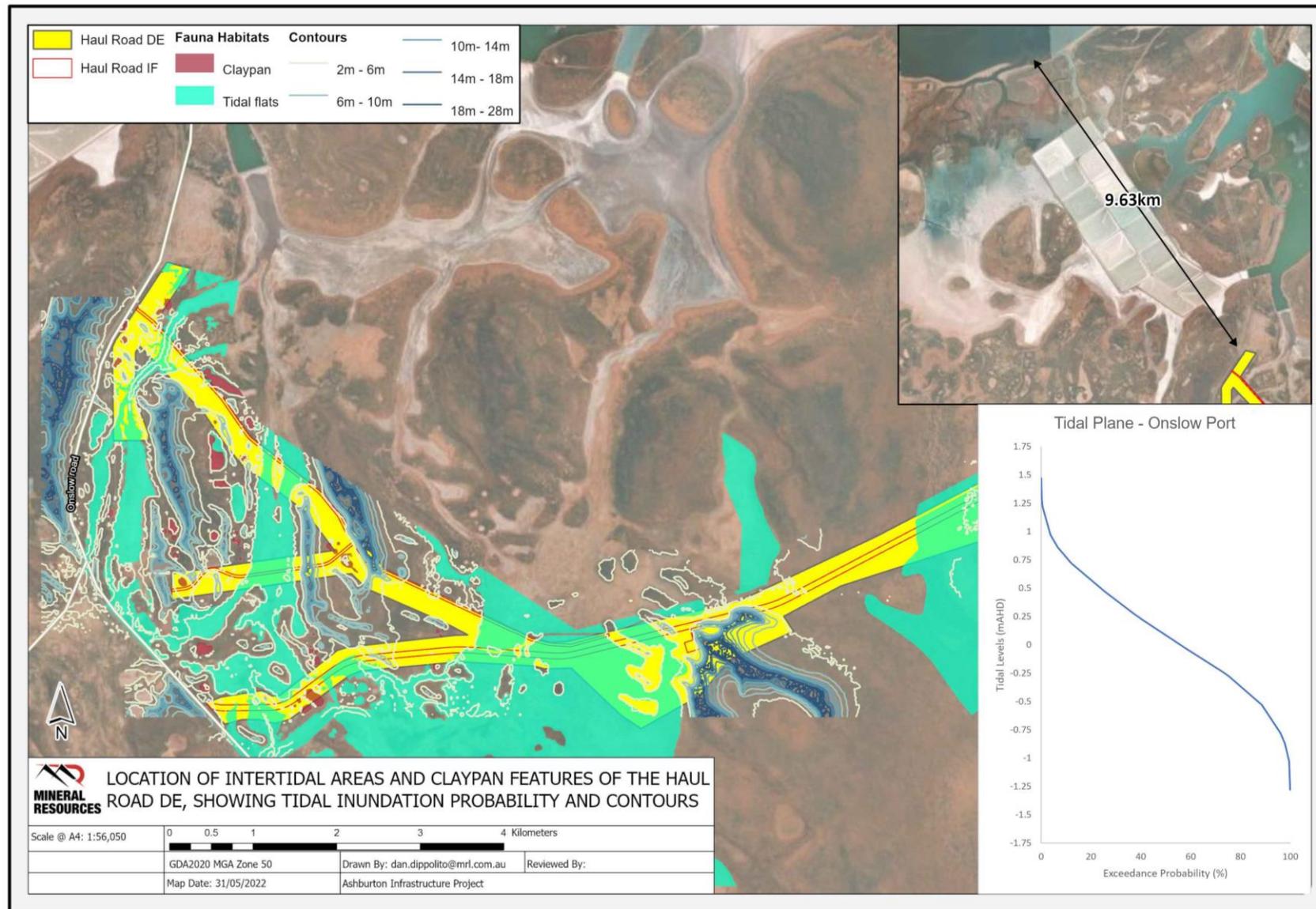


Figure 11-2: Regional Surface Water Catchments, Modelled Sub-catchment and Watercourses



Plate 1: Photo Mosaic of Cane River Crossing



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Figure 11-3: Location of Intertidal Areas and Claypan Features of the Western End of the Haul Road DE*
***Showing Pre-Development Tidal Inundation Probability and Contours**

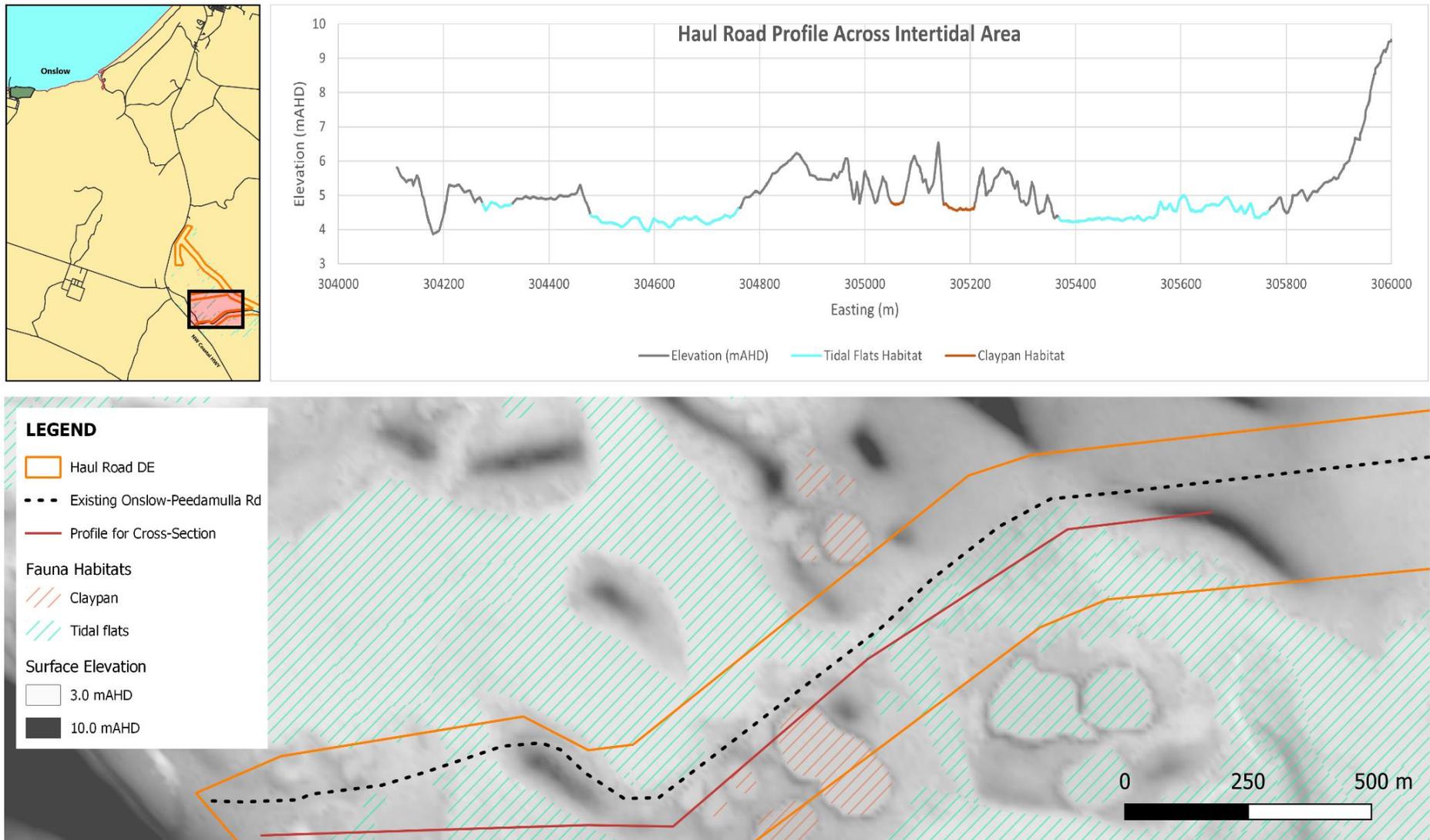


Figure 11-4: Cross-sections of the Intertidal and Claypan features of the Haul Road DE*
***Showing Relevant Hydrological Regimes**

11.3.3.1 Hydrogeology

The Haul Road DE is located entirely within the Pilbara Groundwater Area, which is proclaimed under the RIWI Act. Accordingly, the installation of groundwater bores and abstraction of groundwater will require licenses and permits under that Act.

A background review of the groundwater environment along the Haul Road DE by SRK (2021) identified that groundwater resources are mainly alluvial, sedimentary or fractured rock aquifers, and provided the following description for the aquifers that will be targeted to provide water for haul road construction:

- The Birdrong Aquifer (Carnarvon Basin), the top of which is around 400 m deep at the coast, 200 m deep in the centre and becomes shallower towards the eastern basin margin where it outcrops. Towards the coast, artesian conditions may exist as well as higher salinity; and
- Fractured rock aquifers and paleochannels of the Ashburton Basin, particularly areas along mapped faults, interpreted lineaments features, and adjacent to alluvium beds along drainage lines. These aquifers are typically compartmentalised and with limited storage.

The vegetation types associated with Cane River include groundwater dependent vegetation, including the obligate phreatophyte, *Melaleuca argentea* (in DR03 and DR04).

Existing users

The dominant regional land uses along the haul road alignments are currently mining and cattle grazing. There are existing pastoral, mining and drinking water supply groundwater bores along the proposed haul road (**Figure 11-5**). The Cane River Water Reserve lies 600 m to the north of the DE, and the Bungaroo Creek Water Reserve (over 20 km to the northeast).

Acid Sulfate Soils

ASS risk along the Haul Road DE has been assessed using the Atlas of Australian Acid Sulfate Soils (ASRIS) (ASRIS 2021), with the results shown in **Figure 11-1**. The results indicate that the low-lying intertidal areas and claypans at the western end of the Haul Road DE includes areas mapped as high-moderate and moderate-low likelihood of ASS being present, as well as the area where the haul road crosses the Cane River. For all other areas, the risk of ASS is considered to be negligible.

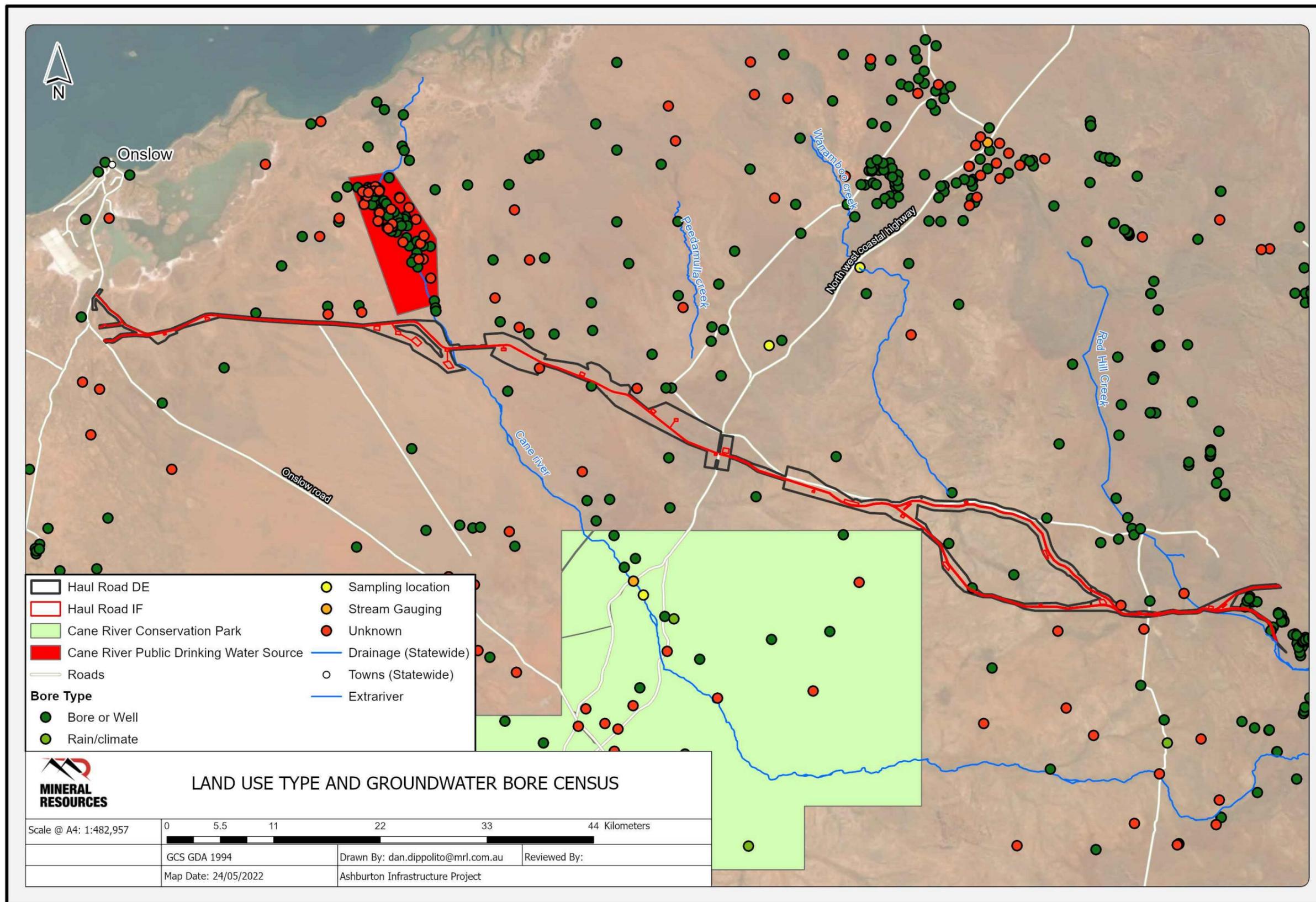


Figure 11-5: Land use Type and Groundwater Bore Census

11.4 Potential Impacts

The Proposal has potential to affect inland and intertidal hydrological regimes and quality of groundwater and surface water so that environmental values are impacted.

11.4.1 Direct impacts

Potential direct impacts of the Proposal on hydrological regimes and quality of groundwater and surface water are:

- Increased (upgradient) and/or decreased (downgradient) inundation (flooding) of natural and built environs as a result of new crossings, causeways, floodways and raised areas; and
- Reductions in the availability of groundwater for existing users or environmental values as a result of groundwater abstraction associated with construction of the haul road.

These impacts may be within or immediately adjacent to the Development Envelopes.

All earthworks include drainage structures within the Port Landside DE and the Warrirda Road upgrade that links the Haul Road DE and Port Landside DE are not part of this Proposal (as detailed in **Section 2.1.5**). Therefore, these works that are related to, but not part of, the Proposal are discussed as cumulative impacts (**Section 11.4.3**).

11.4.1.1 Increased and/or Decreased Inundation of Natural and Built Environs as a Result of New Crossings, Causeways, Floodways and Raised Areas

The construction of haul road crossings (i.e. bridges, floodways and culverts) within defined watercourses, including Cane River and Peedamulla Creek, has the potential to constrict flows within that watercourse, particularly if the design of the crossing is not matched to the full range of the natural flow regime. Possible outcomes of flow constriction include:

- Increased flooding of areas upgradient of the crossing, particularly during high flows; and
- Decreased availability of water downgradient of the crossing, particularly during very low flows.

Elevated crossings over the low-lying areas, namely claypans, and intertidal and sheetflow zones, have potential to interrupt existing hydrological regimes by blocking flow paths. Due to the area's low relief, the effects of these interruptions may have the capacity to be felt over very wide areas.

Final design and modelling of post-construction flows has not been completed but all infrastructure will be designed to minimise restriction to flows and current drainage patterns.

11.4.1.2 Reduction in the Availability of Groundwater for Existing Users or Environmental Values as a Result of Groundwater Abstraction

As set out in **Section 2.1.4.1**, the construction of the 125 km haul road over a period of approximately 12 months will rely on local groundwater resources to supply the construction programme's needs, including for potable supply to the temporary construction camp(s). The Proponent estimates a maximum requirement of 2,000 ML of groundwater over the twelve-month construction period. No water supply is required for operation of the haul road, although additional groundwater supplies beyond this period will be required during decommissioning and rehabilitation of unused areas.

During construction, the Proponent intends to install a series of bores to supply purpose-built turkey's nest dams to be placed approximately every 10 km along the haul road route. It is expected that up to four turkey's nest dams and bores will be operational at any one time, abstracting approximately 6 to 12 L/s. These bores are expected to draw from the regional Birdrong aquifer (where present), local alluvial aquifers associated with watercourses, and local fractured rock aquifers, and will be supported by appropriate Ground Water Licences. No supply bores are proposed to be developed within the Priority 1 Cane River Water Reserve; this will avoid potential impacts to this resource and the groundwater dependent vegetation associated with Cane River.

11.4.2 Indirect Impacts

Potential indirect impacts of the Proposal on hydrological regimes and quality of groundwater and surface water are:

- Increases in existing turbidity and sediment load of surface waters as a result of clearing and soil disturbance, including the construction of crossings and the placement and management of soil stockpiles;
- Increased risks to surface and/or groundwater quality as a result of disturbance of ASS; and
- Increased risks to surface and/or groundwater quality as a result of spills and leaks of hydrocarbons, wastes and other hazardous materials.

Potential water quality impacts to the Cane River must be considered in the context of the downstream Cane River Water Reserve and the alluvial aquifer which it is intended to protect.

11.4.2.1 Increased Turbidity and Sedimentation of Surface Waters as a Result of Clearing and Soil Disturbance

Large-scale clearing of vegetation and earthworks associated with the construction of the haul road (including borrow areas) may result in soil disturbances in areas where surface water runoff can transport that disturbed soil into pools and watercourses, impacting water quality. Owing to the climate, vegetation and pastoral land use of the Pilbara, the water quality of ephemeral watercourses in the region is often highly turbid (coloured) and flows can naturally carry large volumes of suspended sediments (van Vreeswyck et al 2004); however, there is potential for the increased turbidity or sediment load to have local impacts.

11.4.2.2 Increased Risks to Surface and/or Groundwater Quality as a Result of Disturbance of ASS

Mapped areas of elevated ASS risk are adjacent to the Port Landside DE (**Section 11.3.2**) and intersect the Haul Road DE (**Section 11.3.3**). For the haul road, the elevated areas are associated with near-coastal claypans and Cane River sediments.

In areas where the Haul Road DE traverse lower-lying areas where an elevated risk of ASS has been indicated, road construction will require the building up of the surface with large volumes of appropriate fill, as opposed to excavation. For the construction of the Cane River crossing, which will be built using pre-fabricated structures, excavated soil materials will be reused where appropriate, including being blended with other materials and used as subbase for the road. Accordingly, there is potential for ASS materials to come into contact with surface water and impact water quality, noting that the Cane River crossing may be less than 1 km from the Cane River Water Reserve.

11.4.2.3 Increased Risks to Surface and/or Groundwater Quality as a Result of Spills and Leaks of Hydrocarbons, Wastes and Other Hazardous Materials

Spills and Leaks of Hydrocarbons

The construction and operation of the Proposal will involve the ongoing operations of heavy plant and machinery, including haulage and earthmoving vehicles, generators and lighting towers. These will not only have on-board fuel and oil reservoirs but will require regular refuelling and maintenance. Where equipment and machinery operate in proximity to surface water features, including constructed drains, there is potential for leaks and spills of hydrocarbons to impact on the quality of those waterways. There is also potential for large-volume, static fuel storage facilities to impact groundwater resources if persistent or large fuel leaks occur. These potential impacts to water quality are of additional consideration in areas upstream of the Cane River Water Reserve.

Impacts from Wastes and Other Contaminating Materials

Potential exists for impacts to water resources to arise associated with the planned temporary storage of domestic solid and liquid wastes, including wastewater, at both the Port Landside DE and also at the haul road construction camp (**Section 2**). This aspect of the Proposal can be adequately managed under additional existing approvals processes, including the requirements of Part V of the EP Act, as well as the Mining Act.

11.4.3 Cumulative Impacts

The earthworks and site preparation in the Port Landside DE are not part of this Proposal but are related works and addressed as cumulative impacts.

Preparation of the Port Landside DE involves increasing the height of the site by several metres with competent and contaminant-free soil so a final elevation of 4.8 mAHD can be achieved. Subsequent excavation of the site for installation of underground and in-ground services, including stormwater management elements, are not required to go beyond the depth of the clean fill and underlying coastal sands (for example, the depth of the stormwater retention pond will be 1.9 mAHD).

The Port Landside Development will comply with the requirements of the District Water Management Strategy (DWMS, ENV 2010) and Local Water Management Strategy (LWMS, BG&E 2012b), which have both been previously approved by DWER and are administered by Western Australian Planning Commission (WAPC). The primary objective of the DWMS is to minimise potential impacts on natural ecosystems relying on pre-development hydrological regimes and prevent unacceptable flooding and is supported by the LWMS.

The potential for cumulative increases in groundwater abstraction from aquifers along the Haul Road DE to result in impacts to groundwater dependent ecosystems has been considered in the context of the existing DWER Allocation Plan for the Pilbara Groundwater Area (DOW 2013b). The combined increased abstraction of up to 2,000 ML/day from the regional and local aquifers will be within available allocation limits specified in the plan, and the installation and operation of the groundwater bores will be licensed by DWER. Accordingly, no cumulative impacts in this regard arising from the Proposal are expected.

11.5 Mitigation

The Proponent has designed the Proposal to avoid and minimise impacts to the receiving environment wherever possible. These mitigation measures are outlined in **Table 11-3**.

A number of management plans have been prepared for the Proposal to minimise the potential impacts of project construction and operational activities on Inland Waters. The specific management plan that has been prepared that will assist to mitigate potential impacts on Inland Waters includes:

- A **Terrestrial Environment Management Plan (TEMP)**: The TEMP has been prepared to detail the mitigation and management measures the Proponent proposes to implement to reduce direct and indirect impacts to surrounding inland waters, flora, vegetation, fauna and social surroundings. The management objectives for the plan relate to specific management objectives on each environmental factor.

Table 11-3: Proposed Mitigation Measures for Inland Waters

Potential impact	Proposed mitigation			
	Avoid	Minimise	Rehabilitate	Offset Required?
Increased and/or decreased inundation of natural and built environs as a result of new crossings, causeways, floodways and raised areas.	<ul style="list-style-type: none"> Crossings, including bridges, culverts and floodways, will be design, constructed and maintained to ensure natural hydrological regimes are maintained for the majority of conditions, but particularly during low (base) and receding flows. The haul road will be fully sealed prior to operational use. This will greatly reduce erosion and sedimentation risks along the entire length of the road. Any planned disturbance to watercourses will be completed during dry, non-flow periods to minimise environmental impacts, where possible. Rock protection to be installed at waterway crossings where flow velocities are likely to exceed 2 m/s. 	<ul style="list-style-type: none"> Installing and maintaining engineering controls and water management structures (e.g., culverts, bridges and burrows) as part of the Proposal design to maintain hydrological regimes, capture and infiltrate rainfall, minimise the degradation of water quality by sedimentation, erosion or chemical pollutants (Figure 11-6). Once the Haul Road is constructed, the Proponent will also monitor rainfall and water levels (including tidal) at selected locations within intertidal and claypan habitats adjacent to the Haul Road (Figure 10-3). Where impacts to waterflows are detected, additional controls will be implemented to the extents provided for under relevant approvals. Regular inspection and upgrade/ repair to areas undergoing unacceptable erosion (e.g. where vegetation or infrastructure is at risk). 	<ul style="list-style-type: none"> All crossing structures to be fully removed and the site rehabilitated unless alternative land use is agreed, as per approved MCP. Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas within the Haul Road DE (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I). 	No
Reduction in the availability of groundwater for existing users or environmental values as a result of groundwater abstraction.	<ul style="list-style-type: none"> No bores will be established within the Cane River Water Reserve. All bores to be constructed and operated in accordance with RIWI Act permits and licences. All bores to be constructed by appropriately qualified and certified personnel. No groundwater abstraction is required during operation. 	<ul style="list-style-type: none"> Bores will be located at a distance greater than 400 m from existing licensed bores. All bores to be constructed and operated in accordance with RIWI Act permits and licences. Abstraction to be of relatively short duration (i.e. during construction), so water levels should quickly recover. The Proponent will 'make good' any loss or reduction in supply for pastoral bores. 	<ul style="list-style-type: none"> Bores will be decommissioned as per WA Government guidelines unless 	No
Increased turbidity and sedimentation of surface waters as a result of clearing and soil disturbance.	<ul style="list-style-type: none"> Borrow areas within floodplains will be avoided where possible and where necessary, will only be excavated during dry conditions, and all disturbed areas will be stabilised prior to the commencement of the summer wet season. Temporary stockpiles will be preferentially located outside of flood risk areas. 	<ul style="list-style-type: none"> Regular inspection and upgrade/ repair to areas undergoing unacceptable erosion (e.g. where vegetation or infrastructure is at risk) Sedimentation controls and onsite sumps designed to contain most stormwater runoff on site, minimising offsite discharge. 	<ul style="list-style-type: none"> Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas within the Haul Road DE (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I). 	No
Increased risks to surface and/or groundwater quality as a result of spills and leaks of hydrocarbons, wastes and other hazardous materials.	<ul style="list-style-type: none"> Only utilise and place hydrocarbon storage containers in accordance with WQPN 56 "Tanks for fuel and chemical storage near sensitive water resources" (DWER 2018). Include secondary containment. No storage or transfer of hydrocarbons (i.e. refuelling) within 100 m of any existing wellhead. 	<ul style="list-style-type: none"> The Proponent's standard spills response and clean-up procedures will apply. 		No
Increased risks to surface and/or groundwater quality as a result of disturbance of ASS.	<ul style="list-style-type: none"> Prior to excavation, an assessment of acid sulfate soil risk will be conducted in accordance with the DWER guideline (DER 2015b), including in areas where dewatering may be required – to be managed through the Mining Proposal for the haul road. 	<ul style="list-style-type: none"> If present, an ASS Management Plan will be developed and implemented in accordance with the DWER guideline (DER 2015b). 	<ul style="list-style-type: none"> A contaminated sites assessment will be conducted at closure and areas requiring remediation will be identified and addressed, as per approved MCP. 	No

11.6 Assessment and Significance of Residual Impacts

11.6.1 Direct Impacts

11.6.1.1 Increased and/or Decreased Inundation of Natural and Built environs as a Result of New Crossings, Causeways, Floodways and Raised Areas

The Proponent, through iterative design and modelling, will ensure that flow regimes, particularly low flows and receding flows, remain unaffected by any structures crossing waterways and low-lying areas. Proposed engineering controls and water management structures (i.e. culverts and bridges) will be installed to convey flows and maintain hydrological regimes up to 10% AEP. Crossings will be designed to overtop in extreme flood events. All Proposal infrastructure will be designed so that existing access to other infrastructure is not affected even in extreme flood events.

