Clearing Assessment Report

We're working for Western Australia.

North West Coastal Highway
Rail Grade Separation

Pilbara
EOS #2647

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1 PROPOSAL

1.1 Purpose and Justification

Main Roads is proposing a grade separation development between North West Coastal Highway (NWCH) and the Rio Tinto Iron Ore (RTIO) Railway south of Karratha to improve road user safety for the increase in road traffic along this route. The project includes the bridge construction, upgrades to the North West Coastal Highway, and material source areas.

1.1.1 Main Roads Approach to Road Safety and the Environment

Main Roads manages the State road network to achieve balanced economic, social, safety and environmental benefits for the community, and is committed to minimising the environmental impacts of all of its activities. Main Roads recognises that Western Australia's environment is significant from a global perspective and the unique conservation values that are contained within its road reserve. The Main Roads road network often adjoins natural areas and, in some locations, the reserve itself hosts remnant vegetation with high environmental values. Although the reserves were not established for this purpose, Main Roads recognises that it has a responsibility to conserve the environmental values that occur within the State's road network and minimise the impact its proposals have on the environment. In addition to providing a safe and efficient road network for all people using the roads under its control, Main Roads is also committed to protecting and enhancing the natural environment.

In accordance with National and State Government road safety policies, Main Roads is also committed to substantially reducing road trauma on the road network through Safe System principles. The Safe System approach acknowledges that more than two thirds of all serious crashes are due to human error rather than deliberate risk taking (e.g. speeding or drink driving) and seeks to improve behaviour through education and enforcement while managing the safety of vehicles, speeds and the road and road infrastructure. It is shown that improving sub-optimal road formation will substantially reduce the likelihood and severity of road crashes. For example, according to the Road Safety Management Guideline, increasing the sealed shoulder from 0.5 m to 2 m will reduce Killed and Seriously Injured numbers by more than 50%.

As the statutory authority responsible for providing and managing a safe and efficient main road network in Western Australia, Main Roads focuses on improving road safety by thoroughly considering all environmental, economic and community benefits and impacts. It operates on a hierarchy of avoiding, minimising, reducing and then, if required, offsetting our environmental impacts. This has been achieved through changes in proposal scope and design. Main Roads regularly reduces its clearing footprint by restricting earthworks limits for proposals, steepening batters, installing barriers, establishing borrow pits in cleared paddocks and avoiding temporary clearing for storage, stockpiles and turn around bays to avoid and minimise its impacts. Further details on measures to avoid, minimise and reduce are provided in Section 1.6.

1.2 Proposal Scope

Main Roads in partnership with RTIO will grade separate the RTIO railway at Bridge 18.1 by constructing a new bridge and road alignment to the south of the existing NWCH. The project will comprise the following components:

- Grade separation bridge construction south of the existing NWCH at SLK 1097.80;
- Realignment of the North West Coastal Highway;
- Modifications to the intersection of Manuwarra Red Dog Highway and NWCH (SLK 1098.25) and Madigan Road intersections and NWCH (SLK 1098.25);
- Side tracks;
- Material areas; and
- Temporary entryway to fuel station.

The existing NWCH will remain in operation whilst the new alignment is constructed.

1.3 Proposal Location

The construction area is along North West Coastal Highway at SLK 1095.4 and 1099.86 in the local government area of City of Karratha as shown in Figure 1. The central coordinate of the proposal is -20.795087 latitude and 116.770152 longitude.

1.4 Clearing Details

Native Vegetation Clearing Area: 110.72 hectares.

Areas of Native Vegetation Clearing:
The areas of native vegetation to be cleared and vegetation communities are shown in Figure 2.

Type of Native Vegetation:
The type of vegetation to be cleared under this Proposal is in the Roebourne subregion (PIL04) described as '*Coastal and sub-coastal plains with a grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of Acacia stellaticeps or A. pyrifolia and A. inaequilatera*'.

Vegetation type and extent have been mapped at a regional scale by Beard (1975) who categorised vegetation into broad vegetation associations. Two vegetation types are associated with the survey area, with Abydos Plain-Roebourne 589 comprising most of the extended survey area and Abydos Plain-Roebourne 157 occurring in the south-west.