Crossings will be to an accepted design standard, such as AusRoads, and there is a high level of confidence that the design objective and environmental objective of minimising impacts to the hydrological regime can be achieved.

For sheetflow areas, intertidal areas and claypans, the Proponent has committed to the installation of appropriately sized culverts where required along the proposed haul road to minimise impacts to baseline hydrological regimes. The locations of the culverts have been identified at a conceptual phase (**Figure 11-6**) through the preliminary modelling by Water Technology (2020). The use of culverts to maintain landscape flows is established practice and any potential residual impacts to the environment are not considered to be significant.

Once the Haul Road is constructed, the Proponent will also monitor rainfall and water levels (including tidal) at selected locations within intertidal and claypan habitats adjacent to the Haul Road (noting that the claypans are rainfall-dependent and not typically connected to the intertidal regime) to ensure the desired outcome is achieved (**Table 11-3**). In the unlikely event that significant ponding or water deficits are detected and that may be sufficient to result in secondary impacts to important ecological functions or other infrastructure, additional drainage controls will be installed. These measures are described in the TEMP (**Appendix H**)

11.6.1.2 Reduction in the Availability of Groundwater for Existing Users or Environmental Values as a result of Groundwater Abstraction

The potential for groundwater drawdown to impact on other users, is greatly restricted due to the temporary nature of abstraction, limited water supply demand and short duration of abstraction (i.e., construction will be completed within one year). There are no permanent or semi-permanent pools in the area that could be affected and the avoidance of abstraction near Cane River will avoid impacts to the only known obligate phreatophytes in the Survey Area.

A number of management actions are provided in **Table 11-3**, including the commitment to not place bores within the Cane River Water Reserve and to prioritise the use of deeper aquifers that are less likely to interfere with existing users as well as any groundwater dependent ecosystems. The remainder of the actions are consistent with the haul road borefield being located within the Pilbara Groundwater Area, with its requirement for all bores to be approved prior to construction and operated in accordance with DWER licence conditions. Consequently the potential for adverse residual impacts to other users or environmental values over the short span of the borefield operation is expected to be low to negligible.

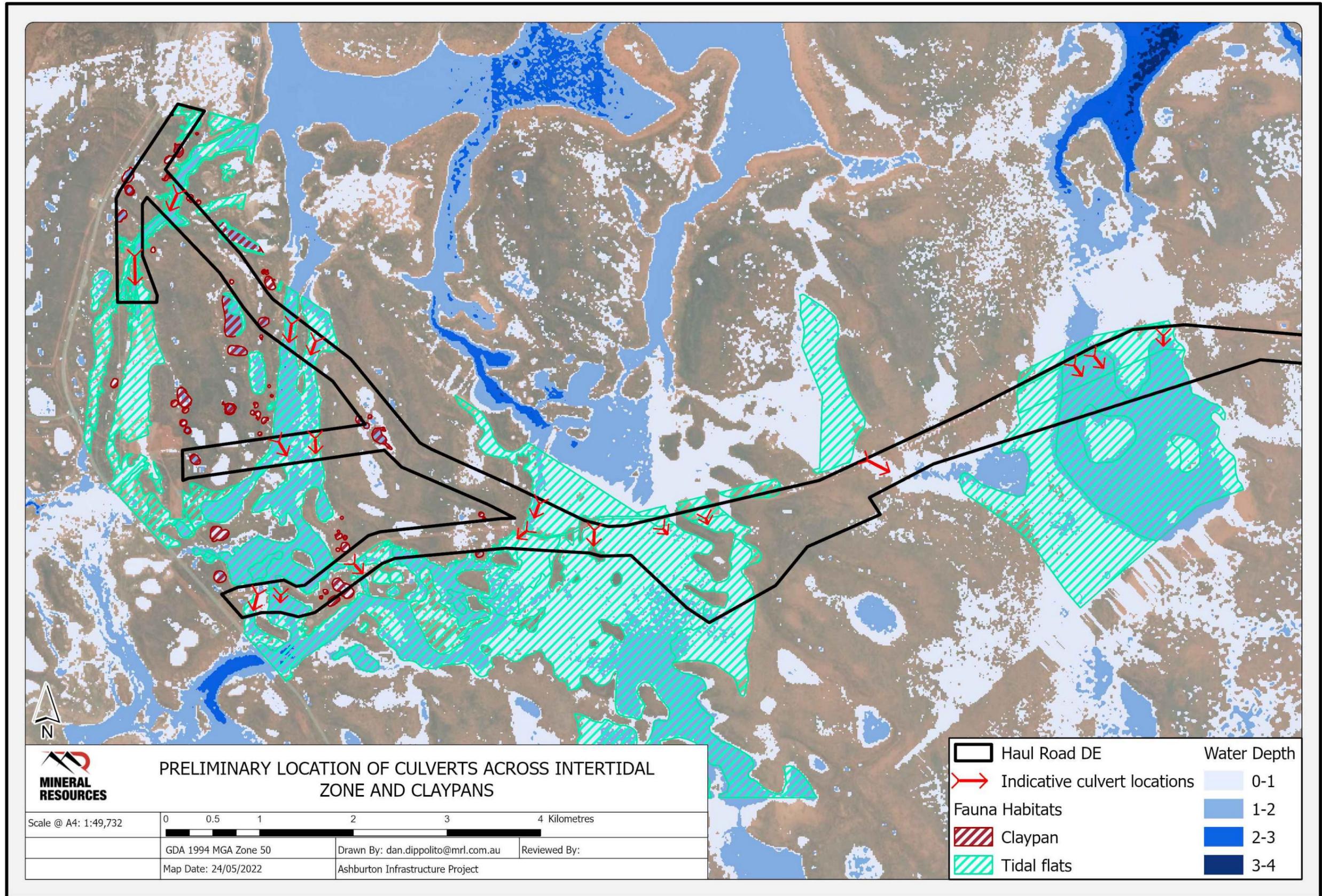


Figure 11-6: Preliminary Location of Culverts Across Intertidal Zone and Claypans

11.6.2 Indirect Impacts

11.6.2.1 Increased Turbidity and Sedimentation of Surface Waters as a Result of Clearing and Soil Disturbance

The potential for water quality to be affected during construction, including at watercourse crossings and from borrow areas, will be avoided or minimised by undertaking works in sensitive areas when inundation and surface water flows are not present, and ensuring the industry-standard, best practice measures described in **Table 11-3** are used at all times. This will include ensuring all disturbed areas have sediment controls installed and will be stabilised, including armouring where required, prior to the commencement of the wet season. Accordingly, the risk to water quality (increased turbidity) is considered to be very low and temporary.

11.6.2.2 Increased Risks to Surface and/or Groundwater Quality as a Result of Disturbance of ASS

Collectively across the Proposal the risk of disturbing ASS and impacting water quality is considered to be negligible to low. The potential for adverse environmental outcomes associated with the disturbance of ASS will be further minimised by means of the following statutory mechanisms: Mining Proposal(s) required under the Mining Act for the construction and operation of the haul road (administered by DMIRS).

11.6.2.3 Increased Risks to Surface and/or Groundwater Quality as a Result of Spills and Leaks of Hydrocarbons, Wastes and Other Hazardous Materials

The risk of impacts to groundwater quality is greatest for those activities associated with the use and storage of hydrocarbons, which in this case will be diesel fuels, hydraulic oils, and other hydrocarbons. The potential for surface and groundwater quality to be adversely impacted will be significantly reduced by applying industry-standard approaches, including maintaining activity buffers around wellheads ensuring appropriate storage and spill response resources (**Table 11-3**) will be implemented through the Part V instruments as well as mining proposals required by the Mining Act. Accordingly, the residual potential impact to water resources from spills and leaks is expected to be minimal and reversible.

11.6.3 Cumulative Impacts

Owing to the requirement to comply with district, regional and state planning and water resource protection policies, the hydrological regimes in the vicinity of the Proposal are expected to be maintained as a result of both the Proposal and related works within the Port Landside Development Envelope.

The location of the Landside DE within the established ANSIA, as well as the requirement for the development to comply with established planning guides and local plans (DWMS, ENV 2010 and LWMS, BG&E 2012b) means that the potential for the port landside development to impact adversely on hydrological regimes is negligible. Existing modelling undertaken to support the current LWMS (BG&E, 2012) confirms that the minimum fill requirements and natural flood corridors prescribed in the ANSIA planning approval documents are adequate to protect existing facilities and remaining natural values.

The construction of the Port Landside facilities will occur on a previously developed site and any large-scale excavation associated with the construction is very unlikely to extend below both the natural coastal sandy soils as well as the additional 2-3 m of fill material used to build the site surface level to 4.8 mAHD (**Section 11.4.3**).

The potential for adverse environmental outcomes associated with the disturbance of ASS will be further minimised by means of the following statutory mechanisms:

- Works Approval(s) and License(s) required under Part V of the EP Act for the construction and operation of the Port Landside development (administered by DWER).

11.7 Environmental Outcomes

Using the EPA's environmental factor guideline for Inland Waters (EPA 2018), the Proponent is confident that the EPA's objective will be met, based on:

- The Proponent's commitment to use established design and modelling processes to ensure crossings of waterways and sheet-flow areas do not impede important flows, particularly base flows, or significantly increase inundation periods for riparian and sheetflow areas or affect access to other infrastructure.
- The temporary and low-volume groundwater requirements for haul road construction, as well as the sparseness of other groundwater users (noting groundwater use will require authorisation under the RIWI Act).
- The low likelihood of contamination of surface or groundwater resources by significant soil erosion or from hydrocarbon spills/leaks.

The anticipated outcome of the Proposal is that hydrological regimes will be maintained, and water quality will not be affected. This is consistent with the EPA objective for Inland Waters.

12. GREENHOUSE GAS EMISSIONS

12.1 EPA Objective

The EPA’s objective for Greenhouse Gas (GHG) emissions is to *‘reduce net greenhouse gas emissions in order to minimise the risk of environmental hard associated with climate change’*. (EPA 2020j).

12.2 Policy and Guidance

The Proponent has considered published policy and guidance relevant to this factor as summarised in **Table 12-1**.

Table 12-1: Policy and Guidance for Greenhouse Gas

Policy / Guidance	Considerations
Environmental Factor Guideline: Greenhouse Gas Emissions (EPA 2020j)	<p>This guidance implemented in 2020 recognises the EPAs commitment to reducing GHG emissions and, subsequently climate change.</p> <p>This guidance has been considered in the application of the mitigation hierarchy to avoid, reduce and offset emissions and the setting of greenhouse gas reduction targets by the Proponent towards net zero emissions by 2050.</p> <p>The Guidance reflects global greenhouse gas reporting standards and uses the following classifications:</p> <ul style="list-style-type: none"> • Scope 1: emissions generated as a direct result of an activity, e.g. diesel combustion by vehicles or gas consumption for on-site power generation. • Scope 2: emissions generated from the consumption of an energy commodity. • Scope 3: indirect emissions, other than Scope 2 emissions, that are generated in the wider community (e.g. the sale of ore). Scope 3 emissions occur as a consequence of the activities of a facility but from sources not owned or controlled by that facility’s business.
Western Australian Climate Policy (Gov of WA 2020)	<p>Sets out the WA Government’s plan for a climate-resilient community and a prosperous low-carbon future; also underscores the commitment to adapting to climate change and working with all sectors of the economy to achieve net zero greenhouse gas emissions by 2050.</p> <p>The Proponent is fully supportive of this policy and has also committed to achieving net zero greenhouse gas emissions by 2050.</p>
National Greenhouse and Energy Reporting Act 2007 (NGER Act)	<p>Under the NGER Act, companies are obligated to report on their GHG emissions in accordance with statutory requirements (CER 2021). The NGER Act provides a single national framework for the reporting and dissemination of information relating to greenhouse gas emissions, energy production and energy consumption in Australia governed by the Clean Energy Regulator (CER).</p>
National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015	<p>In addition to this, pursuant to the Australian Government’s NGER (Safeguard Mechanism) Rule 2015, if a facility is anticipated to emit more than 100,000 tonnes(t) CO₂-e of Scope 1 emissions per financial year (i.e. the ‘safeguard threshold’), it qualifies as a safeguard facility and is required to keep its net emissions levels at or below its emissions baseline set by the CER. Together with the reporting obligations under the NGER Act, the safeguard mechanism provides a National framework for Australia’s largest emitters to measure, report and manage their emissions.</p> <p>The Proposal is expected to emit more than 100,000 t CO₂-e per annum once operational and as a result will constitute a safeguard facility.</p>

Policy / Guidance	Considerations
Carbon Credits (Carbon Farming Initiative—Avoided Clearing of Native Regrowth) Methodology Determination 2015 (CER 2018)	<p>Emissions associated with land clearing have been calculated using the <i>Carbon Credits (Carbon Farming Initiative—Avoided Clearing of Native Regrowth) Methodology Determination 2015</i> (CER 2018). The process involves determining the carbon biomass for an area and converting it to carbon dioxide emissions when the land is cleared.</p> <p>Emissions have been calculated assuming all vegetation will be completely lost upon land clearing and converted to carbon dioxide emissions.</p>

12.3 Receiving Environment

GHG emissions are a key contributor to climate change, with the effects of a changing climate predicted to be significant in Western Australia (EPA 2020j).

Western Australia is committed to achieving net-zero emissions by 2050 as outlined in the Western Australian Climate Policy (Gov of WA 2020).

According to recent government reports, Australia's 2020 emissions for the year to September were at their lowest level in more than 25 years, with total estimated emissions of 510 million tonnes CO₂-e (Australian Government 2021). This represents a decrease of 4.4% compared to 2019 levels and a 19% decrease compared to the 2005 baseline year outlined in the Paris Agreement. As shown in **Figure 12-1** Australia's emissions recorded in the last 30 years peaked in 2007 and have followed a downward trend.

Key factors driving Australia's long-term emission trends outlined by the Department of Industry, Science, Energy and Resources (DISER) in its recent quarterly report (DISER 2021) include:

- Ongoing reductions in emissions from the electricity sector as renewable fuel sources displace coal as a fuel source;
- Increasing emissions from stationary energy (excluding electricity) due to growth in Liquefied Natural Gas (LNG) exports;
- Increasing emissions from transport emissions, despite the decrease in 2020 due to COVID-19,
- Increasing fugitive emissions from fuel extraction in the coal, crude oil and natural gas sub-sector largely due to the growth of the LNG industry;
- Decreasing agricultural emissions due to declining stock populations; and
- Significant reductions in land use, land-use change and forestry emissions due to reductions in land clearing and soil carbon improvements.

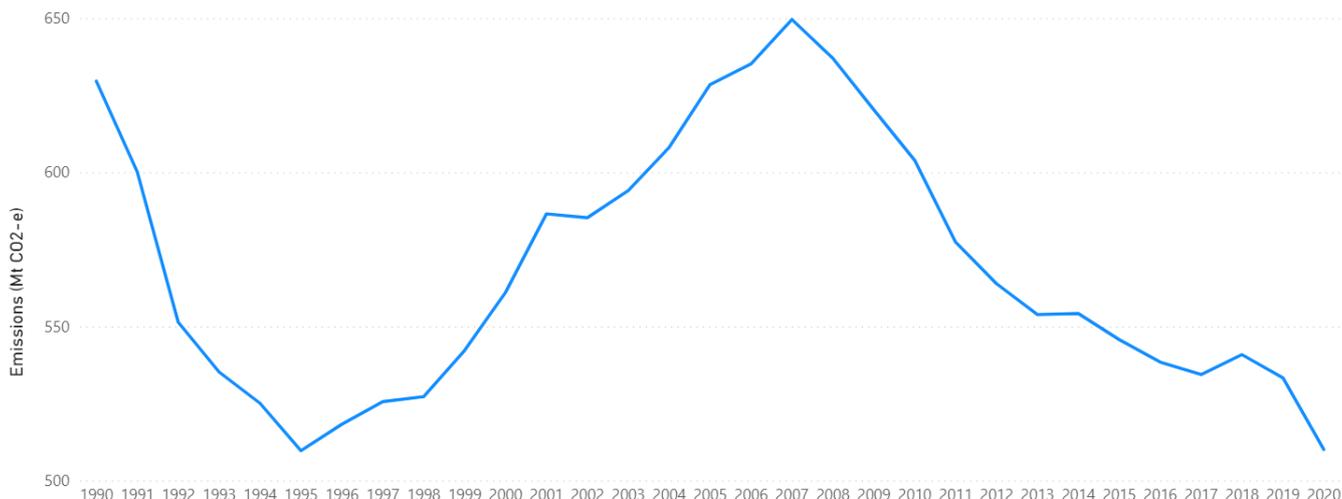


Figure 12-1: Australia Annual Emissions Over Time (Australian Government 2021)

12.3.1 Environmental Studies

Several increasingly detailed assessments have been completed by the Proponent to understand and determine GHG emissions for the Proposal, as well as for existing and reasonably foreseeable projects. These assessments are discussed in **Table 12-2**, however only Greenbase (2021a) is directly applicable to the Proposal.

Table 12-2: Studies for Greenhouse Gas

Study	Findings
Ashburton infrastructure Project Greenhouse Gas Assessment (Greenbase 2021a)	An Assessment of estimated GHG emissions from the construction of the Haul Road DE and construction and operation of landside DE as part of this Proposal.
Onslow Project Greenhouse Gas Assessment (Greenbase 2021b)	An assessment of estimated GHG emissions from the Onslow Project (including mining and haulage to the Port of Ashburton via the Haul Road DE from Bungaroo South).

12.4 Potential Impacts

12.4.1 Direct Impacts

The Ashburton Infrastructure Project is construction of a Haul Road and Operation of a Transshipping Port to export 30 Mt (dry) iron ore with design flexibility for future operational expansion to 40 Mt (dry) expected after year 10, subject to availability of ore. As such, the direct impacts and GHG assessment has been based on 30Mt throughput.

GHG emissions for the Proposal will occur within the Nearshore, Landside and Haul Road DEs and the source of emissions include:

- Haul road construction: vegetation clearance and construction activities associated with the haul road development; and
- Port construction and operations: fuel consumption from construction, PNG electricity generation, transshipping vessels and stationary non-transport purposes, including temporary generators, lighting towers and pumps.

Mining, haulage, offshore shipping and processing of ore are associated with previously approved proposals and are beyond the scope of this Proposal.

The Proponent has included a solar array in the design of the port facilities, totalling 1.15 MW and preventing an estimated 1,000 tonnes of CO₂ from being emitted from the facility each year. Additionally, electric motors have been incorporated into the design to replace diesel-fired motors wherever possible to further avoid greenhouse gas emissions.

A detailed emissions inventory is provided in **Table 12-3**. In keeping with the predicted increase in the throughput of the Proposal, the inventory for port operations includes the predicted emissions for the first 10 years (up to 30 Mtpa) and the next 20 (up to 40 Mtpa). Note that these emissions are conservative and do not include additional future emissions reduction and offset measures to be taken by the Proponent to achieve its target of net zero greenhouse gas emissions by 2050 (**Section 12.5**).

Regarding Scope 3 emissions from port operations, two categories of activities are considered in the inventory:

- All emissions relating to the production of fuel and energy purchased by the Proponent, specifically diesel and Piped Natural Gas (PNG);
- Processing of the sold product, specifically the emissions from the processing of ore sold by the Proponent to produce steel; and
- The results of the above categories are combined to give an annual total in **Table 12-3**

Table 12-3: Estimated Greenhouse Gas Emissions from the Proposal

Activity	Energy Type	Estimated Annual Quantity	Scope 1 tCO ₂ -e/yr	Scope 2 tCO ₂ -e/yr	Scope 3 tCO ₂ -e/yr
Haul Road Construction (in Year 1 only)	Diesel combustion Non-transport (Stationary Purposes)	675,709 L	1,831	0	0
	Vegetation clearing	1,400 ha	76,872	0	0
Port Construction (in Year 1 only)	Diesel combustion Non-transport (Stationary Purposes)	6,274,439 L	17,002	0	0
Total GHG emissions for Year 1			95,705	-	-
Port Operations from Year 2 @ 30Mtpa	PNG combustion for electrical generations		32,230	0	-
	Diesel combustion Stationary Purposes (includes TSVS)		65,558	0	-
Annual baseline GHG emissions			97,788	0	54,602,377

* Discrepancies in tables between totals and sums of components are due to rounding

A breakdown of GHG emissions by source including stationary energy, non- transport emissions, transport emissions, and emissions associated with clearing is located in **Appendix U**.

The potential impacts from GHG emissions associated with the Proposal relate to the contribution to global GHG concentrations from Scope 1 and Scope 3 emissions. As such, the potential impact from the Proposal comprises increased greenhouse gas emissions. It is noted; however, that the Proponent is committed to continuously improving operations and subsequent emissions over the life of the Proposal. It is therefore expected that the Annual GHG emissions for Year 11-30 are a conservative assessment.

12.5 Mitigation

The Proponent as an organisation has committed publicly to achieving net zero emissions across all of its business by 2050. This will include new projects and application of proven technologies to achieve emissions reduction throughout 5 yearly capital expenditure cycles.

Significant opportunities exist for the Proposal involving fuel substitution in the mining and transport fleet, and transshipping (which makes up two thirds of the total Proposal emissions) by moving to green fuel and eventually full electric vehicle capability over the life of the Proposal. These technologies are still under development however MinRes has already selected its haulage fleet supplier to provide the greatest flexibility in retrofitting vehicles as these technologies are delivered to market.

It has developed its *Roadmap to Net Zero Emissions* to “support the organisation’s transition to a low-carbon future” (MinRes 2021). The Proponent will strive to achieve its net zero target by focusing on displacing diesel fuel, renewable generation, electrification of equipment and transport, energy storage, and adopting future fuels. Abatement projects will prioritise current operational efficiencies and ‘net zero ready’ asset design to drive emissions reductions before carbon offset purchasing is considered. The roadmap provided in **Figure 12-2** shows the pathway that will guide the Proponent towards net zero emissions by 2050.

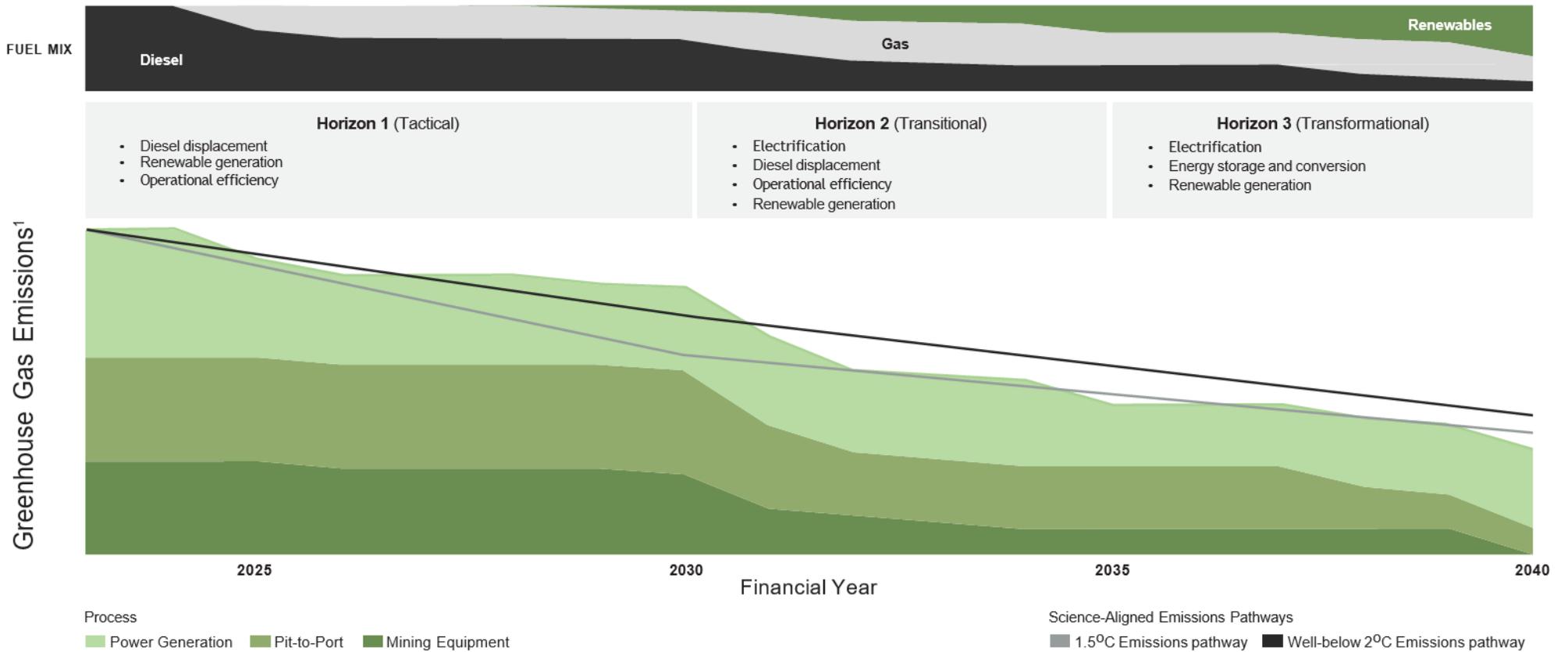
In the 2021 Financial Year, the Proponent implemented the following emission reduction initiatives:

- Installation of a \$6 million, 2.1 megawatt peak solar array with battery storage to displace diesel generation at the Wonmunna iron ore operations, reducing carbon emissions by approximately 2,500 tonnes of CO₂ per year;
- Investigated geothermal baseload and wind power generation potential at various project sites;
- Completed design of modular LNG storage facilities to allow LNG to be rolled-out on sites rapidly and cost effectively as an alternative to diesel for remote power generation;
- Purchased the first electric truck fully assembled in Australia; and
- Participated in the Future Energy Exports Co-operative Research Centre.

Many of these initiatives are ongoing and the Proponent will continue to seek out and support new opportunities to further support decarbonisation.

The Proponent reports its annual energy and Scope 1 and 2 GHG emissions data to the Clean Energy Regulator through the Australian Government’s *National Greenhouse and Energy Reporting Act (2007)*. The Proponent voluntarily discloses that information as part of its annual Sustainability Report (MinRes 2021).

MinRes has strategically positioned itself to be a fast follower of proven green technology and is currently setting 5 yearly business targets for emissions reductions, with the board set to update approved targets in the near future. These targets will support the MinRes roadmap to zero emissions by 2050 at the latest and will underpin the early adoption of new technology to achieve the goals.



¹ Roadmap includes modelling based on peak emissions for each current and forecast future operations over their project life. Abatement initiatives are proposed in accordance with forecasted technology readiness and procurement cycles.

Figure 12-2: The Proponent Roadmap to Net Zero Emissions

To align with the objectives and targets of its *Roadmap to Net Zero Emissions*, the Proponent will develop a Greenhouse Gas Management Plan (GHGMP) for the Proposal. The GHGMP will also be consistent with the EPA GHG guidelines (EPA 2020j) and will include details of the following measures to reduce and offset GHG emissions in the short-term as well as over the life of the Proposal:

- Continually reviewing alternate energy supplies for stationary and mobile emissions sources;
- Supporting the development of large-scale haul truck electrification systems through the “Charge-on Innovation” challenge facilitated by Austmine;
- Minimising the clearing of native vegetation, and progressively revegetating disturbed areas that are no longer required for construction or operational activities as soon as practicable; and
- Assess opportunities to avoid carbon in the Proposal design; and reduce embedded carbon in construction materials.

The GHGMP will be completed prior to implementation of the Proposal.

12.6 Assessment and Significance of Residual Impacts

12.6.1 Benchmarking Against Comparable Proposals

The Proposal is an infrastructure project encapsulating a road network, power plant and stationary non-transport equipment to facilitate shipping activities. As a result, there are limited reported data on emissions associated with Port Operations for comparison and benchmarking.

An emission intensity has been estimated for each aspect including 3rd Party mining and logistics to allow and understanding of the total carbon emission intensity of the ore, from mining to when it is loaded onto the OGV for export. This is outside of the scope of the project under assessment but allows comparison against global production and other Pilbara iron ore operations. The three aspects considered for benchmarking are summarised in **Table 12-4**.

Table 12-4: Project Aspects used for Benchmarking Purposes

Project Aspect	Example for benchmarking	Expected Scope 1 emissions (tCO ₂ -e per year)	Expected emissions Intensity (kgCO ₂ -e/ dry Tonne of ore)
3 rd Party Mining	Mining and Processing at the West Pilbara Iron Ore Project.	228,501	7.6
3 rd Party Haulage	Transport Iron Ore from the West Pilbara Iron Ore Project to Ashburton Port.	137,915	4.6
Port Operations and Transshipping	Port Operations and Transshipping to OGV.	97,788	3.2

Therefore, a representative max total carbon intensity of **15.4 kgCO₂-e / dry tonne of ore**, or 14.6 kgCO₂ e tonne as shipped (which includes 6% DEM) is provided for the Proposal.

This carbon intensity value is comparative to the other major iron ore mining in the Pilbara and sits within the 36th percentile of carbon intensity against average global carbon intensity for iron ore production (Scope 1 and Scope 2 emissions) (see **Table 12-5, Figure 12-3**).

Table 12-5: Carbon Intensity Benchmarking in the Pilbara, WA

Period	Project	Ore production (t) per annum	Total scope 1 Emissions (tCO ₂ -e / per year)	Emissions Intensity (kgCO ₂ -e tonne of ore)
Ashburton Emissions Intensity				
	RHIO-JV Mining	31,800,000 ²	228,501	7.2
	RHIO-JV Pit to Port Haulage	31,800,000 ²	137,915	4.3
	Ashburton Port Operations & Trans-shipping (This Proposal)	31,800,000 ²	97,788	3.1
	TOTAL (includes 3rd Party Mining from RHIO-JV)	31,800,000 ²	464,204	14.6
Average emissions intensity for comparative Proposals in the Pilbara				
2021	FMG - Pilbara Iron Ore1	182,200,000	2,113,193	15.6
2021	RTIO - Pilbara Iron Ore1	266,800,000	3,000,000	11.3
2021	BHP - Pilbara Iron Ore1	252,000,000	3,511,027	13.9

¹ Based on publicly reported data for Mining and Transport, uncertainty if includes Port operations.
² Production reported including DEM (6%)

Iron Ore

Global Carbon Intensity Curves
 (Total Scope 1 & 2 Emissions)

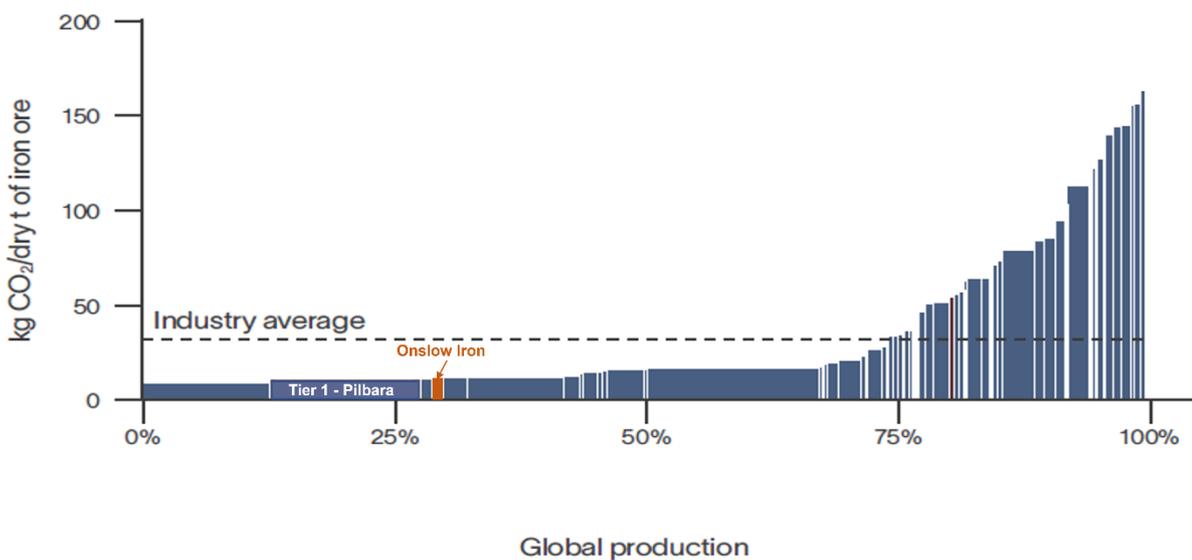


Figure 12-3: Carbon Intensity Curves for Iron Ore Mining (Scope 1 and Scope 2 Emissions)

12.6.2 Cumulative Impacts

The Proposal adds to Western Australia's contribution of GHG emissions, but this contribution will decrease over time to the point of Net Zero emissions by 2050.

In 2019-2020, GHG Scope 1 emissions in WA totalled approximately 68.3 million t CO₂-e (CER 2021). For comparison, the peak Scope 1 emissions (from values in **Table 12-3**) for the Proposal would represent an increase of approximately 0.14% of the WA Scope 1 emissions for that period.

12.7 Environmental Outcomes

The Proposal will contribute to GHG emissions, primarily from the consumption of fuel (diesel and piped natural gas [PNG]), vegetation clearance and electricity generation. The Proposal is predicted to contribute to peak annual emissions of 97,788 tCO₂-e/yr of Scope 1 emissions (**Table 12-3**).

This is considered a conservative assessment as it assumes that no new technologies are developed and implemented by year 11 of the project. The Proponent has committed publicly to achieving net zero greenhouse gas emissions by 2050 and has commenced the implementation of a roadmap to achieve its target. The Proponent will prepare a GHGMP specific to the Proposal taking into consideration any applicable EPA Guidance.

Proposal design and planned operations and mitigation measures have been implemented to avoid and reduce GHG emissions wherever possible. The Proponent commits to continuously improving operations and subsequent emissions over the life of the Proposal. It is expected that the Proposal can be managed to meet the EPA's objective for GHG emissions.

13. SOCIAL SURROUNDINGS

The EPA's objective for social surroundings is *'is to protect social surrounding from significant harm'* (EPA 2020e).

13.1 Policy and Guidance

The Proponent has considered published policy and guidance relevant to this factor as summarised in **Table 13-1**.

Table 13-1: Policy and Guidance for Social Surroundings

Policy / Guidance	Consideration
Instructions on how to prepare an Environmental Review Document (EPA 2020b)	This RSD has been prepared in accordance with the Instructions.
Statement of Environmental Principles, Factors and Objectives (EPA 2020e)	Impacts of the Proposal have been assessed against the EPA objective for all relevant factors.
Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA 2020c)	The attached TEMP and MCEMP has been prepared in accordance with this guidance.
Environmental Factor Guideline – Social Surroundings (EPA 2016i)	The information provided in this chapter addresses the 'considerations for environmental impact assessment' listed in this document.
Guidance Statement No. 41: Assessment of Aboriginal Heritage (EPA 2004b)	<p>This guidance considers 'Aboriginal heritage' in circumstances where heritage values are linked directly to the physical and biological attributes of the environment and when the protection and management of those attributes are threatened as a result of a proposed development.</p> <p>All Aboriginal heritage surveys conducted for the Proposal will be conducted in accordance with the guidance in this document.</p>
Aboriginal Heritage Due Diligence Guidelines (DAA and DPC 2013)	<p>The purpose of these guidelines is to assist land users to be more aware of how their activities could adversely impact an Aboriginal site.</p> <p>The Proponent remains mindful of these guidelines in evaluating how Proposal activities may affect Aboriginal heritage.</p>
Engage Early: Guidance for proponents on best practice Indigenous engagement for environmental assessments under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) (DoE 2016b)	<p>Guidance for proponents on best practice Indigenous engagement for environmental assessments.</p> <p>The Proponent has actively taken steps to identify and engage with Traditional Owner and other Aboriginal stakeholders as early as possible in the development of the Proposal.</p>

13.2 Receiving Environment

13.2.1 Environmental Studies

The studies outlined in **Table 13-2** were undertaken in relation to social surroundings and the assessment of potential impacts primarily draws on information included in these reports.

Table 13-2: Studies for Social Surroundings

Studies and Surveys	Scope and Timing	Survey / Study Effort	Consistency with Guidance and Limitations	Key Findings
<p>Tetra Tech Coffey (October 2021)</p> <p>Ashburton Infrastructure Project - Visual Impact Assessment</p> <p>(All information is captured in Section 13.5.2)</p>	<p>Prepare photomontages.</p> <p>Undertake visual analysis of Proposal from selected observation points.</p>	<p>Survey design, methodology and report-writing adhered to relevant principles. Observer locations in relation to the DE based on consideration of expected significant or prominent view locations.</p>	<p>There is no guidance on the assessment of visual impacts specific to WA.</p> <p>Interpretation of the significance of the changes to visual landscapes resulting from the Proposal requires qualitative or subjective analysis (albeit based on quantitative/objective inputs underpinning the analysis). Therefore, others may arrive at different conclusions on the significance of the effect of the Proposal on their visual experience at the range of observe locations as presented in this document.</p>	<p>This assessment showed that views from all key observer points along both the haul road and landside DEs are unlikely to be significantly affected by the Proposal.</p>
<p>Cosmos Archaeology (2021) Ashburton Infrastructure Project – Maritime Heritage: Non-Aboriginal Desktop Assessment</p> <p>(Appendix V)</p>	<p>Seabed impacts arising from the implementation of the proposed works – such as maritime infrastructure development, channel/turn pocket dredging, indicative anchorages and spoil dumping.</p> <p>Maritime heritage confined to shipwrecks.</p> <p>Examined maritime archaeological sites, defined as shipwrecks, aircraft, dumped materials, maritime infrastructure and associated deposits on or under the seabed below the highest astronomical tide.</p>	<p>Desktop assessment of various sources to identify known and potential shipwrecks and other maritime archaeological sites that are or may be present within the study area (encompassing existing port related areas and proposed areas designated for anchorages and development work).</p>	<p>The assessment included a review of marine geophysical survey data to identify maritime archaeological features – this was limited to one data source, bathymetric data supplied by the Proponent.</p>	<p>One known shipwreck was identified in study area - directly east of the existing Ashburton port facility - interpreted as a modern fishing trawler, dated from the 1970s.</p> <p>No other known or potential shipwrecks occur in the study area. Five potential shipwrecks occur near the study area.</p> <p>No other potential maritime archaeological sites occur within the study area.</p>
<p>Lloyd George Acoustics (2021). Environmental Noise Assessment - Ashburton Project</p> <p>(Appendix W)</p>	<p>Assessed the environmental noise impacts from both the construction and operation of the haul road and the landside port operations. Results compared against the relevant criteria and recommendations provided on noise mitigation where appropriate.</p>	<p>Modelling study to assess noise levels at sensitive receptors including Red Hill Station Homestead, Peedamulla Station Homestead and Campground, Cane River Lore Ground, Chevron Accommodation Village and Wheatstone Facility.</p>	<p>SoundPLAN 8.2 software applied using CONCAWE algorithms in accordance with requirements of the Environmental Protection (Noise) Regulations 1997 (the Noise Regulations).</p> <p>No limitations noted.</p>	<p>Noise levels from construction and operation of the haul road and landside port were predicted to comply with the requirements of the Noise Regulations at all times.</p>
<p>ETA (2021a)</p> <p>Desktop Air Quality Study to determination monitoring locations</p> <p>(Appendix X)</p>	<p>Desktop study to determine potential monitoring locations and equipment at the Port.</p>	<p>N/A</p>	<p>The study was undertaken in accordance with AS/NZS 3580.1.1:2016 guidance</p>	<p>Monitoring locations and equipment recommended at various locations, including:</p> <ul style="list-style-type: none"> • Onslow (regulatory monitor); • Chevron Wheatstone (non-regulatory monitor); and • Onslow Salt (non-regulatory monitor).
<p>ETA (2022)</p> <p>Air Quality Assessment -Ashburton Infrastructure Project</p> <p>(Appendix Y)</p>	<p>Air Quality assessment to determine potential air quality impacts from the Port Landside facilities through dispersion modelling.</p>	<p>Modelling of NO₂ and particulate matter (TSP, PM₁₀ and PM_{2.5}), taking into account:</p> <ul style="list-style-type: none"> • Site-specific meteorological data; • Background air quality; • Estimated Proposal emissions; • Discrete sensitive receptor locations; an • Two model scenarios – operations at 30 Mtpa and 40 Mtpa. 	<p>The modelling has been conducted using the Weather Research and Forecasting (WRF) model, a mesoscale numerical weather prediction model coupled with the CALMET/CALPUFF model suite.</p> <p>Emission rates were estimated using recognised and accepted methods of emissions estimation, which included published emission factors from the National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Mining.</p>	<p>Under the modelled maximum operating Port throughput of 40 Mtpa, although the Proposal will contribute to an increase of particulate air emissions, all cumulative values will remain within guideline air quality limits at sensitive receptors.</p>

13.2.2 Aboriginal Social and Cultural Heritage

13.2.2.1 Native Title

Native Title is the set of rights and interests over land and waters in Australia and its Territories that have a foundation in traditional Aboriginal land-related law, lore and custom. These rights are given recognition under the Commonwealth *Native Title Act 1993*, which balances them against other land-related rights and interests in the area in question.

Native title rights and interests may include rights to:

- Be involved in land use decision-making processes;
- Access an area for traditional purposes, like camping or ceremonies;
- Visit and protect important places and sites;
- Hunt, fish, and gather food or traditional resources like water, wood and ochre; and
- Teach law and custom on country.

Australian law recognises that native title exists where Aboriginal people have maintained a traditional connection to their land and waters, continue to observe their traditional laws and customs and were acts of government have not extinguished it.

Portions of the Haul Road and Landside DEs are on the land the subject of two native title determinations (**Figure 13-1**):

- Thalanyji (WCD2008/003); and
- Kuruma Marthudunera Part B (WCD2018/003).

Buurabalayji Thalanyji Aboriginal Corporation (BTAC) is the PBC representing the Thalanyji People and the Robe River Kuruma Aboriginal Corporation (RRK) is the PBC that holds the native title rights and interests on trust for the Kuruma Marthudunera people.

The PPA has a heritage agreement with the Thalanyji People guiding consultation and other matters that may affect Thalanyji interests including within the Landside DE. The Proponent activities within the Landside DE will be managed under a Heritage Management Plan approved by the PPA.

No native title determination extends over the Nearshore and Marine DEs.

13.2.2.2 Consultation and Engagement with Traditional Owners

Early and ongoing consultation has occurred with Aboriginal knowledge holders from the region, including the RRK on behalf of the Kuruma Marthudunera peoples and the BTAC on behalf of the Thalanyji, and as well as various members of the Banjima people who are the Aboriginal holders of Peedamulla Station pastoral lease (**Section 13.2.2.3**).

The Proponent has further enhanced an already strong relationship with the RRK over the history of the Proposal and continues to foster this relationship with regular meetings. This positive engagement is reinforced with the community through activities such as employment forums and donations of educational materials for the group. Consultation with RRK and Kuruma Marthudunera Traditional Owners concerning the Proposal has included:

- Proposal overview and progress updates;
- The Proponent's commitment to its relationship with RRK;

- Three specific heritage advisory committee meetings to discuss the content of a Social and Cultural Heritage Management Plan (SCHMP), with a further on-country meeting planned. The on-country meeting has been delayed due to the death of an Elder and will be reconvened once this 'sorry business' is concluded;
- Planned heritage surveys, including the schedule and resolution of concerns; and
- Business and community development opportunities, including rehabilitation of exploration areas.

The Proponent is also in the process of developing a SCHMP, working collaboratively with the RRK for the last six months to establish a comprehensive SCHMP for the Proponents interests in RRK country. The SCHMP is aimed at managing the following objectives identified under through Social Surroundings guidance and consultation and agreed to by the Proponent and RRK:

- Establish a framework and process to identify and record significant heritage sites and cultural values in collaboration with RRK;
- Avoid where possible and minimise impacts to significant heritage sites and cultural values
- Proactively manage and minimise potential indirect impacts, including visual, noise, dust and vibration impacts to social and cultural places and activities;
- Where possible, maintain access to areas for RRK to undertake traditional activities;
- Manage and restrict access to cultural heritage sites by personnel that are not members of the RRK;
- Avoid where possible and minimise impacts to culturally significant flora and fauna;
- Avoid where possible and minimise changes to water regimes of water resources known to have Aboriginal cultural values;
- Establish a framework for ongoing consultation with RRK through the life cycle of the projects; and
- Work collaboratively with RRK to identify training, employment and contracting opportunities in association with, but not limited to the objectives above.

The SCHMP is currently being prepared allowing for careful consideration and input from all parties. Current collaborative development efforts and, an indicative timeline of completion of the SCHMP.

Proponent engagement with BTAC and the Thalanyji people commenced in 2020. Consultation with BTAC and Thalanyji Traditional Owners in relation to the Proposal has included:

- Proposal overview and progress updates;
- Consultation and agreement on heritage surveys within the DE; and
- Employment, training and business development opportunities.

The Proponent is also awaiting results from on-ground surveys of the Proposal located within the Thalanyji determination to determine the requirements and scope of any SCHMP that may be required.

13.2.2.3 Peedamulla Station

The Haul Road DE intersects Peedamulla Station in the lower Cane River area. This area sits on land over which no sustainable native title determination application (native title claim) has yet been lodged. Parts of this area were formerly subject to claims by the Noala People and Thalanyji People. The pastoral lease is; however, held by the Jundaru Aboriginal Corporation, with the Ashburton Aboriginal Corporation as sublessee. Both corporations are owned by the Banjima People. The station is managed by and for Aboriginal people, most of whom have cultural and heritage ties to the area. Registered native title determinations surrounding the Peedamulla/lower Cane River area include the Thalanyji (WCD2008/003) as discussed in **Section 13.2.2.1**, as well as Yaburara & Mardudhunera (WCD2018/006).

Consultation with Peedamulla Station owners in relation to the Proposal has included:

- Proposal overview, options and progress updates.
- Consultation to discuss access arrangements.
- Development of a pastoral access agreement; and
- Agreement to undertake mapping of places of significance to them within the Haul Road DE.

13.2.2.4 Registered Aboriginal Heritage Sites and Other Heritage Places

The AH Act protects all Aboriginal heritage sites in WA, whether or not they are registered with the DPLH. Under Section 18 of the AH Act, consent is required from the Minister for Aboriginal Affairs for any activity which will negatively impact Aboriginal heritage sites. Authorisation can also be granted under Section 16 of the AH Act to enter, excavate, examine or remove anything on an Aboriginal heritage site (e.g., for archaeological purposes).

Several historical heritage surveys have been conducted within parts of the DE (**Figure 13-1**). These include extensive surveys conducted by the PPA (which has an established agreement with the Thalanyji) within the Landside DE. Prior surveys cover the NWCH alignment and eastern parts of the alignment on Red Hill Station within the Haul Road DE.

No registered site listed under the DPLH Aboriginal Heritage Inquiry System under the AH Act occur within the Proposal IF, and only one site, lodged (not registered) with DPLH (Site ID 28200: Toolunga Creek Heritage Site 4 – Artefact/Scatter type site), occurs in any Proposal DE. This site is located approximately 800 m south of the proposed NWCH crossing – the bulk of the site sits outside the DE, with a small part extending into the Haul Road DE by approximately 14 m.

Heritage surveys (archaeological and ethnographic) specific to the Proposal have been undertaken with additional surveys planned for October-November 2021 along the Haul Road DE. Survey areas are shown in **Figure 13-1**. Relevant results from the surveys are expected to be available later in 2022.

The potential for submerged Aboriginal heritage to be present in the Nearshore and Offshore DE has been considered. A preliminary desktop review indicated sediments carried in the highly dynamic system of the Ashburton coast has buried most remnant ancient and now submerged, terrestrial landforms in the area. It is understood no concern associated with cultural heritage in 'sea country' has been raised by the Thalanyji People in heritage surveys undertaken for the ANSIA.

13.2.2.5 Cultural Uses

Although not a site registered under the AH Act, the Lower Cane River has high cultural heritage significance due to the proximity of the Cane River Lore Ground and associated place, including some registered under the Act (e.g. Registered Site 11405 – Cane River). The Cane River Lore Ground, on the eastern side of the river, is located approximately 1.2 km from the Haul Road DE and approximately 2 km from the Haul Road IF at its closest point, on the western side of the river. The proposed Cane River crossing is located approximately 4 km south of the Law Ground. Survey work in 1974 noted that that Aboriginal people were travelling from Yandeyarra, Roebourne and Port Hedland to attend ceremonies at Cane River, with attendance estimated from historical material to be in the hundreds (DoW 2011). The Cane River Lore Ground is known to be used for initiation ceremonies with songs related to the travels and exploits of ancestral beings along dreaming tracks, which are generally rivers. The pools, waterways and the vegetation which accesses water are important features associated with the Law Ground.

The Proponent recognises that potentially important cultural values can be expected to be held by Traditional Owners in relation to areas and landforms such as waterways, waterholes and rock shelters or, for example, where bush foods and medicines are known to be found; however, other than the Lore Ground, no other specific culturally significant area or uses have been identified to occur within or in proximity to the Haul Road or Landside DEs through consultation with Traditional Owners to date.

13.2.3 European Heritage and Cultural Values

No significant sites of European heritage or related cultural values occur within the Haul Road or Landside DEs.

One known shipwreck was identified in the marine archaeology study area (here in referred to as study area) adjacent to the Landside DE, directly east of the existing Ashburton port facility - interpreted as a modern fishing trawler, dated from the 1970s (Cosmos Archaeology 2021). No other known or potential shipwrecks occur within the study area. Other shipwrecks were found to have been wrecked in the nearby area of Onslow and Ashburton; however, these fall outside of the study area.

The Shire of Ashburton heritage inventory (Element 2019) lists places of non-Aboriginal heritage value within the local government area. The closest heritage places to the Haul Road and Landside DEs include:

- Peedamulla Homestead (approximately 1.6 km from the DE);
- Old Onslow Townsite (approximately 5 km); and
- Red Hill Homestead (approximately 8 km).

13.2.4 Amenity, Tourism, Recreational and Community Uses

The region where the Proposal is located is considered sparsely populated. The Shire of Ashburton has an area of 105,647 km² with a population of approximately 10,000, mostly residing in the towns of Tom Price, Onslow, Pannawonica and Paraburdoo (Shire of Ashburton 2021). The small Aboriginal communities of Bindi Bindi, Wakathuni, Bellary, Youngaleena and Ngurawaana are also located in the Shire (Shire of Ashburton 2021). Of these, only Bindi (located in the Onslow townsite) is in proximity to the Proposal.

The areas within and adjacent to the Haul Road and Landside DEs are not known to be used for any significant recreational, and other community uses. The Peedamulla Station campground and homestead are located approximately 1.6 km and 2.7 km from the Haul Road DE, respectively, and the Red Hill Station homestead is located approximately 8 km North of the Haul Road DE. Other potentially sensitive receptors in the vicinity of the Proposal, include the Wheatstone accommodation village within the ANSIA, which is approximately 8 km south of the Landside DE and the Onslow townsite approximately 10 km to the northeast.

The Haul Road and Landside DEs are located within a generally flat landscape with coastal plain and lowlands of mostly low relief in the western and central parts, with the terrain becoming hillier at the eastern end of the Haul Road DE as it enters the western Hamersley Ranges. Because of this, there are no significant high points identified within or in the vicinity of the DEs that are regularly used as lookouts by tourists or locals.

With a few exceptions, such as Onslow Road, Onslow-Peedamulla Road and NWCH the Haul Road DE is not located near or intersecting roads commonly accessed by the public, and the Landside DE is within the industrial zone of the ANSIA. The proposed haul road will pass under the NWCH, potentially affecting the amenity for road users at this location.

Offshore, the Mackerel Islands represent a significant tourism site for the region, with resort accommodation available on Thevenard Island. Visitors can participate in a range of land- and sea-based activities, including fishing, diving/snorkelling and turtle and whale watching in waters around Thevenard Island, approximately 10 km east of the Offshore DE.

The coastal region's numerous creek systems, mangroves, rivers and beaches provide shore and small boat fishing for various finfish and invertebrate species such as crabs. Offshore islands and reef systems provide recreationally caught species. Most recreational fishing in the area is line fishing from boats in around offshore islands and reefs (O2 Marine 2021c). Recreational fishing also occurs in nearshore coastal waters and small creek mouths along the coast (Chevron 2010a), Fishing Spots 2021). However, recreational fishing is restricted within the nearshore DE due to a boating safety exclusion zone established at the Port. The nearest creek mouth is approximately 1.5 km east of the proposed port, at Hooley Creek. A boat ramp and associated facilities is located near the mouth of Four Mile Creek a further 2 km east of Hooley Creek, but the region's main boat ramp is located on Beadon Creek at the Onslow townsite.

Commercial fisheries in the Onslow region target a variety of species, including finfish, crustaceans, molluscs and echinoderms. Prawn fishing is the largest fishery in the region; however, is not permitted in the Nearshore DE; the following State commercial fisheries occur in the vicinity of the Proposal (O2 Marine 2021c):

- Onslow Fish Trawl;
- Mackerel Managed Fishery; and
- Pilbara Demersal Trap and Line.

Consultation with the Western Australian Fishing Industry Council is planned to discuss the Proposal in relation to commercial and recreational fishing.

Locations identified as key sensitive receptors with respect to their potential to be affected by air quality changes, noise or odour include:

- Onslow townsite;
- Cane River Lore Ground;
- Peedamulla campground and homestead;
- Red Hill Station homestead;
- Chevron Accommodation Camp;
- Onslow Salt evaporation ponds; and
- Chevron Wheatstone gas processing facility.

It is noted that the Chevron Accommodation Camp is located on industrial zoned land and looks to have a significant laydown areas attached to it, therefore it was categorised as Industrial under *Schedule 1, Part A(8) of the Environmental Protection (Noise) Regulations 1997 “caretaker’s and like residences attached to or forming part of the premises referred to in this Part” (LGA 2021)*. The Onslow Salt Evaporation Ponds have also been categorised as Industrial. This categorisation has an assigned noise level of 65 dB L_{A10} for all times of the day.

Should it be deemed that the Chevron Accommodation Camp does not form part of an industrial use and is a ‘noise sensitive premises: highly sensitive area’, the influencing factor and therefore the assigned level, can be determined based on local government land use maps. The Chevron Accommodation Camp is located within the ANSIA and based on this land zoning the calculation for the influencing factor is shown in **Table 13-3** below. The most critical time period in terms of compliance with regulations would be the night period, and the allowable noise levels under the regulations during this time a ‘noise sensitive premises: highly sensitive area’ is 35 dB L_{A10} + influencing factor. Using the influencing factor of 20 dB the allowable level during this time period would be 55 dB L_{A10}. It should be noted that modelled noise levels are modelled to be below levels assigned for noise sensitive premises at the Chevron Accommodation Camp.

Table 13-3: Influencing Factor for the Camp’s Assigned Noise Levels

Receiver	Description	Within 100 metre radius	Within 450 metre radius	Total
Chevron Accommodation Camp	Industrial land	100%	100%	20 dB
	Commercial land	0%	0%	0 dB
	Transport Factor			0 dB
	Total			20 dB

13.2.5 Historical Development

Of the industries developed in the region following European colonisation the most prominent have been pastoralism since the mid 19th century and mining - and oil and gas in coastal and offshore areas - since the mid 20th century. Fishing, pearling and tourism are also key elements of the local economy (Shire of Ashburton 2021). The 120,000 ha Cane River Conservation Park (CP), on the southern boundary of Peedamulla Station and south of the Haul Road DE, was formed on land previously used for pastoral leases.

Existing and historical impacts on cultural heritage in the Thalanyji (WCD2008/003) native title determination area are expected to have occurred from grazing within pastoral stations – through impacts on waterholes and other cultural sites, native vegetation and native fauna, although the extent and significance of any such impact is not readily assessed. The formation in 2000 of the Cane River CP, within Thalanyji country, is expected to have effectively mitigated impacts from historical cattle and sheep grazing on the ex-station areas used to form the park. Grazing from pastoral activities is similarly expected to have had some impact on cultural heritage of the Kuruma Marthudunera Part B (WCD2018/003).

Existing and historic mining and/or oil and gas and other industrial projects within the Thalanyji (WCD2008/003) native title determination area include the Macedon Domestic Gas Plant, the Chevron Wheatstone Project, both within the ANSIA, and Onslow Salt Project and the Shire of Ashburton's Pilbara Regional Waste Management Facility. Within the Kuruma Marthudunera Part B (WCD2018/003) native title determination, the major projects are all mining-based, including the Proponent's Bungaroo South, APIM's WPIOP and the Rio Tinto's Mesa A and Mesa J projects.

Mining in the region will likely have affected Aboriginal cultural heritage through degradation and direct disturbance to heritage sites and cultural landscapes. Substantial detail on registered sites and other aspects of cultural heritage is typically not provided within existing environmental assessment documents, and statistics of the number and location of Section 18 consents issued under the AH Act are not publicly available, limiting any estimate of the number of sites that may have been disturbed within Thalanyji and Kuruma Marthudunera native title claims. Loss of access to culturally important sites and places can be another issue raised by Traditional Owners with respect to mining projects; however, to date no group has indicated a concern of this nature to the Proponent concerning this Proposal.

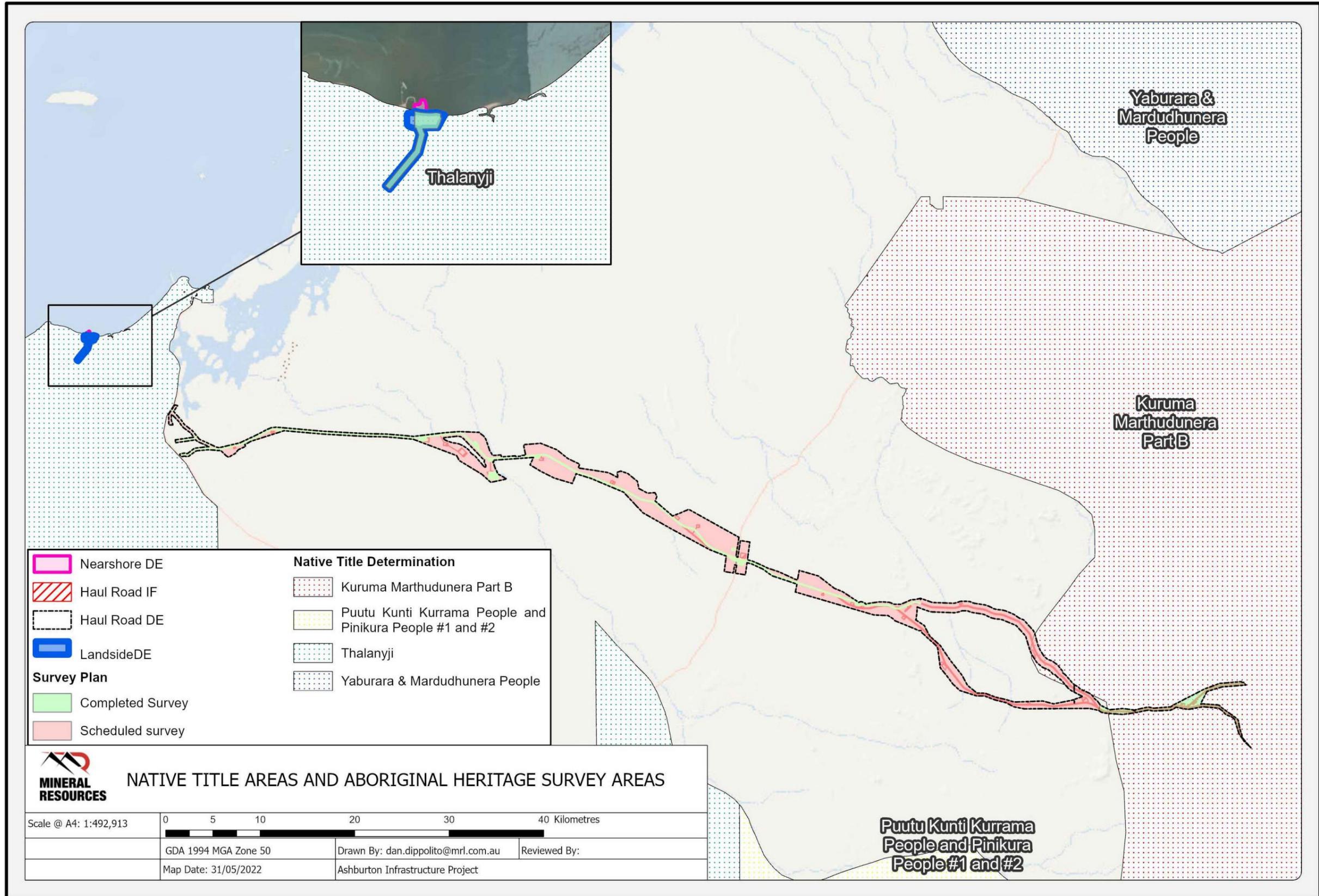


Figure 13-1: Native Title Areas and Aboriginal Heritage Survey Areas

13.3 Potential Impacts

The potential direct, indirect and cumulative impact from development within the Haul Road DE on social surroundings are identified as follows.

13.3.1 Direct Impacts

The potential direct impacts of the Proposal on social surroundings have been identified as:

- Disturbance of sites of cultural heritage significance; and
- Development of road and other infrastructure which may result in impacts on visual amenity.

13.3.1.1 Disturbance of Sites of Cultural Heritage Significance

There are no sites of Aboriginal or European cultural heritage significance currently identified within the Proposal DE, or within the Nearshore and Offshore DEs, with the exception of a marginal overlap of a lodged site (Site ID: 28200) with the Haul Road DE approximately 800 m south of the NWCH crossing. Forthcoming heritage surveys will confirm if any Aboriginal heritage sites do occur outside the areas already covered by prior surveys. The Proponent acknowledges waterways, waterholes and rock shelters are, for example, areas where bush foods and medicines are known to be found and therefore may hold cultural significance; however, no specific areas have been identified by Traditional Owners to date.

At its closest point, the Cane River Lore Ground is approximately 2 km north of the Haul Road DE and will not be directly impacted by the Proposal.

The Proponent is committed to **avoiding** sites identified within the Haul Road IF, including providing a suitable buffer to minimise indirect disturbance, through design alterations to the Haul Road IF. If there are particular sites that cannot be avoided the Proponent will seek Ministerial consent under Section 18 of the AH Act, in consultation with the relevant Traditional Owners.

13.3.1.2 Impacts to Visual Amenity

The locations which were assessed as having the most potential for visual amenity impacts were coastal areas near the proposed Port and the NWCH crossing.

Other locations considered for assessment of impact on visual amenity included:

- Coastal areas - near the proposed Port at Seaview Drive and Onslow townsite at the Onslow Salt pier;
- NWCH crossing;
- Warrirda Road approach to Port DE;
- Cane River Lore Ground;
- Peedamulla Old Homestead and Campground; and
- Red Hill Station homestead.

13.3.2 Indirect Impacts

The potential indirect impacts of the Proposal on Social Surroundings have been identified as:

- Disturbance of places of cultural significance, plants and animals with cultural associations due to dust and noise;
- Impacts from haul road on pastoralists – noise and inhibition of staff and livestock movement, including access to bores and watering points.
- Impacts to other places due to dust or noise; and

- Impacts from Port infrastructure and use on commercial and recreational fishing.

13.3.3 Cumulative Impacts

The Proposal has potential to contribute to the following cumulative impacts to Social Surroundings at a regional scale:

- Loss of native vegetation and fauna habitat of cultural importance.
- Potential disturbance to sites of cultural heritage significance; and
- Effects on commercial and recreational fishing due to port infrastructure and use.

13.4 Mitigation

The Proponent has applied the mitigation hierarchy (avoid, minimise and rehabilitate) during the Proposal design to reduce the potential impacts to social surroundings. Potential impacts have been avoided or minimised through design of the Haul Road DE and IF. Areas of land disturbed as a result of implementing the Proposal will be progressively rehabilitated to agreed post-mining land use outcomes and this will be documented in a MCP that will accompany the Mining Proposal when Mining Act approvals are submitted. Specific mitigation measures are summarised in **Table 13-4** and discussed further below.

A number of management plans have been prepared for the Proposal to minimise the potential impacts of project construction and operational activities on Social Surroundings. The specific management plan that has been prepared that will assist to mitigate potential impacts on Social Surroundings includes:

- A **Terrestrial Environment Management Plan (TEMP)**. The TEMP has been prepared to detail the mitigation and management measures the Proponent proposes to implement to reduce direct and indirect impacts to surrounding inland waters, flora, vegetation, fauna and social surroundings. The management objectives for the plan relate to specific management objectives on each environmental factor.
- A **Social and Cultural Heritage Management Plan (SCHMP)**. SCHMP's will be prepared with each Traditional Owner group and implement best-practice management for Aboriginal heritage, including the close involvement of Traditional Owners in management and monitoring. The SCHMP's will be aimed at managing the following objectives identified under through Social Surroundings guidance and consultation and agreed to the Proponent and each Traditional Owner group where required.
- A **Cultural Heritage Management Plan (CHMP)**. The has been prepared by the PPA covering the Landside DE – under this plan Thalanyji Monitors will be present during first disturbance ground clearing activities. The Proponent is preparing a CHMP for works within the PPA footprint that aligns with the PPA CHMP.

Table 13-4: Proposed Mitigation Measures for Social Surroundings

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset Required
<p>Direct impact: Disturbance of sites of cultural heritage significance</p> <p>No sites identified within IF, one site marginally within DE, with further heritage surveys planned –Aboriginal heritage sites of very high cultural heritage significance, if identified, will be avoided and other confirmed sites will be assessed under Section 18 of the AH Act</p>	<p>The Proposal has been redesigned to avoid the Cane River Lore Ground, including an appropriate buffer, in consultation with Traditional Owners, to avoid any indirect disturbance.</p> <p>Potentially significant creekline crossings cannot be avoided.</p> <p>With the exception of one lodged site (ID: 28200), no Aboriginal heritage sites have been identified to date – if any sites are identified within the Haul Road DE the Proponent will assess options for amending the alignment to avoid the site – very significant sites will be avoided regardless.</p>	<p>The Proponent will develop a SCHMP with each Traditional Owner group and implement best-practice management for Aboriginal heritage, including the close involvement of Traditional Owners in management and monitoring.</p> <p>A Cultural Heritage Management Plan (CHMP) has been prepared by the PPA covering the Landside DE – under this plan Thalanyji Monitors will be present during first disturbance ground clearing activities. The Proponent is preparing a CHMP for works within the PPA footprint that aligns with the PPA CHMP.</p> <p>Ensure relevant Aboriginal heritage material is appropriately salvaged and stored prior to disturbance, in line with Traditional Owner wishes and statutory approvals.</p> <p>Minimise clearing and access restrictions within areas used for cultural purposes or have cultural significance (e.g., at watercourse crossings).</p> <p>Ensure sediment controls in place during construction at waterway crossings upstream of any significant waterholes.</p>	<p>Implement MCP.</p> <p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Strategy (Appendix I).</p>	No
<p>Development of road and other infrastructure which may result in impacts on visual amenity</p>	<p>The Proposal has been designed to avoid areas of regular public traffic and the Cane River Lore Ground.</p>	<p>All infrastructure is designed to be as compact and/or lowest height profile as practicable.</p> <p>Dust suppression measures will be implemented where dust is visible to minimise levels at all times.</p>	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Strategy (Appendix I).</p>	No
<p>Disturbance of places of cultural significance, plants and animals with cultural associations due to dust and noise</p>	<p>Haul road will be sealed upon completion of construction, so dust will only potentially be an issue during construction phase of the Proposal.</p>	<p>Minimise clearing and access restrictions within areas used for cultural purposes.</p> <p>The Proponent will implement dust controls including:</p> <ul style="list-style-type: none"> Avoid any high dust emission works during high wind (e.g., vegetation clearing) and implement additional use of dust management measures (such as water carts and misting sprays) where these works are not avoidable. Implement dust suppression measures including utilising water carts and misting sprays on unsealed roads and access tracks, cleared areas and at locations of high dust risk during construction. Measures will be implemented where dust is visible and based on predicted meteorological conditions. Water used for dust suppression will be sourced from nearby groundwater bores along the Haul Road alignment. Utilise dust control strategies at the Port Facility such as bin covers, dust extractors, dust containment enclosures; dump pockets where / when dust is identified as an issue Maintain any dust-generating material at the Port facility at Dust Extinction Moisture (DEM) levels (or slightly above to account for evaporative losses) Vehicle movements at the Port facility are to be in accordance with PPA's Traffic Management Plan (Ashburton) and kept to established roads, flow paths and speed limits Temporarily cleared areas will be progressively sealed or rehabilitated reducing the area of bare earth susceptible to dust lift off. The Haul Road will be sealed to minimise dust emissions during operation. 	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Strategy (Appendix I).</p>	No

Potential Impact	Proposed Mitigation			
	Avoid	Minimise	Rehabilitate	Offset Required
		<ul style="list-style-type: none"> Implement Port Dust Management Procedure and Land Clearing Procedure. Establish community complaints register to log when and the reason for complaints occurring. <p>Noise levels from construction and operation are predicted to comply with the Noise Regulations however the Proponent will implement noise standard controls including:</p> <ul style="list-style-type: none"> Ensure all relevant plant and machinery is fitted with noise dampening equipment. 		
Indirect impact from haul road on pastoralists – noise and inhibition of staff and livestock movement, including access to bores and watering points	Not applicable	<p>Noise levels from construction and operation are predicted to comply with the Noise Regulations however the Proponent will implement noise standard controls including:</p> <ul style="list-style-type: none"> Ensure all relevant plant and machinery is fitted with noise dampening equipment; and Construction will be minimised at night in the vicinity of sensitive premises such as station homesteads. <p>Underpasses will be installed under the haul road to facilitate light vehicle traffic and stock movement in locations to be agreed with the station leaseholders.</p> <p>The Proponent will ensure existing access to bores and watering points is maintained wherever possible - if access cannot be maintained affected bores and watering points will be replaced with new bores or watering points to the agreement of the pastoralist or tenement holder.</p>	Not applicable.	No
Impacts to other places due to dust or noise	<p>Haul road will be sealed upon completion of construction, therefore dust emissions will low risk during operation.</p> <p>Noise levels from construction and operation on key receptors are predicted to comply with the Noise Regulations</p>	<p>The Proponent will implement noise standard controls as described above.</p> <p>The Proponent will implement dust controls as described above and detailed in the TEMP.</p> <p>Note: The Chevron Accommodation Camp is not impacted by noise levels from the proposal even if reclassified as a noise sensitive premise, so no further noise mitigation is required.</p>	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Strategy (Appendix I).</p> <p>Implement MCP.</p>	No
Indirect impacts from port infrastructure and use on commercial and recreational fishing	Transshipment area chosen to avoid areas of higher biological activity (e.g. reefs), therefore avoiding higher productivity fishing areas.	<p>Workforce will not be permitted to utilise port or associated facilities for fishing.</p> <p>Fishing will not be permitted within port exclusion zones, for safety reasons.</p>	Port infrastructure will be removed and rehabilitated upon project completion or as agreed with the PPA.	No

13.5 Assessment and Significance of Residual Impacts

13.5.1 Impacts to Sites of Cultural Heritage Significance

There are no sites of Aboriginal or European cultural heritage significance currently identified within any parts of the DE, including both terrestrial and marine areas, with the exception of the single lodged site (Site ID 28200: Toolunga Creek Heritage Site 4), approximately 800 m south of the proposed NWCH crossing. This heritage site boundary extends into the Haul Road DE by approximately 14 m and is approximately 100 m from a potential borrow pit. The Proposal will avoid this site. The Landside DE has been extensively surveyed and based on current information, no impacts to heritage places within the unsurveyed parts of the Haul Road DE are expected.

Forthcoming heritage surveys will confirm if any Aboriginal heritage sites do occur outside the areas already covered by prior surveys. **No concerns** have been raised by Traditional Owners with respect to any specific location within the DE outside areas covered by prior surveys to date. If any site is identified this will be avoided if possible, including implementation of an appropriate buffer, through the design of the haul road or other infrastructure footprint. The Proponent will manage any sites of Aboriginal heritage significance that cannot be avoided in accordance with the AH Act.

13.5.2 Impacts to Visual Amenity

Photomontages were prepared to assess the visual impact at locations which were determined as having the most potential for visual amenity impacts, including coastal areas near the proposed Port and the NWCH crossing. The small scale of the proposed Port facilities and low profile of the proposed haul road resulted in these being barely visible from the viewing locations identified, as discussed below. Therefore, **no significant impact** to visual amenity is expected given the sparse population of the region, low relief landscape in which the Proposal generally sits, the low profile of the haul road, and given no significant high lookouts or well-known recreation sites are located in its vicinity.

13.5.2.1 Coastal Areas near the Proposed Port

The Proposal's port infrastructure will not be conspicuous given its scale and proximity to the neighbouring and much larger Wheatstone facility. Furthermore, the Landside DE is in a section of coast that is not close to any significant viewing areas, with the Onslow townsite (**Figure 13-2**) approximately 10 km from the Port area and the nearest potentially affected public lookouts are near the entry to Four Mile Creek approximately 4 km and from the Landside and Nearshore DEs (**Figure 13-3: Visual Impact Assessment – Port Facilities viewed from Seaview Drive and Figure 13-4**). Natural landforms in this part of the coast restrict the view towards the port area, further limiting any potential visual impact. Therefore, **no significant impact** to visual amenity is expected through the construction of the Port infrastructure.

13.5.2.2 North West Coastal Highway Crossing

The visual impact assessment (**Figure 13-5 and Figure 13-6**) shows that given the haul road crossing at the NWCH will be an underpass in a visually unremarkable section of the road, tourists and other road users are unlikely to experience any significant visual impact from the Proposal as they travel along the highway. The road will only be briefly visible from vehicles travelling at the speed limit, at the crossing point. Therefore, **no significant impact** to visual amenity is expected through the construction of the NWCH crossing.

13.5.2.3 Other Sensitive Locations

All other sensitive locations with potential to be affected by visual changes to the landscape are too far from the Proposal to be significantly impacted. Again, this a function of the low profile of the haul road within a generally flat landscape. An assessment based on photos taken from or nearby these sensitive locations – the approach to the port area from Warrirda Road, Cane River Lore Ground and the Peedamulla Station and Campground – with an indication of where the Proposal disturbance area would be relative to those points – demonstrate that the Proposal would not be visible from these locations as it would be obscured due to distance and vegetation (**Figure 13-7, Figure 13-8 and Figure 13-9**). Note that due to the sensitive and sacred nature of the Cane River Lore Ground it was not directly accessed for this purpose, rather photos were taken from nearby (approximately 2 km

west) to provide an approximation of the view from that location (**Figure 13-8**). As the Proposal is not visible from these locations (i.e. imposing a digital representation of the haul road on the image does not show anything), the figures show the view towards the approximate location of the haul road from those points with the most prominent features (e.g. the communication tower in **Figure 13-9**) in the field of view indicated to give some perspective on why the road would not be visible.

Access to Red Hill Station was not possible for the assessment so Google Earth imagery was used as a substitute to provide a simulated viewpoint from near the homestead, approximately 8.5 km from the haul road IF (**Figure 13-10**). The digital rendering of the haul road alignment on the Google Earth imagery shows it would be, at most, barely visible even from a simulated viewpoint approximately 40 m above ground level. Therefore, **no significant impact** to visual amenity is expected through the construction of the haul road to Red Hill Station.

13.5.3 Impacts to Places of Cultural Significance due to Dust and Noise

Consultation to date has not identified any such place within any of the DEs; however, consultation will remain ongoing to ensure the Proponent is aware of any concerns Traditional Owners may have in this regard. Given the current use and history of the port area, including extensive heritage survey coverage, no new issues are expected to be raised in Landside DE.

Any effects of dust and noise are expected to remain restricted and temporary along the relatively narrow dimensions of the Haul Road DE and IF. Dust and noise would be expected to peak during construction, with any temporary effect ameliorated by standard dust suppression and noise management measures such as use of water carts and noise baffling equipment on machinery and plant as outlined in the TEMP. Native fauna with cultural value for hunting and other purposes is expected to avoid and move away from the noise and activity of construction areas, with no barriers to large areas of connected habitat surrounding the haul road alignment.

Plants in the region are adapted to dust, with one study finding no evidence of negative impacts on plant health for dust deposition in semi-arid environments (Matsuki 2016). This will include any plants used for bush tucker, medicine or other cultural purposes. The Proposal has been designed to limit the potential for dust emissions.

No significant impact on any places of cultural significance or plants and animals with cultural associations are expected from the Proposal.

13.5.4 Impacts to Pastoralists from Haul Road

Two pastoral stations will be traversed by the Haul Road DE, Peedamulla and Red Hill. The Red Hill homestead is approximately 8 km and Peedamulla homestead approximately 3 km from the proposed road alignment and **unlikely** to be significantly affected by noise. The noise modelling assessment concluded that noise levels during construction of the haul road will comply with the requirements of the Noise Regulations at all times (**Table 13-4** Lloyd George Acoustics 2021).

The Proponent will also implement a TEMP (**Appendix H**) and has established Weed Hygiene and Control Procedure to reduce the risk of existing weeds being spread or new weeds being introduced into the Haul Road DE and surrounding area. Weed control measures will be implemented within the Haul Road DE, as well as in areas around the clearing front and in retained native vegetation adjacent to cleared areas, as outlined in **Table 9-16**. The Proponent will undertake targeted control of the two declared weed species, *Parkinsonia aculeata* and *Prosopis pallida*, recorded within the Haul Road DE (360 Environmental 2021a), to avoid the spread of these existing weeds into new cleared and uninfested areas.

The haul road will be fenced 372m on both sides for its entire length, which will impede stock and vehicle movement for station operations. Therefore, the Proponent will install underpasses beneath the haul road at appropriate locations and of sufficient dimensions as agreed with pastoral leaseholders to ensure any effect on station management is minimised. If stock or pastoralist access to any bores and watering points are affected despite the installation of underpasses, the Proponent will replace bores and watering points, to the agreement of the pastoralist or tenement holder, to further ensure impacts to station management are minimised.

With these measures in place the Proposal is **unlikely** to result in any significant impact on pastoralists.



Figure 13-2: Visual Impact Assessment – Port Facilities views from Onslow Salt Pier

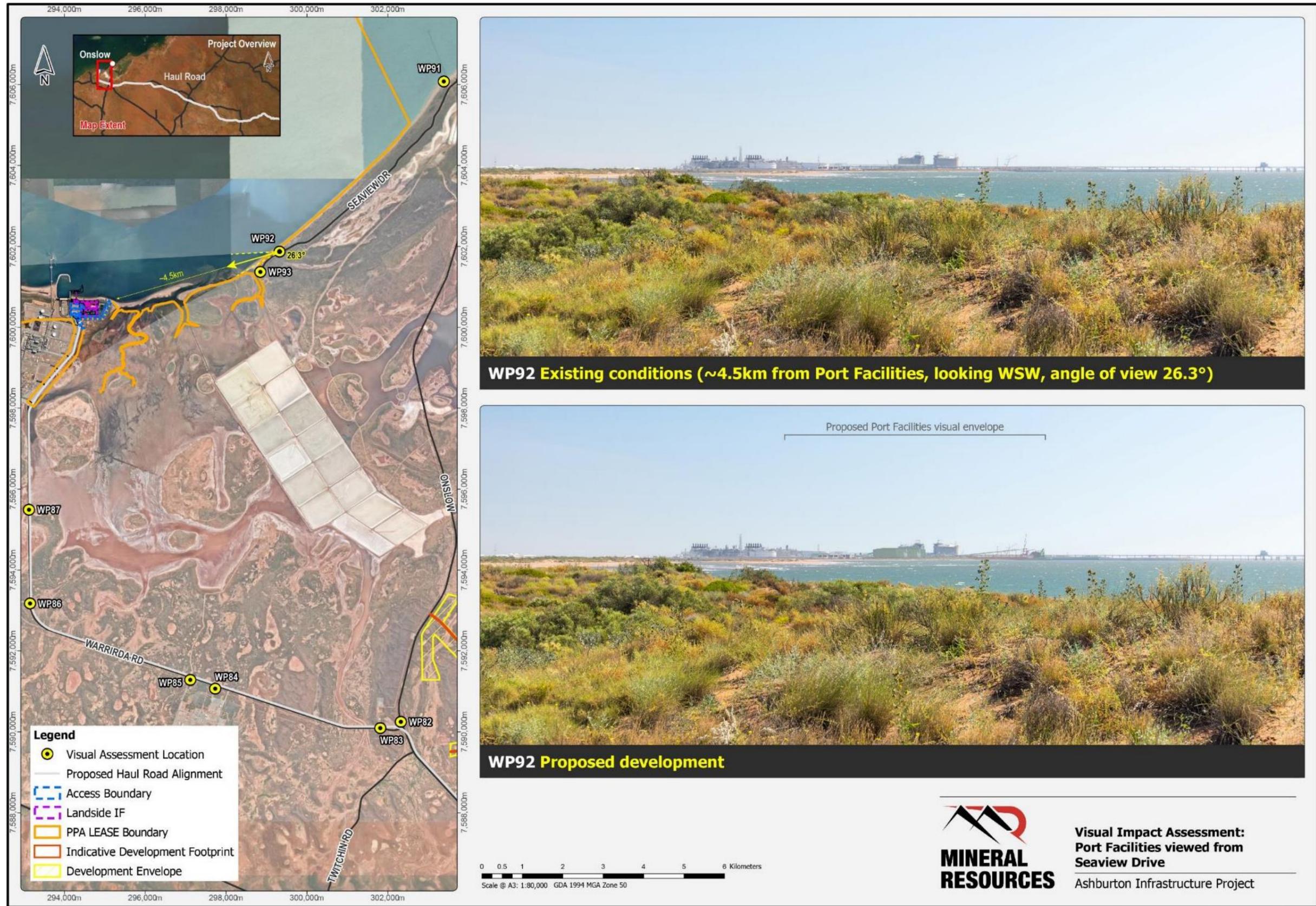


Figure 13-3: Visual Impact Assessment – Port Facilities viewed from Seaview Drive



Figure 13-4: Visual Impact Assessment – Port Facilities viewed from Four Mile Creek

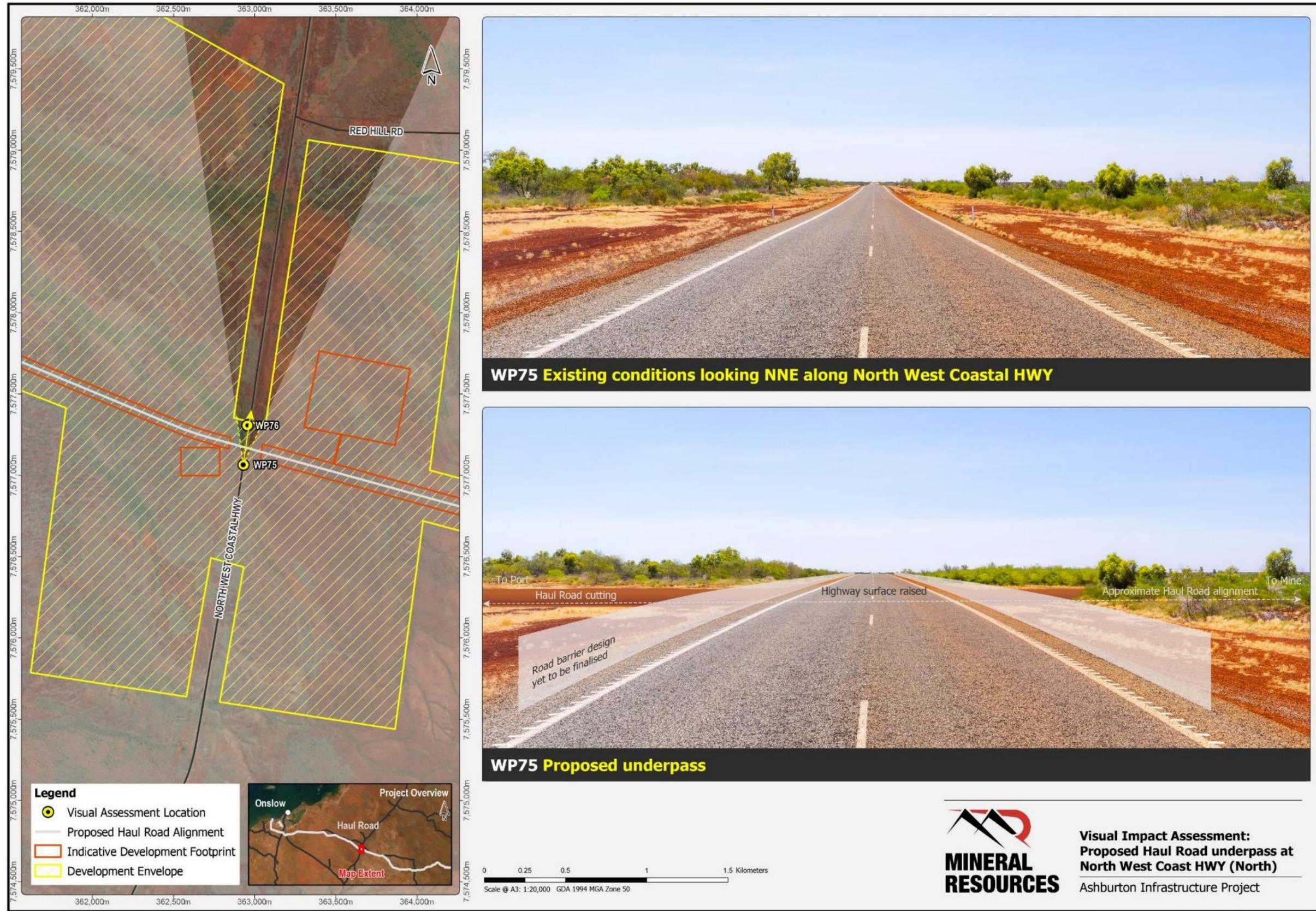


Figure 13-5: Visual Impact Assessment – Proposed Haul Road underpass at NWCH (North)

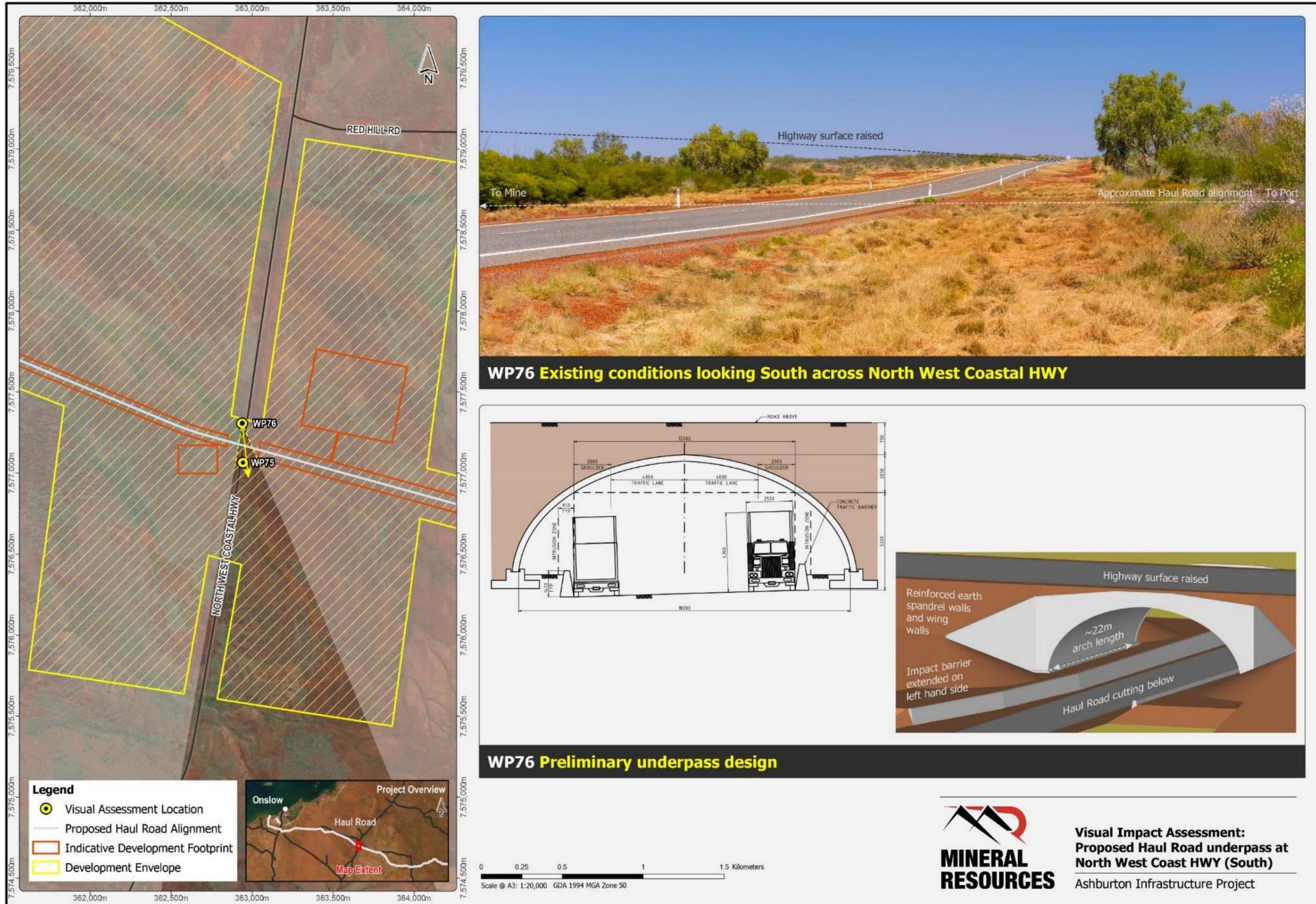


Figure 13-6: Visual Impact Assessment – Proposed Haul Road underpass at NWCH (South)



Figure 13-7: Visual Impact Assessment – Port Facilities viewed from Warrirda Road

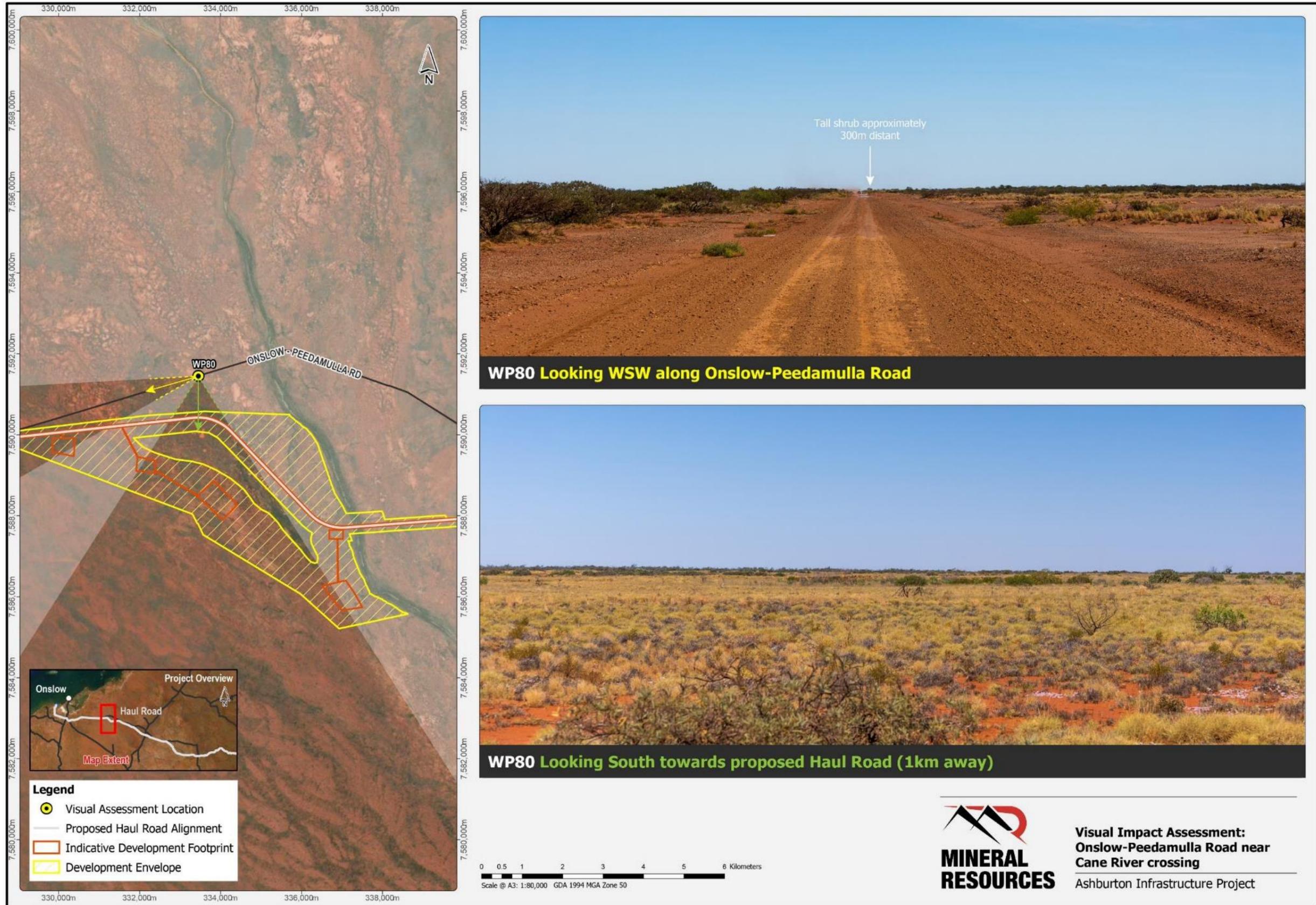


Figure 13-8: Visual Impact Assessment – Onslow-Peedamulla Road (near Cane River Crossing)



Figure 13-9: Visual Impact Assessment – Peedamulla Station and Camp Ground

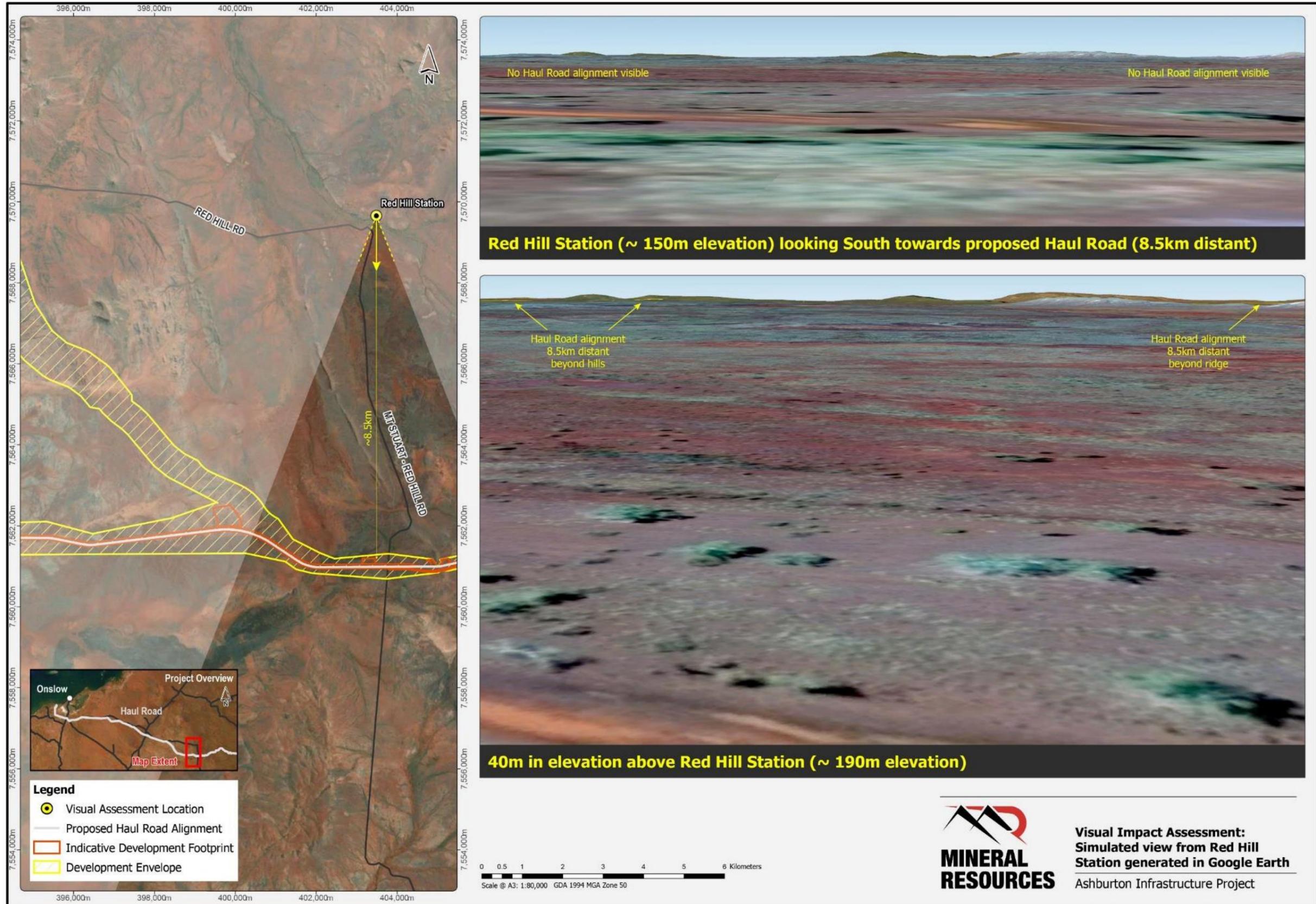


Figure 13-10: Visual Impact Assessment – Simulated view from Red Hill Station (generated in Google Earth)

13.5.5 Impacts to Other Places due to Dust or Noise

Dust emissions may occur during construction; however, these emissions will be temporary and the small number of sensitive receptors near the Proposal are **unlikely** to be affected. Dust emissions will be managed using industry-standard dust control measures. Dust emissions from the haul road during operation are expected to be negligible as it will be sealed (ETA 2022).

At the Port, modelling indicated that under the maximum operating throughput scenario assessed (40 Mtpa), dust and other air quality impacts on key sensitive receptors will be negligible (ETA 2022), as described in detail in **Section 14.2**. Residential areas including the Onslow townsite, approximately 10 km from the Proposal, are **unlikely** to be significantly affected by any dust impacts. Similarly, the modelling predicts that TSP and dust deposition will remain well below the adopted human health and amenity air quality assessment criteria at the Chevron Accommodation camp and Onslow Salt evaporation ponds and, therefore, are **unlikely** to be significantly affected by any dust impacts (see **Section 14.2** for further detail). Maximum TSP concentrations at the Onslow Salt evaporation ponds and camp are predicted to be no more than $12.5 \mu\text{g}/\text{m}^3$ and $2.3 \mu\text{g}/\text{m}^3$, respectively, compared to the assessment criteria of $90 \mu\text{g}/\text{m}^3$. Maximum dust deposition at the evaporation ponds and camp is predicted to be no more than $0.015 \text{ g}/\text{m}^2/\text{month}$ and $0.001 \text{ g}/\text{m}^2/\text{month}$, respectively, compared to the assessment criteria of $2 \text{ g}/\text{m}^2/\text{month}$.

The inclusion of background concentrations resulted in the predicted maximum 24-hour total suspended particulate (TSP) concentrations at the neighbouring Wheatstone facility above the assessment criteria under the two scenarios modelled; however, that receptor is not classified as a sensitive receptor in regulatory terms, being an industrial facility. This was the only exceedance of any of the air quality parameters, including dust emissions, predicted by the modelling (ETA 2022). Unsurprisingly, modelling of the lower throughput scenario (30 Mtpa) also did not predict any exceedances of air quality parameters at any sensitive receptor, with the exception of cumulative TSP 24-hour maximum at Wheatstone facility as aforementioned.

A noise assessment was undertaken to determine noise emissions from both the construction and operation of the Haul Road and the Landside facilities. To assess the noise emissions from the operation of the Haul Road, noise measurements of trucks using the haul road for the MinRes Koolyanobbing mine site was undertaken, which is considered similar to the expected noise from the Proposal. The assigned noise levels are in accordance with the Noise Regulations, which for highly sensitive premises such as a station homesteads (as discussed in **Section 13.5.4**) are as low as 35 dB (at night-time, Sundays and public holidays) and industrial premises such as the Wheatstone facility are as low as 65 dB. The predicted maximum noise levels at key sensitive receptors from haul road construction and operation are shown in **Table 13-4**.

Port construction and operational noise levels at Onslow are predicted to be approximately 25 dB, well under assigned levels (Lloyd George Acoustics 2021). As the camp is within the ANSIA, it was categorised in the noise modelling assessment as 'Industrial' as detail in **Section 13.2.4**. This categorisation has an assigned level of 65 dB LA₁₀ for all times of the day, which the Proposal is not predicted to exceed (as shown in **Table 13-4**).

In the event the camp was determined a 'Noise sensitive premises: highly sensitive area' it would have an assigned level of 55 dB (including the influencing factor as detailed in **Section 13.2.4**) during the most critical time periods 10 pm to 7 pm Monday-Saturday, and 10 pm to 9 am Sunday and Public Holidays). The LA₁₀ maximum predicted noise levels at the Camp remains below this assigned allowable noise (as shown in **Table 13-5**).

Table 13-5: Predicted Noise Levels

Receptor	Assigned Noise Levels (L _{A10}) dB	Predicted Noise Levels (L _{A10}) dB	
		Haul Road Construction	Haul Road Operation
Cane River Lore Ground	35	34	31
Peedamulla campground and homestead	35	31	27
Red Hill Station homestead	35	<30	<20
Chevron Accommodations Camp	65	47	44
	('Industrial')		
	55		
	('Noise sensitive premises: highly sensitive area')		
Wheatstone facility	65	<30	36

13.5.6 Effects on Commercial and Recreational Fishing to Port Infrastructure and Use

No commercially important marine fauna is restricted to the Nearshore or Offshore Des (O2 Marine 2021c). Exclusion zoning currently prevents fishing access to the Port in this regard in comparison to the adjacent Wheatstone operation (Chevron 2010a). The assessment for that development concluded some impacts to local fishing may occur, but only a low risk of any significant effect to fish species, with any that are potentially to be affected well represented in the region.

Other concerns raised by the Onslow community at the time were in relation to the addition of the Wheatstone workforce leading to excessive fishing in the area putting pressure on fish stocks. Given the relative scale of the Proposal, including extent of infrastructure and comparatively small workforce, the Proponent anticipates only negligible additional impacts in this regard, and these will be managed through restrictions on workforce use of the Proposal area for fishing and education on their rights and responsibilities to the local community.

Dredge plume modelling (O2 Metocean 2022) identified dredging will result within a temporary, localised turbidity plume within the nearshore and offshore DEs, typically associated with sediment disposal at Spoil Ground C (**Section 13.2**). Given the temporary nature of dredging and relatively low volume of spoil predicted, and the use of existing PPA spoil disposal locations the Proponent does **not** anticipate any impact on local fishing.

13.5.7 Cumulative Impacts

Very little information is available with respect to native vegetation and fauna important to Traditional Owners for cultural uses, i.e., bush tucker and bush medicines, within the DE. However, as shown in **Section 9** and **Section 10** with respect to broad values for native vegetation and terrestrial fauna habitat, the cumulative impact of the Proposal will be **minor**, and this is expected to be reflected in any cumulative impacts on culturally important flora and fauna values.

As discussed in **Section 13.2.2.1**, the Thalanyji and Kuruma Marthudunera native title claims are overlapped by pastoral leases and contain major industrial and mining developments. Historical pastoral activities may have degraded aspects of cultural heritage, but these effects are not well understood. Similarly, there are no publicly available records of registered heritage sites disturbed or destroyed under Section 18 of the AH Act, so it is difficult to assess the potential cumulative loss to Thalanyji and Kuruma Marthudunera peoples in this regard. Nevertheless, there are no Aboriginal heritage sites recorded in the DE and no significant sites expected from

upcoming surveys given the narrow dimensions of the Haul Road DE; therefore, any cumulative impact represented by the Proposal is expected to be at most, **negligible**.

As discussed in **Section 13.5.6**, the scale and extent of the Proposal in the marine environment (5 ha IF) in comparison to the existing Wheatstone development is minor and therefore any cumulative impact on commercial and recreational fishing due to port infrastructure and use will be **very low**.

Therefore, there are **no significant cumulative impact** to Social Surroundings is anticipated from the Proposal.

13.6 Environmental Outcomes

Based on the assessment of potential impacts and proposed mitigation measures to protect environmental values associated with Social Surroundings, the Proponent considers that the EPA objective for this factor can be met. The predicted outcomes for Social Surroundings are summarised below:

- **No** significant impact to any Aboriginal heritage site or place of cultural heritage importance;
- **No** impact to any European heritage site;
- **No** significant impact to visual amenity;
- **No** significant impact to sensitive receptors, including places of cultural significance, plants and animals with cultural associations or to residents and pastoralists, from noise, dust or odour; and
- **No** significant impact to commercial and recreational fishing.

Given no significant residual impacts are predicted for this factor, no environmental offsets are proposed, and the Proponent considers the Proposal can be managed to meet the EPA's objective for social surroundings.

14. OTHER FACTORS

14.1 Coastal Processes

14.1.1 EPA Objective

The EPA's environmental objective for the factor Coastal Processes is *'To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.'* (EPA 2016l).

14.1.2 Policy and Guidance

The relevant policy and guidance considered in the assessment of the Coastal Processes factor are:

- Statement of Environmental Principles, Factors and Objectives (EPA 2020e);
- Instructions on how to prepare an Environmental Review Document (EPA 2020b); and
- Environmental Factor Guideline: Coastal Processes (EPA 2016l).

14.1.3 Studies and Findings

A literature review of hydrodynamic studies that informed similar – albeit much larger – projects around the Ashburton region, and their coastal processes management plans addressing WA Ministerial conditions, was completed for this assessment. Outcomes from the literature review informed the Proposal-specific hydrodynamic (wave and currents) modelling study conducted by experienced hydrodynamicists with robust knowledge of the region. The literature review identified the geophysical processes, natural features, and man-made structures responsible for shaping the coastline in the vicinity of the Proposal. Results from the regional (Exmouth to Dampier) and local hydrodynamic models, quantitatively validated against records of waves, water levels, and currents collected by the DoT and qualitatively against published results from other hydrodynamic models developed for the area, were subsequently used to guide the desktop assessment of likely alterations to the geophysical processes arising from Proposal infrastructure and activities.

All relevant studies developed for the Proposal are included with a link to their specific Appendix numbers. Studies developed for other projects which are relevant to the Proposal are also listed below. For detailed information on each study, please refer to each report:

- Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Project: Hydrocarbon Spill Modelling, (Chevron 2010b);
- Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Project: Modelling of the Discharges to the Marine Environment (Chevron 2010c);
- Wheatstone Project Coastal Processes Monitoring and Management Plan (CPMMP) (PPA 2021);
- Ashburton Infrastructure Project: Base Hydrodynamic Modelling (**Appendix BB**) (O2 Metocean 2021c); and
- Ashburton Infrastructure Project – Impact to the Coastal Processes due to the Construction of the Proponent's AIP Marine Infrastructure (**Appendix CC**) (O2 Metocean 2021d).

Study and findings for the Proposal are summarised in **Table 14-1**.

Table 14-1: Studies for Coastal Processes

Study	Findings
Wheatstone Project hydrodynamic modelling studies (Chevron 2010b; Chevron 2010c)	<p>The review focused on the numerical modelling studies prepared for the prediction of oil spill and brine discharge fate and transport from Wheatstone’s activities. From this review the dominant hydrodynamic processes were confirmed, and the industry-standard for hydrodynamic modelling in the region established.</p> <p>Results presented in these studies, prepared and developed for a much larger project in the Proposal region, served as benchmark to Proposal modelling investigation. The review informed the optimum location of Proposal -specific model boundaries, forcing, initial conditions, and other aspects intrinsic to hydrodynamic numerical modelling.</p>
Wheatstone Project Coastal Processes Monitoring and Management Plan (PPA 2021)	<p>PPA’s (2021) Coastal Processes Monitoring and Management Plan establishes procedures which provide for the management and monitoring of environmental impacts attributable to Chevron’s Wheatstone port infrastructure, consistent with the requirements of MS 1131 and Condition 32 in the Commonwealth Ministerial Approval (EPBC 2008/4469). Amongst other associated points, MS 1131 states that [...] operation of the nearshore marine facilities [...] achieve the following outcomes as far as is practicable as measured under the Coastal Processes Monitoring and Management Plan: ‘<i>minimise change to littoral sediment transport</i>’, and ‘<i>minimise an erosion trend under non-cyclonic conditions in the position of the mean sea level shoreline and dune vegetation line between the nearshore marine facilities and Beadon Creek</i>’.</p> <p>Wheatstone’s ACW is a key nearshore marine facility that acts as a barrier to the longshore sediment transport which, without appropriate management, would result in significant coastal changes. Sand bypassing is included in the Coastal Processes Monitoring and Management Plan (PPA 2021) to minimise the change to littoral sediment transport. Although expected every approximately 5-years, the main trigger for sand bypass operations occurs when the net accretion of sediment volume within the extraction area (located west of the MOF) exceeds 200,000 m³. As the net sediment transport is eastward, and the Proposal will be located on the east side of the existing ACW breakwater, the management strategy designed to meet the MS 1131 will not be affected by the Proposal and the sand bypassing trigger is expected to be retained during and post Proposal construction.</p>
Ashburton Infrastructure Project: Base Hydrodynamic Modelling (O2 Metocean 2021c) (Appendix BB)	<p>The Proponent engaged O2 Marine to undertake a Proposal -specific hydrodynamic modelling package that included the development of a base hydrodynamic model (tidal and waves) to force a dredge plume model and brine discharge model. The hydrodynamic modelling study confirmed the presence of an eastward littoral drift current during the proposed dredge and construction period, and a weak wave and current climate in the vicinity of the Proposal, in agreement with previous numerical modelling studies undertaken for other larger projects.</p>
Ashburton Infrastructure Project – Impact to the Coastal Processes due to the Construction of the Proponent’s AIP Marine Infrastructure (O2 Metocean 2021d) (Appendix CC)	<p>As an addendum to the hydrodynamic modelling package, O2 Metocean summarised their review of oceanographic processes and littoral transport studies at the site as well as the ongoing coastline monitoring and management plans pertinent to MS 1131 in a technical note.</p> <p>Findings addressed the coastal processes (nature and extent of the littoral transport process) that could potentially be altered by Proposal infrastructure (piled jetty and dolphin structures), increased dredged area at the existing channel, and the presence of moored TSVs on an almost continuous basis.</p> <p>Further, since the temporary impermeable causeway required for the Proposal construction will be placed immediately east of the existing MOF, short-lived and away from natural longshore sediment transport regions, its impact on long term changes to the coastal processes was deemed negligible.</p> <p>The technical note concluded that the Proposal infrastructure would result in negligible effects on the propagation of current and very minor changes to an already mild wave climate, with the exception of highly localised effects within a few diameters of the structure (i.e. tens of metres), a mild-change to very local oceanographic conditions due to the introduction of TSVs during loading, and negligible changes to current and wave conditions due to Proposal dredge basin (berthing pocket), leading to negligible practical importance to littoral transport processes arising from the Proposal.</p> <p>The technical note recommended maintaining the existing management strategy for sand bypassing as detailed in (PPA, 2021) would still be the preferred option, given that the proposed changes associated with the Proposal are unlikely to induce any significant change in the Proposal nearshore wave and current climate when compared to the region’s current state.</p>

14.1.4 Receiving Environment

The Ashburton region presents weak swell with wind-waves that respond to the seasonal monsoon wind pattern and year-round land-sea breeze system. Currents are dominated by the semi-diurnal tides which regularly exceed 2 m, though inshore of the 30 m isobath there are weak seasonal drift currents driven by the regional winds. Very near-shore currents are influenced by breaking waves, with a net eastward drift in summer that can pause or reverse during the dry season (winter) months.

Near-shore sediments are largely fine-grained terrigenous materials, likely sourced from event-based (i.e., flood) discharge of the Ashburton River during the wet season. The net sediment transport of this near-shore sediments is toward the east due to littoral drift currents from the angle of attack of the Indian ocean swells and the north-westerly monsoon winds that coincide with the timing of Ashburton discharge events weighted towards the wet season. O2 Marine (2021h) classified the seabed sediments within the dredge footprint (berthing pockets).

The Proposal is located immediately east of a comparatively large existing ACW breakwater which interrupts the longshore transport of sediment, leading to limited natural sediment accretion the Proposal site within the Nearshore DE. It is noted that the coastline position is currently monitored over a considerable distance both to the west and east of the Proposal. Triggers linked to the amount of sediment trapped by the existing ACW breakwater have been set to prevent changes to coastal position east of the existing ACW under an existing Ministerial statement (MS 1131).

14.1.5 Potential Impacts, Mitigation, and Impact Assessment

Table 14-2 presents a summary of the potential impacts, mitigation measures and impacts assessment.

Table 14-2: Assessment of Other Environmental Factors Coastal Processes

Relevant Proposal Activities	Potential Impacts	Management, Monitoring & Mitigation	Impact Assessment	Predicted Outcomes
EPA Objective: To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.				
Proposal infrastructure within the Nearshore DE.	Potential impacts from altered coastal processes (modification of wave energy; modification of tidal current energy) may result in minor changes to sedimentation patterns in the immediate vicinity of the Proposal coastal infrastructure within the Nearshore DE (further impacting benthic communities or intertidal habitats).	<p><u>Avoid:</u> The Port infrastructure has been positioned away from benthic communities that offer protection to the coastline (e.g. mangroves, reef or seagrass meadows).</p> <p><u>Avoid:</u> The Port infrastructure has been positioned and designed such that beach access from trucks undertaking coastal remedial activities is not interrupted or obstructed; Beach access will be maintained for trucks to pass under the beach crossing from the Landside DE to the Nearshore DE.</p> <p><u>Avoid:</u> The Port infrastructure has been positioned within an existing port backed by industrial parks (i.e. Wheatstone and ANSIA), where there is negligible social coastal value.</p> <p><u>Minimise:</u> The Port infrastructure has been positioned east of an existing coastal disturbance for which remedial actions exist under a Ministerial statement.</p> <p><u>Minimise:</u> The Port infrastructure has been designed to minimise changes to currents and wave conditions near-shore (i.e. trestle structure with service pipelines running on deck, not along the seabed) thus enabling movement of sediments in and around the Proposal coastal infrastructure.</p>	<p>Modifications to wave energy will be highly localised and minor, as the trestle structure permits wave propagation and as the infrastructure is already within a sheltered zone with low wave energy, there will be no practical impacts on coastal processes. As littoral transport in the area is already interrupted, and subject to ongoing management, there are no predicted impacts.</p> <p>Modification of tidal current energy and patterns will be highly-localised and minor, as the trestle structure permits flow, with only very minor losses due to drag on the infrastructure.</p> <p>No benthic communities that offer protection to the coastline (e.g. mangroves, reef or seagrass meadows) will be affected as the Proposal is located away from these features</p>	<p>Meets EPA Objective</p> <p><i>Overall, the impacts to Coastal Processes are not considered to be significant and the EPA objective for Coastal Processes is considered to be met.</i></p>
Berthing pocket within the Nearshore DE.	Potential impacts from altered coastal processes may result in local changes to the hydrodynamic and sedimentation patterns in the immediate vicinity of the Proposal coastal infrastructure.	<p><u>Minimise:</u> The Port berth pocket has been placed adjacent to an existing, dredged, navigational channel.</p> <p><u>Minimise:</u> The Port berth pocket dimensions have been reduced to as low as reasonably possible to allow safe navigation and mooring.</p>	The relatively small berthing pocket (by surface area, compared to existing, dredged navigational channel) results in a direct impact, however the physical alteration will be highly-localised and adjacent to a larger, prior, bathymetry modification (the access channel to the existing MOF). On open coastlines (greenfield projects) a new berthing pocket could lead to non-local effects by modifying sediment pathways, however here the Proposal dredge footprint has been positioned within a highly-modified section of the coast, where sediment pathways are already interrupted by a pre-existing structure and subject to ongoing management.	<p>Meets EPA Objective</p> <p><i>Overall, the impacts to Coastal Processes are not considered to be significant and the EPA objective for Coastal Processes is considered to be met.</i></p>
TSVs loading while moored at the Proposal within the Nearshore DE.	Potential impacts from altered coastal processes may result in minor changes to sedimentation patterns in the immediate vicinity of the moored TSVs.	<p><u>Avoid:</u> The Port infrastructure has been positioned within an existing port backed by industrial parks, where there is negligible social coastal value.</p> <p><u>Minimise:</u> The Port infrastructure has been positioned east of an existing coastal disturbance for which remedial actions exist under a Ministerial statement (MS 1131).</p> <p><u>Minimise:</u> The Proposal's vessel size has been minimised, resulting in a mild-change to very local oceanographic conditions (sheltering effect).</p>	The TSVs will result in a reflection of incident waves that attack the TSVs hull, with the waves around the ends of the TSVs likely diffracting around the bow and stern leading to a reduction in wave energy. The introduction of the TSVs therefore could lead to a more sheltered area shoreside of the vessel. Given that the outcome of the nearshore wave assessment (O2 Metocean 2021d) was that the wave climate within the Nearshore DE is sheltered by the MOF breakwater, any likely exacerbation in the wave climate due to a vessel sheltering effect are likely to have a negligible impact on the littoral transport process as the location is already considered sheltered.	<p>Meets EPA Objective</p> <p><i>Overall, the impacts to Coastal Processes are not considered to be significant and the EPA objective for Coastal Processes is considered to be met.</i></p>

14.2 Air Quality

14.2.1 EPA Objective

The EPA's environmental objective for the factor Air Quality is '*to maintain air quality and minimise emissions so that environmental values are protected*' (EPA 2020e).

14.2.2 Policy and Guidance

The relevant policy and guidance considered in the assessment of the Air Quality factor are:

- Statement of Environmental Principles, Factors and Objectives (EPA 2020e);
- Instructions on how to prepare an Environmental Review Document (EPA 2020c);
- Environmental Factor Guideline – Air Quality (EPA 2020k);
- Draft Guideline – Air Emissions – Activities regulated under the Environmental Protection Act 1986, Environmental Protection Regulations 1987 (DWER 2019);
- A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities (DEC 2011);
- Variation to Ambient Air Quality National Environmental Protection Measure (NEPM) (NEPC 2021); and
- Protocol for environmental management: mining and extractive industries (EPAV 2007).

14.2.3 Studies and Survey Findings

Study and survey findings relevant to the Proposal are summarised in **Table 14-3**.

Table 14-3: Studies for Air Quality

Study	Findings																																																						
Desktop Air Quality Study to determination monitoring locations (ETA 2021a) (Appendix X)	Desktop study to determine potential monitoring locations and equipment in accordance with AS/NZS 3580.1.1:2016 guidance. This has been used to inform the Dust Management Plan for the Port.																																																						
AIP Air Quality Assessment (ETA 2022) (Appendix Y)	<p>The purpose of this air quality assessment was to assess the potential air quality impacts associated with landside facilities to be developed and operated at the Port of Ashburton. Potential air quality impacts of the Proposal were determined through a dispersion modelling study (WRF/CALMET/CALPUFF suite), which incorporated site-specific meteorological data, and emissions information estimates for the Proposal based on equipment design specifications specific to the Proposal. Nitrogen dioxide (NO₂) and particulate matter (PM) - including TSP, PM₁₀, PM_{2.5} size fractions, and dust deposition, were modelled and assessed.</p> <p>The assessment criteria adopted for this study are primarily based on the DWER (2019) guidelines, which also reference the numerical values from the ambient air quality standards specified in the Ambient Air Quality NEPM (NEPC, 2021). The more stringent Ambient Air Quality NEPM standards for NO₂ (as varied 15 April 2021) are not reflected in the DWER (2019) guidelines, however the later have been adopted here to inform the assessment in regard to future regulatory requirements.</p> <p>In their current form, the DWER (2019) guidelines for NO₂ and TSP/PM₁₀/PM_{2.5} (defined as criteria pollutants in the guideline) require the criteria to generally be '...met at all existing and future offsite sensitive receptors in the modelling domain'. DWER (2019) guidelines do not address the settling or deposition of dust, therefore the New South Wales and Victorian State Government specified criteria is referenced.</p> <p>At the maximum throughput of 40 Mtpa the port facility results in the following changes to existing conditions at identified nearby receptors (Figure 14-1).</p> <p>Onslow township</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Maximum (project only)</th> <th>Maximum (cumulative)</th> <th>Assessment criteria</th> </tr> </thead> <tbody> <tr> <td>TSP (µg/m³)</td> <td>5.7</td> <td>48.5</td> <td>90*</td> </tr> <tr> <td>PM₁₀ (µg/m³)</td> <td>2.2</td> <td>23.6</td> <td>50**</td> </tr> <tr> <td>PM_{2.5} (µg/m³)</td> <td>0.7</td> <td>8.5</td> <td>25**</td> </tr> <tr> <td>Dust deposition (g/m²/month)</td> <td>0.004</td> <td>N/A</td> <td>2***</td> </tr> <tr> <td rowspan="2">NO₂ (µg/m³)</td> <td>0.18</td> <td>0.62</td> <td>31 (annual average)*</td> </tr> <tr> <td>13.5</td> <td>37.4</td> <td>168 (1-hour average)*</td> </tr> </tbody> </table> <p>*NEPC, ** DWER 2019, *** EPAV 2007</p> <p>Wheatstone Camp</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Maximum (project only)</th> <th>Maximum (cumulative)</th> <th>Assessment criteria</th> </tr> </thead> <tbody> <tr> <td>TSP (µg/m³)</td> <td>2.3</td> <td>45.1</td> <td>90*</td> </tr> <tr> <td>PM₁₀ (µg/m³)</td> <td>0.9</td> <td>22.3</td> <td>50**</td> </tr> <tr> <td>PM_{2.5} (µg/m³)</td> <td>0.3</td> <td>8.1</td> <td>25**</td> </tr> <tr> <td>Dust deposition (g/m²/month)</td> <td>0.001</td> <td>N/A</td> <td>2***</td> </tr> <tr> <td rowspan="2">NO₂ (µg/m³)</td> <td>0.04</td> <td>0.29</td> <td>31 (annual average)*</td> </tr> <tr> <td>10</td> <td>41.5</td> <td>168 (1-hour average)*</td> </tr> </tbody> </table> <p>*NEPC, ** DWER 2019, *** EPAV 2007</p>	Pollutant	Maximum (project only)	Maximum (cumulative)	Assessment criteria	TSP (µg/m ³)	5.7	48.5	90*	PM ₁₀ (µg/m ³)	2.2	23.6	50**	PM _{2.5} (µg/m ³)	0.7	8.5	25**	Dust deposition (g/m ² /month)	0.004	N/A	2***	NO ₂ (µg/m ³)	0.18	0.62	31 (annual average)*	13.5	37.4	168 (1-hour average)*	Pollutant	Maximum (project only)	Maximum (cumulative)	Assessment criteria	TSP (µg/m ³)	2.3	45.1	90*	PM ₁₀ (µg/m ³)	0.9	22.3	50**	PM _{2.5} (µg/m ³)	0.3	8.1	25**	Dust deposition (g/m ² /month)	0.001	N/A	2***	NO ₂ (µg/m ³)	0.04	0.29	31 (annual average)*	10	41.5	168 (1-hour average)*
Pollutant	Maximum (project only)	Maximum (cumulative)	Assessment criteria																																																				
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	10	41.5	168 (1-hour average)*																																																				

Study	Findings			
	Onslow Salt ponds			
	Pollutant	Maximum (project only)	Maximum (cumulative)	Assessment criteria
	TSP (µg/m ³)	12.5	55.3	90*
	PM ₁₀ (µg/m ³)	4.8	26.2	50**
	PM _{2.5} (µg/m ³)	1.5	9.3	25**
	Dust deposition (g/m ² /month)	0.015	N/A	2***
	NO ₂ (µg/m ³)	0.28	1.49	31 (annual average)*
		25.8	41.1	168 (1-hour average)*
	*NEPC, ** DWER 2019, *** EPAV 2007			
	Chevron			
	Pollutant	Maximum (project only)	Maximum (cumulative)	Assessment criteria
	TSP (µg/m ³)	57.7	100.5	90*
	PM ₁₀ (µg/m ³)	22.2	43.6	50**
	PM _{2.5} (µg/m ³)	6.7	14.5	25**
	Dust deposition (g/m ² /month)	0.042	N/A	2***
	NO ₂ (µg/m ³)	0.4	2.72	31 (annual average)*
		37.4	133.4	168 (1-hour average)*
	*NEPC, ** DWER 2019, *** EPAV 2007			

14.2.4 Receiving Environment

14.2.4.1 Landside DE

The Landside DE includes port and power generation infrastructure, which is to be located within the already developed industrial areas at the Port, namely the ANSIA.

No ambient air quality data is publicly available for the Onslow region, so data from the Port Hedland Industries Council Yule River monitoring station, 380 km north of the Proposal is used as a proxy for background data on the basis that this is representative of a coastal location in the Pilbara, with average wind speeds of 6 m/s (ETA 2022) (**Appendix Y**).

Proxy air quality background data for the Proposal is summarised in **Table 14-4**.

Table 14-4: Proxy Background Air Quality Data and Assessment Criteria (ETA 2022)

Emission Type	Emission	Proxy Background Data		Air Quality Assessment Criteria		
		Measured Concentration	Averaging Period	Measured Concentration	Averaging Period	Reference
Particulate Matter	TSP	42.8 µg/m ³	24 hours	90 µg/m ³	24 hours	DWER (2019)
	PM ₁₀	21.4 µg/m ³	24 hours	50 µg/m ³	24 hours	DWER (2019)
	PM _{2.5}	7.8 µg/m ³	24 hours	25 µg/m ³	24 hours	consistent with NEPC (2021)
	Dust	NA	24 hours	2 g/m ² /month	24 hours	EPAV (2007)
Combustion Gas	NO ₂	NA	1 hour	164 µg/m ³	1 hour	NEPC (2021)

Wind speed averages for the Onslow Airport Station (Station ID: 005017) range from 5.5 m/s, with wind speeds below 2 m/s recorded from all directions (ETA 2022). The two dominant wind directions are west-northwest at 8 m/s and south to southeasterly between 4-8 m/s (ETA 2022). Generally, wind speeds are higher during spring and summer daylight hours than autumn and winter winds, and as such dust lift off increases and subsequent ambient air quality is reduced during periods of higher wind speeds in an already naturally windy environment.

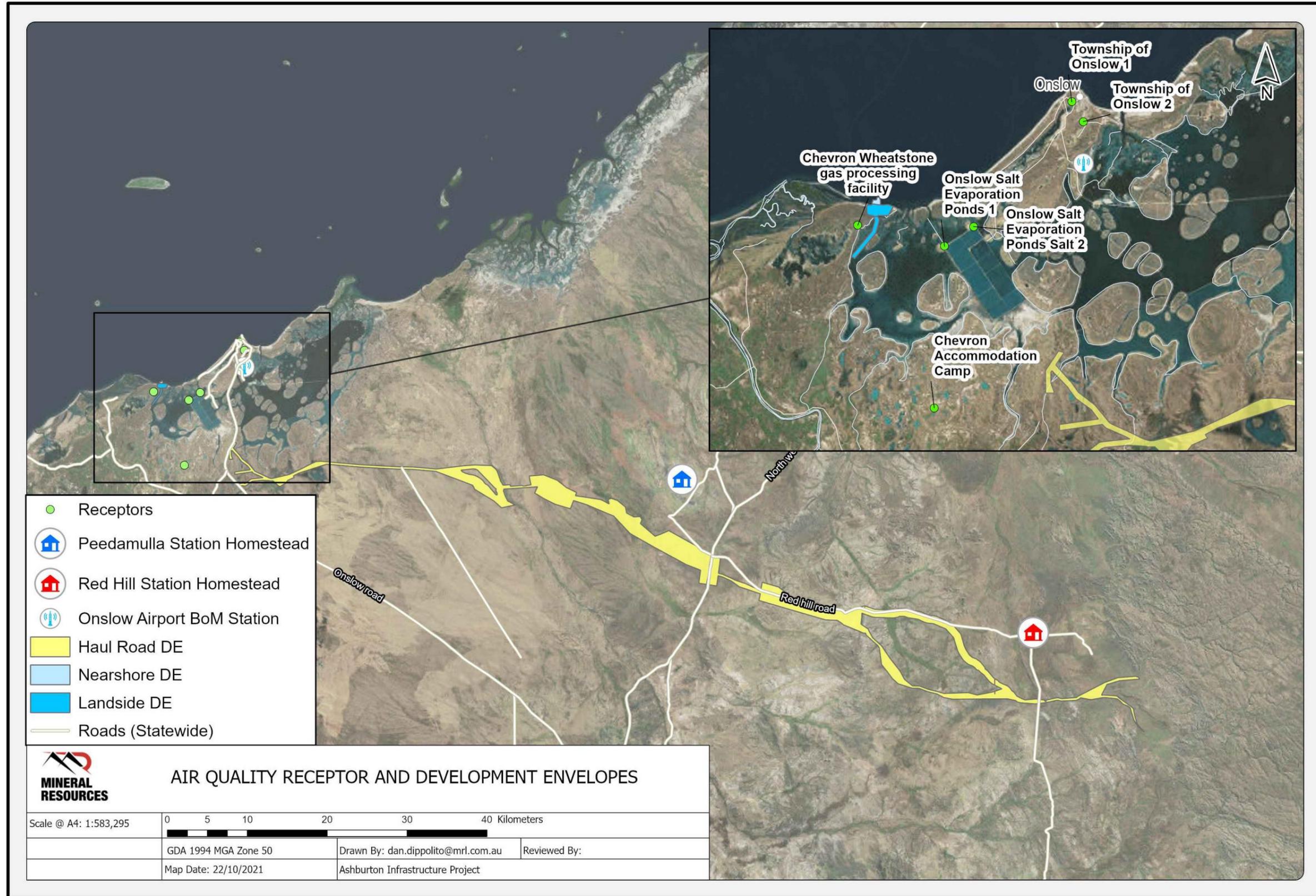
Proximal to the Landside DE, four receptors relevant to air quality occur (**Figure 14-1**):

- Onslow township (12 km northeast of the Landside DE);
- Chevron Wheatstone Facility (0.8 km southwest of the Landside DE);
- Onslow Salt Pans (3.5 km southeast of the Landside DE); and
- Chevron Accommodation Village (11 km south-southeast of the Landside DE).

Sensitive (human) receptors are defined as components of the environment that can be adversely impacted by dust (such as people, dwellings) that exist now and, in the future, (DEC 2011). The Onslow township and Chevron Accommodation Village receptors are considered sensitive receptors, as people reside on both a temporary and permanent basis. The Chevron Wheatstone Facility and Onslow Salt Pans are not considered sensitive receptors in the accepted sense as they are industrial workplaces and personnel do not reside at either (ETA 2022), noting that air quality at industrial workplaces is required to meet standards specified by Safe Work Australia.

14.2.4.2 Haul Road DE

The Haul Road DE is predominantly located on pastoral stations remote from communities and sensitive (human) receptors. One sensitive receptor, the Red Hill Station Homestead, is located within 9 km of the Haul Road DE and approximately 90 km from the Landside DE (**Figure 14-1**). Within the Pilbara region where the Haul Road DE is located, wind-blown dust is the main contributor to ambient dust levels, with bushfires being the most significant contributor to airborne particulate levels (RDA Pilbara 2013).



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Figure 14-1: Air Quality Receptor and Development Envelopes

14.2.5 Potential Impacts, Mitigation, and Impact Assessment

Table 14-5 presents a summary of the potential impacts, mitigation measures and impact assessment.

Table 14-5: Assessment of Other Environmental Factors – Air Quality

Relevant Proposal Activities				
EPA Objective: <i>To maintain air quality and minimise emissions so that environmental values are protected.</i>				
<p>General construction (ground disturbance and wind erosion, plant, vehicle and equipment movement) - Haul Road DE and Port Landside DE.</p>	<p>Particulate (dust) emissions may cause or significantly contribute to an exceedance of air quality standards.</p>	<p><u>Avoid:</u></p> <ul style="list-style-type: none"> The Red Hill Station Homestead and access tracks have been avoided through redesign of the Haul Road DE. Sealing of the haul road to minimise dust emissions and erosion. Design parameters to maximise the suppression and capture of particulate emissions within the Landside DE including an enclosed transfer/storage shed, bins and conveyors (Figure 14-2) 	<p>Particulate emissions during construction.</p> <p>Particulate emissions during construction will be generated through vegetation clearing (Haul Road DE only) and earthwork activities, including vehicle and machinery movements. These activities will be concise in nature.</p> <p>Dust suppression techniques, such as water carts and misting sprays, will be frequently used during construction to further minimise dust generation.</p> <p>Dust (particulate) levels are expected to be restricted to the Proposal DE and immediate adjacent areas, even under extreme weather conditions.</p>	<p>Meets EPA Objective</p> <p><i>Using the EPA’s environmental factor guideline for Air Quality (EPA 2020k), the Proponent is confident that the EPA’s objective for Air Quality will be met, based on:</i></p> <ul style="list-style-type: none"> The limited duration and scale of construction activities, the remoteness of the proposed roadworks, and the established performance outcomes of the proposed construction dust management measures. The sealing of the haul road and covering of ore loads. The adoption of best practice approaches to the design and operation of the port ore handling facilities, including the fully enclosed handling shed and conveyors. The relatively small scale of the PNG power generation facility and distance from sensitive premises. Modelling verifies that air quality standards/guideline values will not be exceeded at sensitive premises, even when considered in cumulation with baseline conditions. A Port Dust Management Procedure and Land Clearing Procedure will be prepared and will be implemented to ensure dust risks are minimised and events or incidents are identified and responded to appropriately. The port product loading operations will be licensed under Part V of the EP Act.
<p>General operations from ore haulage and handling (truck in-loading, conveyors), vehicle and equipment movements - Port Landside DE.</p>	<p>Dust emissions may impact on the amenity of nearby receptors (Section 13.5.5).</p>	<p><u>Minimise - Construction:</u></p> <ul style="list-style-type: none"> Avoid any high dust emission works during high wind (e.g., vegetation clearing) and implement additional use of dust management measures (such as water carts and misting sprays) where these works are not avoidable. Implement dust suppression measures including utilising water carts and misting sprays on unsealed roads and access tracks, cleared areas and at locations of high dust risk during construction. Measures will be implemented where dust is visible and based on predicted meteorological conditions. Water used for dust suppression will be sourced from nearby groundwater bores along the Haul Road alignment. Temporarily cleared areas will be progressively sealed or rehabilitated reducing the area of bare earth susceptible to dust lift off. Implement Port Dust Management Procedure and Land Clearing Procedure Establish community complaints register to log when and the reason for complaints occurring. 	<p>Particulate emissions during operations – Haul Road.</p> <p>The haul road will be fully sealed, which will significantly avoid the generation of airborne dust. Fugitive dust emissions from haul trucks will be minimised by ensuring all loads are covered.</p>	
<p>Combustion gas emissions from power generation – Port Landside DE.</p>		<p><u>Minimise – Haul Road operations:</u></p> <ul style="list-style-type: none"> Haulage loads will be covered, and trucks routinely washed down to minimize dust. The haul road will be routinely inspected and maintained. 	<p>Particulate emissions during operations – Port.</p> <p>Modelling of particulate emissions from Proposal port activities (Table 14-3) predicts slight increases to maximum ground-level concentrations of particulates at surrounding receptors; however, these increases are not significant either in terms of relative contribution or by contributing to exceedances of applicable standards or guidelines at sensitive receptors, even under worse-case/peak activity (i.e. 40 Mtpa) conditions.</p>	
<p>General operations from ore haulage (vehicle movements) – Haul Road DE to Port Landside DE.</p>		<p><u>Minimise – Port operations:</u></p> <ul style="list-style-type: none"> Utilise dust control strategies at the Port Facility such as bin covers, dust extractors, dust containment enclosures; dump pockets where / when dust is identified as an issue. Maintain any dust-generating material at the Port facility at Dust Extinction Moisture (DEM) levels (or slightly above to account for evaporative losses). 	<p>Combustion gas emissions from power generation – Port.</p> <p>Modelling of NO₂ emissions from power generation activities for the Proposal (Table 14-3) shows that, under maximum operating capacity and worse case weather conditions, predicted annual and maximum 1 hour ground level NO₂ concentrations are below acceptable NEPM criteria levels for Proposal emissions only and also when cumulative impacts from background concentrations are considered.</p>	

Relevant Proposal Activities

- Vehicle movements at the Port facility are to be in accordance with PPA's Traffic Management Plan (Ashburton) and kept to established roads, flow paths and speed limits.
- Establish ambient air quality (particulate) monitoring program at Onslow townsite and adjacent to nearby commercial receptors (Chevron and Onslow Salt) with real-time data to inform dust management.
- Monitor wind and weather forecasts to identify high-risk conditions and plan accordingly.
- Wetting down of dusty areas.
- Reviewing and expanding dust controls if emissions exceed predictions or complaints are received.
- The port operations will require a works approval and licence under Part V of the EP Act and will also be subject to performance requirements under the *Port Authorities Act 1999*, through the PPA.

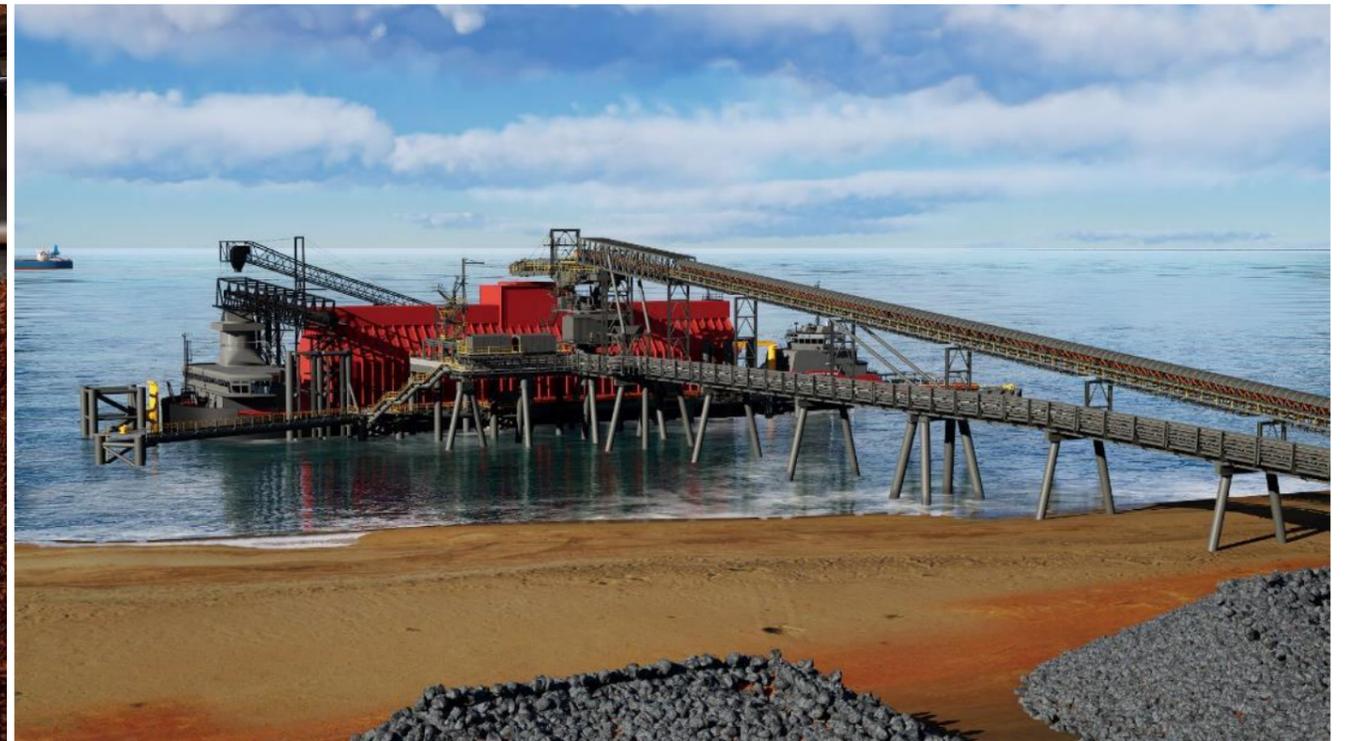


Figure 14-2: Visual Representation of likely Dust Management System (Landside and Nearshore DE)

15. OFFSETS

This section summarises the predicted significant residual environmental impacts associated with the Proposal and the offsets proposed.

The process of identifying significant residual impacts and determining appropriate offsets follows the framework provided by the WA Environmental Offsets Policy (Gov of WA 2011) and the WA Environmental Offsets Guidelines 2014 (Gov of WA 2014). It is important to note that, the Proposal is being assessed in parallel under the EPBC Act but an assessment against EPBC Policy is not included in this RSD (Version 1). However, it is expected that offsets proposed under the EP Act are consistent with Commonwealth requirements for offsetting significant residual impacts to MNES species.

15.1 EP Act Environmental Offsets Policy

The rate, scale and nature of current and future development, combined with the impacts of other land uses and threatening processes, have raised the EPA's concerns about cumulative environmental impacts in the Pilbara region (EPA 2014). In particular, the EPA is concerned about:

- Informing regulation and management of cumulative impacts on native vegetation due to impacts from clearing, pastoralism, feral animals, weeds and climate change in the Pilbara, and the lack of reliable information on the extent and condition of native vegetation at a regional scale.
- Addressing knowledge gaps in mine-site rehabilitation to understand practicable measures to protect the environment; and
- Subterranean fauna focussing on species identification, improved sampling and survey protocols, understanding of habitat requirements, resilience to disturbance and access to data to inform advice on development proposals, reduce uncertainty for decision-makers and improve conservation outcomes.

The EPA has determined that a proactive approach to compensating for the clearing of native vegetation in the Pilbara is required and has established a strategic regional conservation initiative to consolidate and manage offset funds for the Pilbara; the Pilbara Environmental Offsets Fund (the PEOF) (DWER 2021b). The WA Government has established the PEOF in response to recommendations from the EPA for a strategic, coordinated approach to the application of environmental offsets to achieve broad-scale biodiversity conservation outcomes.

The PEOF pools financial contributions for environmental offsets for Pilbara resource and infrastructure projects approved under the EP Act, which are conditioned in accordance with the WA Environmental Offsets Policy (Gov of WA 2011) and associated WA Environmental Offsets Guidelines (Gov of WA 2014). Financial contributions to the PEOF will be used to implement conservation projects that counterbalance any significant residual impacts of those developments at a landscape level in the Pilbara.

The EPA notes that in establishing and implementing the PEOF, the WA Government has committed to ensuring that the offsets implemented via the PEOF are underpinned by the principles set out in the WA Environmental Offsets Policy (Gov of WA 2011), including:

- Offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted (Principle 3);
- Environmental offsets will be based on sound information and knowledge (Principle 4);
- Environmental offsets will be applied within a framework of adaptive management (Principle 5); and
- Environmental offsets will be focused on longer-term strategic outcomes (Principle 6).

Contributions to the PEOF to offset the significant residual impact from the clearing of native vegetation considered in 'Good to Excellent' condition has been used as the standard offset approach by the EPA and proponents in the Pilbara since 2012. This clearing will be offset at a rate of \$840/ha for clearing of native vegetation in Hamersley sub-regions, based on 2020/21 financial year rates and subject to annual indexation based on CPI (DWER 2021b).

On the DWER web page, a base rate has not yet been set for Roebourne. Strategic approaches, such as using a fund, can provide a coordinating mechanism to implement offsets across a range of land tenure (Gov of WA 2014).

15.2 Assessment of Significant Residual Impact – EP Act

Environmental offsets will only be applied where the residual impacts of the Proposal are determined to be significant after avoidance, minimisation and rehabilitation have been pursued (Gov of WA 2014). These measures have been detailed in the **Section 9** and **Section 10** and are summarised in **Table 15-1**.

Significant Residual Impacts (SRI) to environmental values recognised under WA policy are summarised in **Table 15-1** and were determined in accordance with the Residual Impact Significance Model (RSIM) provided in the WA Environmental Offsets Guidelines (Gov of WA 2014):

- The Proposal will result in clearing up to approximately 1,564 ha of native vegetation within a Haul Road DE of approximately 16,209 ha.
- Following application of the mitigation hierarchy, the following residual environmental impacts are considered significant impacts and therefore may require an offset:
 - Clearing of approximately 846 ha of native vegetation in ‘Good to Excellent’ condition in Hamersley sub-region; and
 - Clearing of up to 141 ha of supporting habitat for Northern Quoll.

A summary of the significant impacts to Northern Quoll is provided below.

15.2.1 Northern Quoll

Critical habitat as defined in the National Recovery Plan for the Northern Quoll, *Dasyurus hallucatus* (Hill and Ward 2010) is habitat “*where northern quolls are least exposed to threats or least likely to be in the future... two particular broad habitat types fall into this category: rocky areas and offshore islands. Daytime den sites, in particular, provide important shelter and protection for northern quolls from predators and weather*” and rocky areas which contain these features, can retain water and contain microhabitats, creating greater prey diversity than nearby non-rocky areas (Hill and Ward 2010). While the surrounding foraging and dispersal habitats are also important, they are generally more widespread, and any clearing of these habitats is likely to be less significant.

Based on this definition and the result of the terrestrial fauna survey (360 Environmental 2021b) the Mesa and Breakaway habitat recorded in the Terrestrial Survey Area is considered critical habitat. None of this habitat occurs in the Haul Road DE.

The Commonwealth listing advice states that the upper home range of this species is up to 150 ha for males and 35 ha for females (TSSC 2005), which would have an approximate radius of 1 km (based on a 150 ha home range). This represents the approximate distance an individual would travel from the denning habitat to disperse and forage. Given this, any foraging and dispersal habitat within 1 km of the Mesa and Breakaway habitat is considered supporting habitat for the Northern Quoll. The Haul Road DE is located within 1 km of Mesas and Breakaway habitat and therefore overlaps with supporting habitat, including the following habitats; Stony Hills and Slopes, Drainage Line/Creek (minor) and Stony Plain.

After the application of avoidance and mitigation avoidance measures, the Proponent considers that the Proposal is likely to result in the following significant residual impact for Northern Quoll, clearing of up to 141 ha of supporting habitat. **Therefore, offsets are proposed to address this significant residual impact.**

Table 15-1: Residual Impact Significance Model (RISM)

Existing Environmental Impact	Environmental Aspect	Mitigation			Significant Residual Impact
		Avoid and Minimise	Rehabilitation Type	Likely Rehabilitation Success	
Environmental Factor: Flora and Vegetation					
<p>Contact/key survey findings:</p> <p>The Development Envelope comprises the following flora and vegetation value:</p> <ul style="list-style-type: none"> 49 vegetation types mapped within the Haul Road DE of which 30 potentially support local Priority flora species. 8 vegetation units representing potential GDV. 583 flora taxa were recorded in the Haul Road DE. 7 priority flora species were recorded in the Haul Road DE. 	<p>Clearing of 1564 ha of native vegetation including 846.1 ha of native vegetation in Good to Excellent condition within the Pilbara bioregion.</p>	<p>The proposed clearing has been minimised as far as practicable to reduce the extent of clearing required.</p> <p>The Proponent will ensure clearing only occurs in approved ground disturbance areas and avoid clearing outside of the Haul Road DE.</p> <p>Vegetation clearing shall be kept to the minimum amount required, as far as practicable.</p> <p>Survey and clearly demarcate clearing areas prior to clearing commencing, including flagging and signage as required.</p> <p>Observers and spotters will be used when working near sensitive sites, e.g., near Priority flora, or when clearing boundaries may not be readily visible (for example due to dense vegetation).</p> <p>Induct relevant personnel and contractors on land disturbance and vegetation clearing management including:</p> <ul style="list-style-type: none"> Significant vegetation and flora present in the Haul Road DE; Key protection measures being implemented; “no-go” areas; Clearing boundaries; and Requirements of the SSDP. 	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas (such as borrow pits and temporary construction areas) will be undertaken in accordance with the Closure Strategy (Appendix I).</p>	<p>Can the environmental values be rehabilitated? Evidence?</p> <p>Yes. Large scale land rehabilitation works are proven to be feasible in the Pilbara as demonstrated by the establishment of vegetation on post-mining waste rock landforms. Other examples can be cited from non-mining contexts including land development and road construction.</p> <p>Operator experience in undertaking rehabilitation?</p> <p>The Proponent has significant relevant experience in planning and undertaking rehabilitation at other operations. In addition to the Proponent in-house capacity, the Proponent utilises highly qualified and experienced rehabilitation and revegetation contractors to undertake critical works.</p> <p>What is the type of vegetation being rehabilitated?</p> <p>A total of 49 vegetation types have been mapped in the Haul Road DE. These are described in Section 9.3.2.3.</p> <p>Topsoil will be applied in the areas from which it was collected. In-situ stockpiling in accordance with strict guidelines will increase the accumulation of local plant species in the soil and benefit the re-establishment of the vegetation communities within the rehabilitated Haul Road DE.</p> <p>Time lag</p> <p>Progressive rehabilitation will continue to be undertaken throughout the life of the Proposal where practicable.</p> <p>Credibility of the rehabilitation proposed (evidence of demonstrated success)</p> <p>The proposed rehabilitation has a high degree of credibility. As the haul road corridor is relatively narrow, no part of the route is far from the extant vegetation outside the corridor. This will provide a source of wind, water and insect carried seed into the rehabilitating areas. Management and monitoring of the topsoil stockpiles will provide data on the need for the collection of supplementary seed to be used in rehabilitation.</p>	<p>The significant residual impacts, after the implementation of the mitigation hierarchy, is clearing of up to 846.1 ha of native vegetation in Good to Excellent condition in the Hamersley subregion.</p>

Existing Environmental Impact	Environmental Aspect	Mitigation			Significant Residual Impact
		Avoid and Minimise	Rehabilitation Type	Likely Rehabilitation Success	
Environmental Factor: Terrestrial Fauna					
<p>Contact/key survey findings:</p> <p>The Development Envelope comprises the following terrestrial fauna values:</p> <ul style="list-style-type: none"> 9 broad habitat types. 6 conservation significant fauna species were recorded within the Terrestrial Survey Area. 	<p>Clearing of 1564 ha of native vegetation constituting fauna habitat</p> <p>Clearing of fauna habitat including up to:</p> <ul style="list-style-type: none"> 1 ha of Claypan. 42 ha of Drainage Line/River/Creek (major). 226 ha of Drainage Line/River/Creek (minor). 207 of Mulga Woodland. 1,564 ha of Plain. 528 ha of Sand Dunes and Swales. 150 ha of Stony Hills and Slopes. 1,564 ha of Stony Plain. 69 ha of Tidal Flats. 	<p>The Proponent has undertaken a redesign of a haul road to avoid direct impacts to Mesas and Breakaway habitat. This includes realigning the corridor to avoid Mesas and Breakaway habitat. The new design has avoided all Mesas and Breakaway habitat is known as Northern Quoll denning habitat, Ghost Bat and Pilbara Leaf-nosed Bat roosting habitat and shelter for Pilbara Olive Python.</p> <p>The proposed clearing has been minimised as far as practicable to reduce the extent of clearing required. The Proponent has revised the Haul Road DE from 25,930 to 16,209 ha.</p> <p>The Proponent will ensure clearing only occurs in approved disturbance areas and will avoid any clearing occurring outside of the Haul Road IF in accordance with the SSDP process outlined in the TEMP (Appendix H).</p> <p>Landform corridors such as drainage lines will remain and maintain connectivity of habitat.</p> <p>The ground disturbance will be minimised as far as practicable.</p> <p>Vegetation clearing at creek crossings will be minimised as far as practicable. Water crossings (bridges/overpasses/culverts) will be installed over major rivers and creeks to minimise impacts to Drainage Lines/Rivers/Creeks (major) habitat.</p> <p>Induct relevant personnel and contractors on land disturbance and vegetation clearing management including:</p> <ul style="list-style-type: none"> Native and conservation significant fauna present in the Project area; Key protection measures being implemented; Significant species habitat and “no-go” areas; and Allowable operation times (i.e. no night-time clearing to be undertaken within 1 km of Mesa and Breakaway habitat); <p>Clearing boundaries; and Requirements of the site-disturbance procedure (SSDP).</p>	<p>Progressive rehabilitation of approximately 1200 ha of temporary disturbance areas will be undertaken (such as borrow pits and temporary construction areas) in accordance with the Closure Strategy (Appendix I).</p>	<p>As per Flora and Vegetation above.</p>	<p>The significant residual impact, after the application of the mitigation hierarchy, is the clearing of up to 141 ha of supporting habitat for the Northern Quoll.</p>

15.3 Offset Commitment

The Proponent proposes offsets in financial contributions to the PEOF at the specified rates outlined below for each significant residual impact. Areas requiring offsets outlined below are conservation estimates based upon the most current mine planning information when preparing this RSD (**Table 15-2**). The offset rate per hectare for IBRA sub-regions has been sourced from the PEOF webpage on the DWER webpage and will be subject to CPI (DWER 2021b).

Table 15-2: Environmental Values from Pilbara Environmental Offset Fund for the Proposal

Environmental Value	IBRA Sub Region	Potential Extent of Significant Residual Impact	Offset Rate Documented on DWER Webpage*	Estimated Financial Contribution
Clearing of supporting habitat for Northern Quolls within 1 km of potential denning habitat.	Hamersley	Up to 141 ha	\$1,679/ha	\$236,739
Clearing of native vegetation in 'Good to Excellent'.	Hamersley	Up to 705 ha (excluding the 141 ha offset at the higher rate for Northern Quoll.	\$840/ha	\$592,200
Total Estimated PEOF Contribution				\$828,939

*Rates are as published at <https://www.wa.gov.au/service/environment/business-and-community-assistance/program-pilbara-environmental-offsets-fund> and are adjusted inflation on an annual basis. Where environmental values overlap, only the highest applicable rate will be applied (i.e. supporting Northern Quoll habitat within 1 km of denning habitat that is in Good to Excellent condition would be offset at the higher rate, not the sum of the base rate and higher rate).

The total offset value is estimated to be approximately \$828,939. Where offsets are required for an environmental value that is also subject to offsets under one or more other environmental values, the higher offset rate shall apply. The actual offset amounts will be based on extents of actual clearing, which will be determined through an Impact Reconciliation Report (IRR) (**Appendix HH**). The intended construction timeframe is less than one year, so it is intended that the first and final offset amount will be calculated within three months of completion of construction. If the construction period is extended, then biennial reporting will be conducted from the date of approval. The IRR will provide the location and spatial extent of the native vegetation clearing undertaken within 'Good to Excellent' condition to calculate the required monetary contribution to the PEOF.

15.4 Consistency with Offset Policies

The approach to offsetting the significant residual impacts associated with the Proposal is considered to be consistent with the six principles outlined in the WA Environmental Offset Policy (Gov of WA 2011). **Table 15-3** summarises how these principles have been considered during the development of the offsets approach.

Table 15-3: Principles of the WA Environmental Offsets Policy

Principle	Response
Environmental offsets will only be considered after avoidance and	Avoidance and minimisation of impact have been included as part of the planning and design process. The Proponent considered various options to avoid impacts to areas of high-value where practicable. In particular, the Proponent has: <ul style="list-style-type: none"> Reduced the size of the DE from 25,930 ha to 16,209 ha (by approx. 37%).

Principle	Response
mitigation options have been pursued.	<ul style="list-style-type: none"> Realigned the corridor to avoid all Mesas and Breakaway habitat which are considered of high value to many conservation significant species. <p>The application of the mitigation hierarchy for the Proposal has ensured that all practical avoidance and minimisation measures have been considered and pursued where appropriate. Offsets have only been considered for those significant impacts that are not able to be avoided or minimised.</p>
Environmental offsets are not appropriate for all projects.	The identified SRI are considered appropriate to be offset as they are not considered to be either minor (too minor to require an offset) or likely to be considered environmentally unacceptable regardless of offsets.
Environmental offsets will be cost-effective, as well as relevant and proportionate to significance of the environmental value being impacted.	<p>The Proponent commits to providing financial offsets that are proportionate to counterbalance the SRI to the identified environmental values.</p> <p>The rates applied have been determined by the WA Government as being appropriate to the Roebourne and Hamersley sub-region of the Pilbara.</p>
Environmental offsets will be based on sound environmental information and knowledge.	Contribution to the PEOF is not a traditional offset where, for example a single conservation project would need to consider sound environmental information and knowledge about a particular species or community. However, the conservation and research projects to be implemented at a broad-scale through the PEOF are intended to address the cumulative impacts of mining in the Pilbara as identified by the EPA and supported by the Australian Government, to provide a more detailed understanding of conservation values in the Pilbara region to improve decision making regarding conservation and management.
Environmental offsets will be applied within a framework of adaptive management.	The PEOF includes various mechanisms to ensure adaptive management processes, including partnerships, scheduling, procurement, funding arrangements, performance measures and reporting requirements.
Environmental offsets will be focused on longer term strategic outcomes.	The EPA recognises that the establishment of the PEOF is consistent with this principle in that strategic approaches, such as the use of the PEOF, will provide a mechanism to coordinate the implementation of offsets across a range of land tenures (Gov of WA 2014). The PEOF provides a strategic, coordinated approach to the application of environmental offsets to achieve broad-scale biodiversity conservation outcomes for the Pilbara region. The Proponent recognises the commitment of the EPA to this strategic approach and is contributing via being a participant in the working group for establishment of the PEOF.

16. HOLISTIC IMPACT ASSESSMENT

16.1 Summary of Environmental Effects of the Proposal

16.1.1 Marine (Nearshore and Offshore)

The health of marine fauna populations is intrinsically linked to the health and availability of their habitat and environmental quality. With impacts to habitat and environmental quality **unlikely** to be significant, the Proposal is also **unlikely** to significantly impact on marine fauna including:

- No impacts to important habitats (i.e., nesting, nursery, foraging or breeding areas), for any conservation significant marine fauna species;
- The number of individuals affected is expected to be low and not significant in terms of local populations;
- No reduction in populations of species of local and regional importance;
- No reduction in the biodiversity of marine fauna in the DEs or surrounds; and
- Suitable habitat for all other identified marine fauna species (including threatened and migratory MNES) will continue to be available in the Development Envelope, local and regional areas.

The Proposal can be implemented without significant impacts on the health, diversity and productivity of the environment. The Proposal is manageable using the mitigation hierarchy (avoid, minimise and rehabilitate). The predicted outcome is that the residual significance to State and Commonwealth Endangered, Vulnerable, and Priority fauna and flora species can be effectively managed.

16.1.2 Terrestrial (Haul Road and Landscape).

The Proposal will clear up to **1,564 ha** within the Haul Road DE. There is no clearing for this Proposal in the Landside DE. The Haul Road DE is within three sub-regions (Cape Range, Hamersley and Roebourne). These sub-regions collectively have over 99% of pre-European vegetation remaining, with Roebourne the lowest extent remaining (96%). Overall, 9.7% of these sub-regions are protected in conservation reserves. There are no known TECs and PECs in the Haul Road DE and, therefore, will not be directly impacted by clearing.

Up to **418 ha**, moderate value foraging and dispersal habitat (Drainage Line/River/Creek, Stony Hills and Slope) will be cleared; this habitat extends beyond the Haul Road and is not restricted in the region.

The Proposal has been re-designed to minimise clearing native vegetation and terrestrial fauna habitat. The Proposal avoids all Mesas and Breakaway habitats (potential denning, roosting and foraging habitat for the MNES species Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Pilbara Olive Python) and minimises footprint at creek crossings.

The indicative footprint has been designed to minimise significant impacts to the six Priority flora species (*Abutilon* sp. Onslow (F. Smith s.n. 10/9/61) (P1), *Euphorbia inappendiculata* var. *inappendiculata* (P2), *Eremophila forrestii* subsp. *viridis* (P3), *Indigofera rivularis* (previously known as *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301)) (P3), *Owenia acidula* (P3) and *Goodenia nuda* (P4).

Clearing the Haul Road DE will have a limited impact on native vegetation and fauna habitat.

16.2 Interconnected Factors

16.2.1 Marine

The relationship between marine environmental factors has been considered to determine whether the combined effect on multiple factors may cause a significant impact and require management.

The Proponent recognises the high degree of connectivity and interrelatedness between marine fauna, benthic habitat, coastal processes and marine environmental quality. Understanding the environmental processes and

their interactions is critical to assessing the significance of potential impacts from the Proposal on the marine environment surrounding the Proposal and its associated habitat and flora and fauna communities. A holistic view of interconnections between factors for the marine environment is shown in **Figure 16-1**.

The maintenance of marine environmental quality, for example, is recognised as critical to the protection of BCH. Importantly, apart from small, localised and temporary impacts during construction, no impacts to marine environmental quality are expected from this Proposal.

The Proponent also recognises that critical benthic habitats often support marine fauna. Due to the types of benthic habitat found in the surrounding environment and the limited extent, severity and duration of impacts to this habitat as a result of the Proposal, significant impacts to BCH that is critical to support conservation significant marine fauna are also **unlikely**.

Underwater noise, which is a key potential impact identified from the proposed piling, has the potential to impact marine fauna. To address this a detailed modelling and impact assessment of the likely effects of piling generated underwater noise to sensitive receptors was undertaken. Following avoidance and mitigation strategies being implemented, it is predicted that temporary increases in noise levels can be managed without significant impact to marine fauna.

The Proposal has been designed to avoid high-value and sensitive environmental receptors primarily through utilising the existing port location and expanding facilities in an area that is already subject to disturbance and has negligible benthic habitat and therefore low productivity. **Figure 16-2** shows how the infrastructure of the Port impacts the environmental factors.

Benthic habitats located within the Offshore DE include low profile reef habitat with macroalgae, filter feeders and coral. However, within this DE, the anchorage area has been designated in areas of bare sand, with sufficient buffer to avoid impacts to any sensitive BCH.

The combined effects on the marine environment as a whole are no greater than the effects on individual factors (marine fauna, MEQ BCH and Coastal Processes). Furthermore, any potential impacts to these factors have been effectively mitigated through the development of a comprehensive set of monitoring and management plans to be implemented during dredging (**Appendix E**), construction (**Appendix C**) and operations (**Appendix D**) of the Proposal.

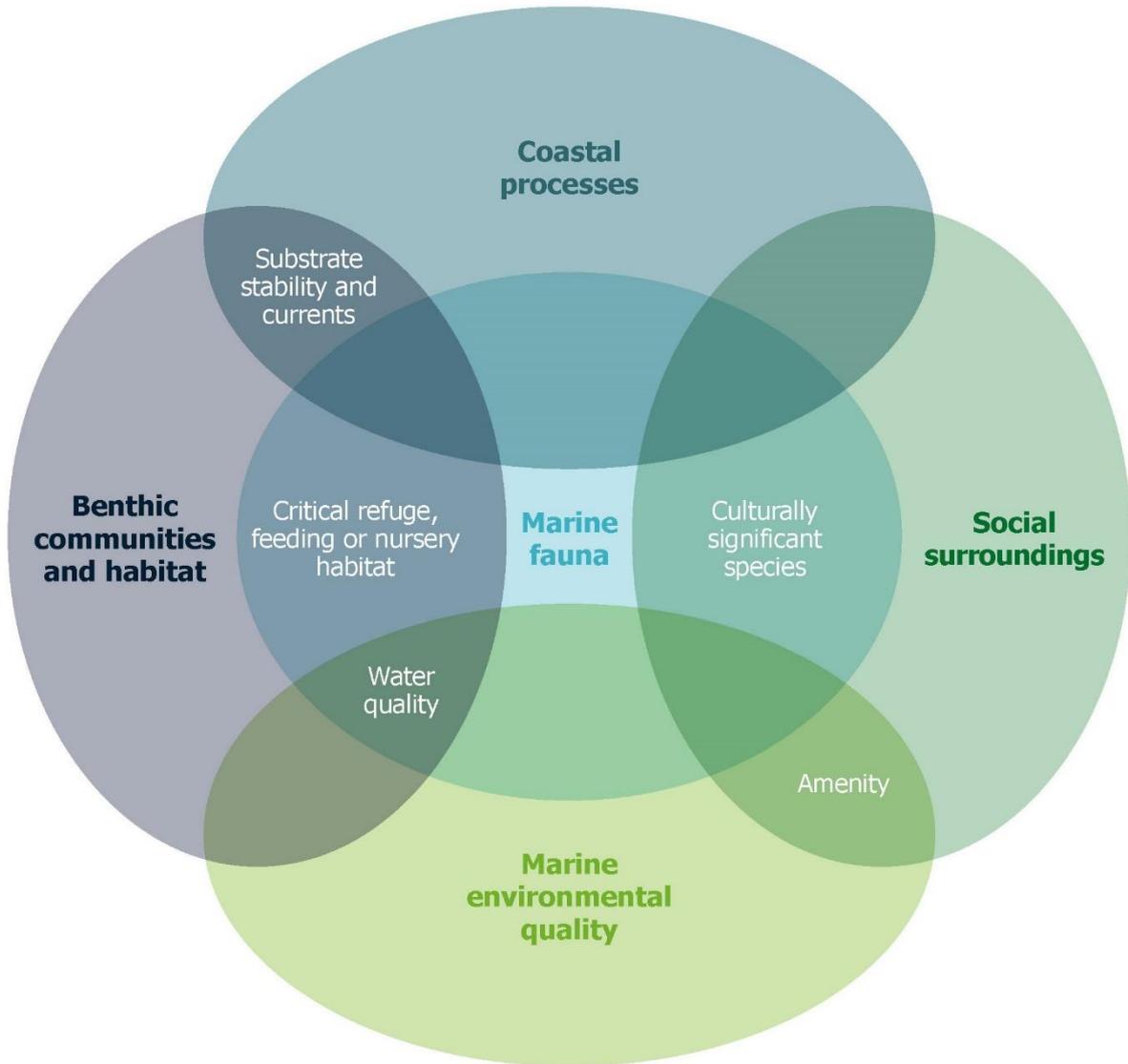


Figure 16-1: Holistic View of Links Between Marine Environmental Factors



Figure 16-2: Holistic Impact Assessment: Port Infrastructure

16.2.2 Terrestrial

A holistic view of interconnections between factors for the terrestrial environment is shown in **Figure 16-3**.

The relationship between terrestrial environmental factors has been considered to determine whether the combined effect on multiple factors may cause a significant impact and require management. Important environmental values for different factors in the Haul Road DE tend to co-occur. That is, the most important fauna habitats are associated with rocky habitats (mesas) and drainage lines. These areas support higher biodiversity and are also important for social surroundings and the maintenance of hydrological regimes. Therefore, the avoidance of high-value habitat (Mesas and Breakaway) and minimising impact to major watercourses has also minimised the potential for significant combined environmental effects that might occur if the Proposal disturbed large areas of these landscape features.

Total avoidance of the Cane River is not possible due to the linear nature of the infrastructure; however, the width of the crossing has been minimised and borrow pits will be placed outside the highest density of *Abutilon* sp. that occur immediately to the west of the crossing. **Figure 16-3** shows how the haul road crossing at the Cane River affects environmental factors as this major watercourse holds significant value for multiple terrestrial factors: Flora and Vegetation, Terrestrial Fauna, Inland Waters and Social Surroundings. The haul road crossing will be designed to maintain water flow. Therefore, the Proposal will **not significantly impact** this area, which has high environmental and social value.

No clearing for this Proposal will occur in the Landside DE and therefore the Proposal will avoid additional impacts to biodiversity and inland waters (**Figure 16-3**). All the impacts from dust, noise, light and visual amenity from construction and operation have been minimised through the co-location with existing infrastructure and through closed handling of ore to minimise dust and noise. These measures minimise the extent of coastline affected by development and ensure the impacts at the Port are as low as reasonably practicable, which benefits the environment as a whole.

The combined effects on the terrestrial environment as a whole are **no greater** than the effects on individual factors (Flora and Vegetation, Terrestrial Fauna, Inland Waters and Social Surroundings). These effects have been minimised by applying the mitigation hierarchy (avoid, minimise and rehabilitate) to each factor as described in **Section 9, 10, 11 and 13**.

16.2.3 Additional Considerations Arising from Holistic Impact Assessment

There are **no additional significant residual impacts** or additional mitigation required due to the holistic impact assessment. The combined effects on the terrestrial and marine environment holistically are **no greater** than any individual factor.

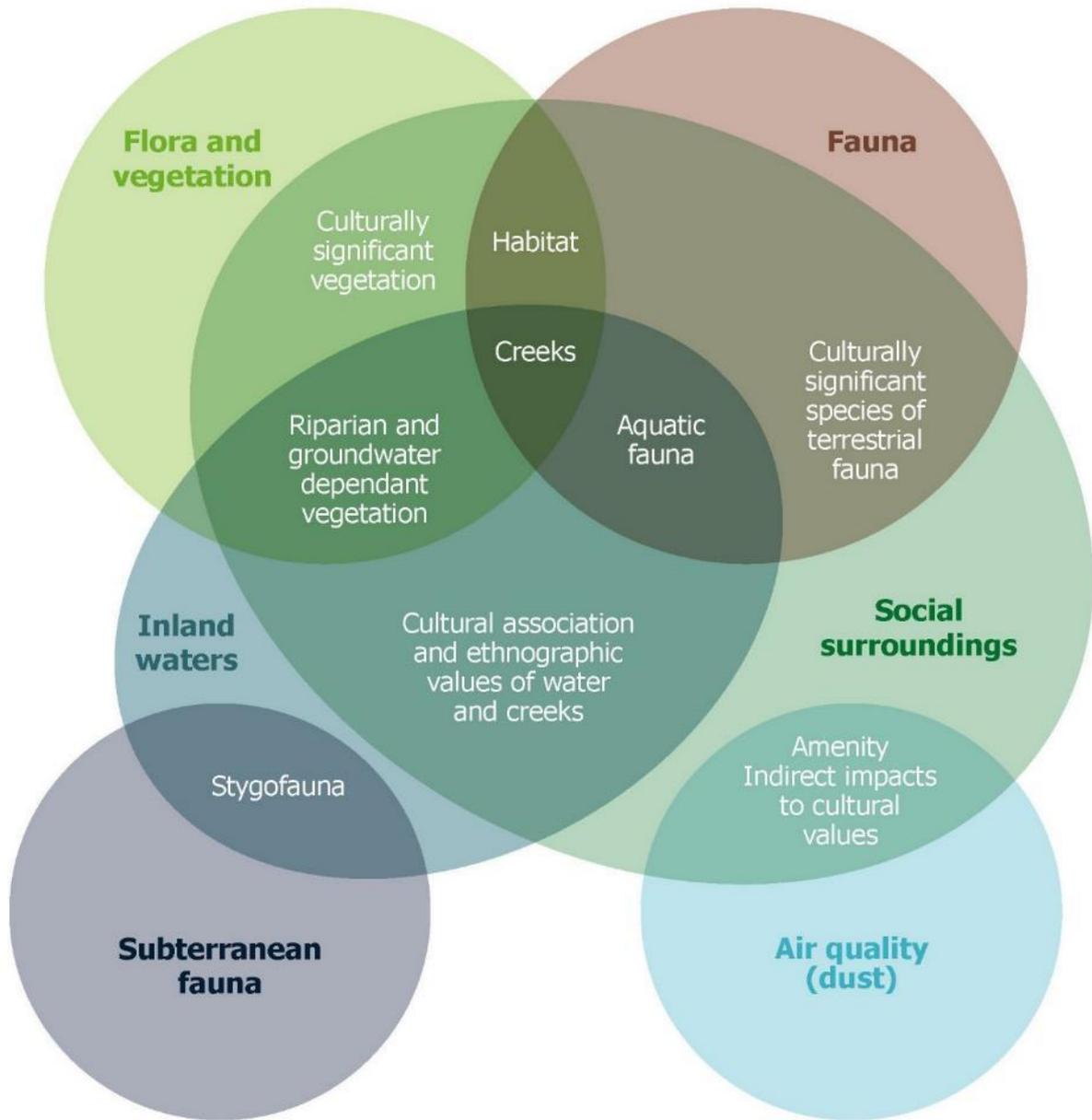


Figure 16-3: Holistic View of Links between Terrestrial Environmental Factors

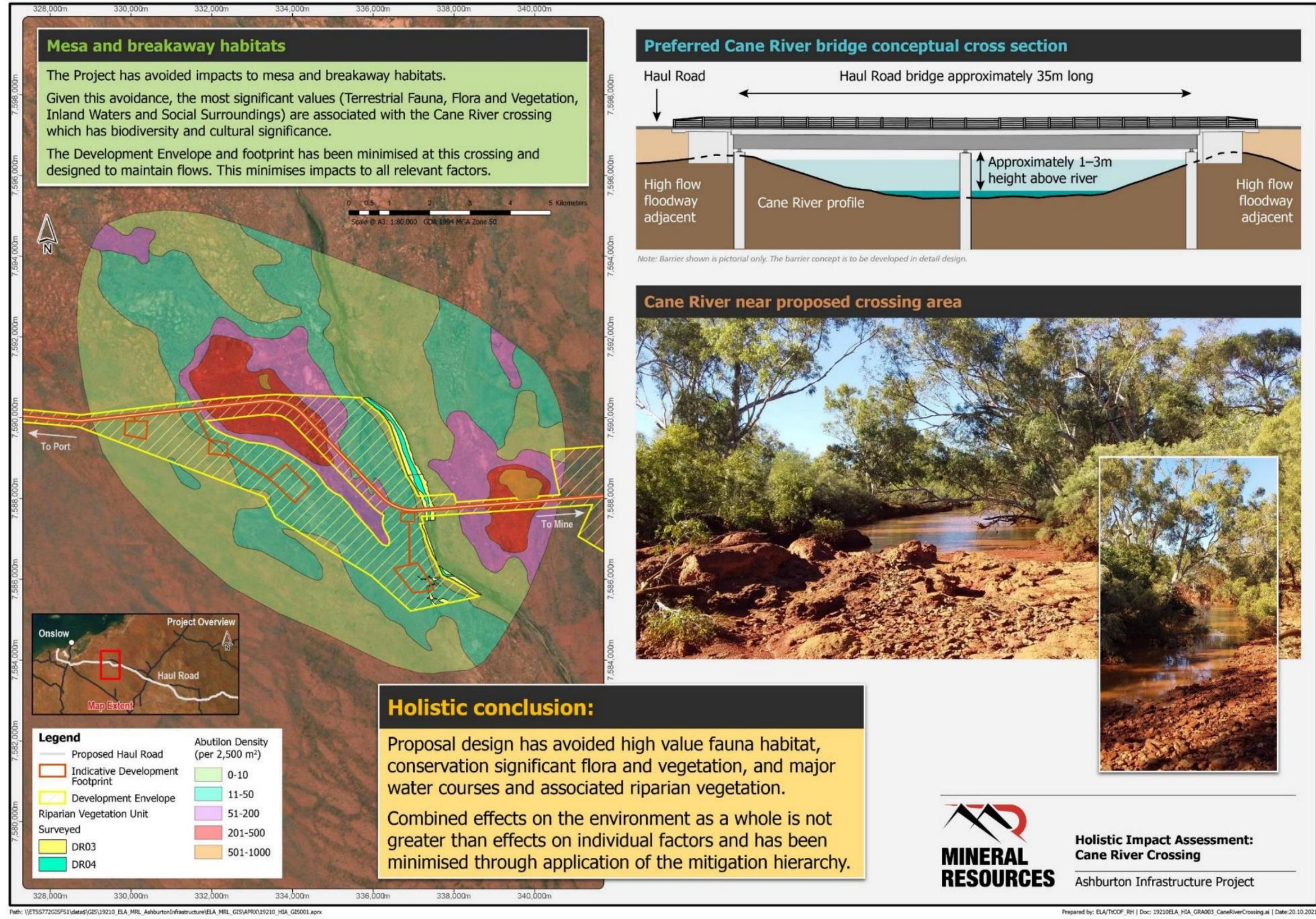


Figure 16-4: Holistic Impact Assessment – Cane River Crossing

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APPENDICES

Appendix A: Mineral Resources Environmental Policy

Appendix B: Framework Environmental Management Plan (FEMP)

Appendix C: Marine Construction Environmental Management Plan (MCEMP)

Appendix D: Marine Operational Environmental Monitoring and Management Plan (OEMMP)

Appendix E: Dredging and Spoil Disposal Management Plan (DSDMP)

Appendix F: Artificial Light Management Plan (ALMP)

Appendix G: Underwater Noise Management Protocol (UNMP)

Appendix H: Terrestrial Environmental Management Plan (TEMP)

Appendix I: AIP Closure Strategy

Appendix J: Dredge Plume Modelling Report

Appendix K: Desalination Brine Plume Modelling Report

Appendix L: Marine Fauna Desktop Assessment Report

Appendix M: Benthic Communities and Habitat Survey and Assessment Report

Appendix N: Supplementary Benthic Communities and Habitat Survey of Spoil Ground C Report

Appendix O: Marine Pest Impact Risk Assessment Report

Appendix P: Underwater Noise Modelling Report

Appendix Q: Water Quality Desktop Review Report

Appendix R: Flora and Vegetation Survey and Assessment Report (excluding Red Hill Station)

Appendix S: Compiled Flora and Vegetation Survey and Assessment Report (including Red Hill Station)

Appendix T: Vertebrate Fauna and SRE Fauna Survey and Assessment Report

Appendix U: Greenhouse Gas Assessment Report

Appendix V: Maritime Heritage – Non-Aboriginal Desktop Assessment Report

Appendix W: AIP Environmental Noise Assessment Report

Appendix X: Desktop Air Quality Study to Determine Monitoring Locations

Appendix Y: Air Quality Assessment Report

Appendix Z: Sediment Sampling and Analysis Plan

Appendix AA: Sediment Sampling and Analysis Plan – Implementation Report

Appendix BB: Base Hydrodynamic Modelling Report

Appendix CC: Assessment of Impact to Coastal Processes from AIP's Marine Infrastructure Report

Appendix DD: Ashburton Haul Road Surface Water Flow Assessment Report

Appendix EE: AIP Port Flood Assessment Report

Appendix FF: Onslow Road to NWCH - Waterways Assessment Approach and Baseline Results Report

Appendix GG: Ashburton Haul Road – Groundwater Investigation Report

Appendix HH: Impact Reconciliation Report

Appendix II: Ashburton Infrastructure Project – Migratory Birds Desktop Assessment Report

Appendix JJ: Red Hill North and South Haul Road - Vertebrate Fauna and SRE Assessment Report

Appendix KK: AIP – Desktop Bat Assessment Report