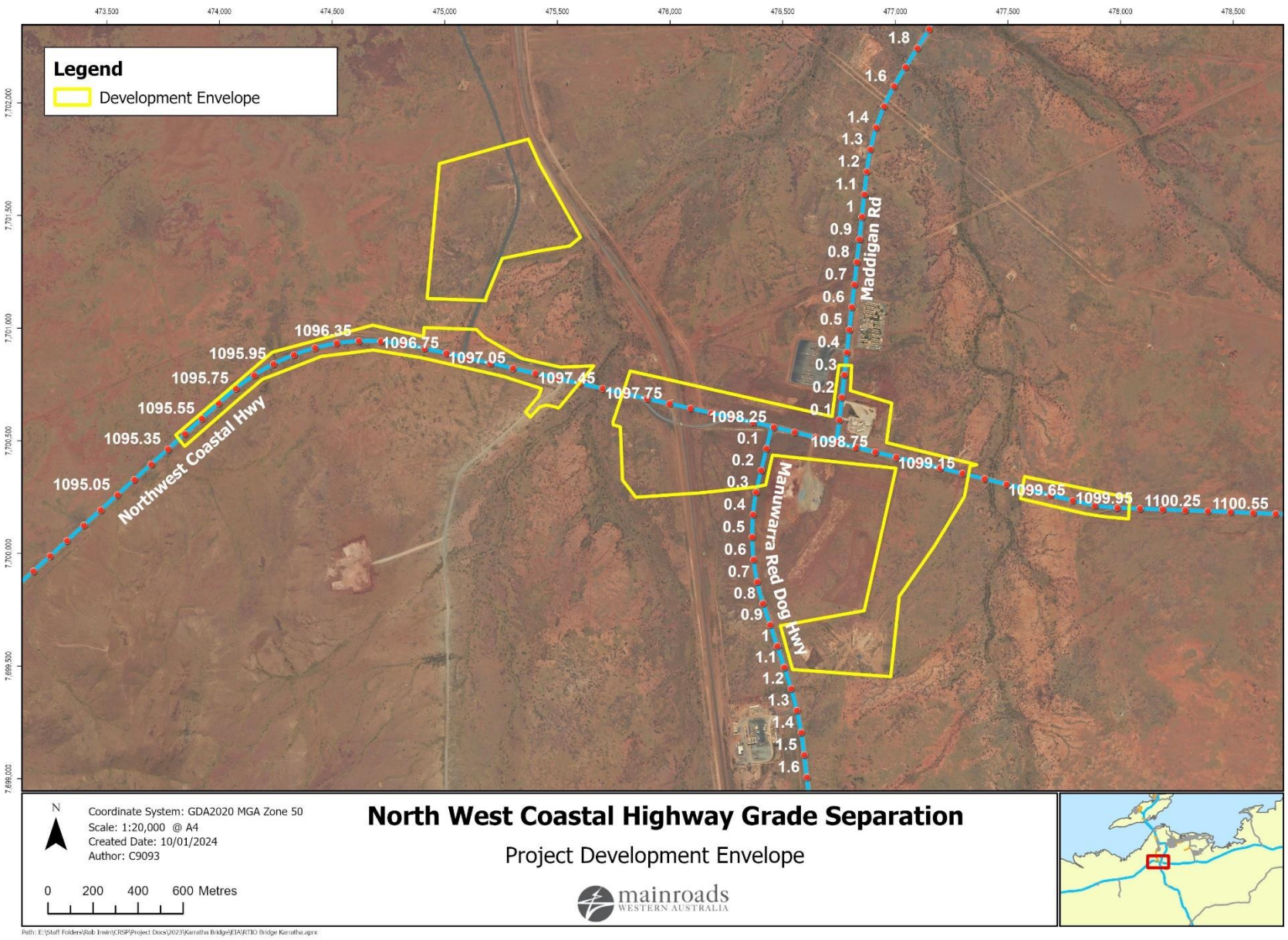

Figure 1. Location Map – North West Coastal Highway Grade Separation

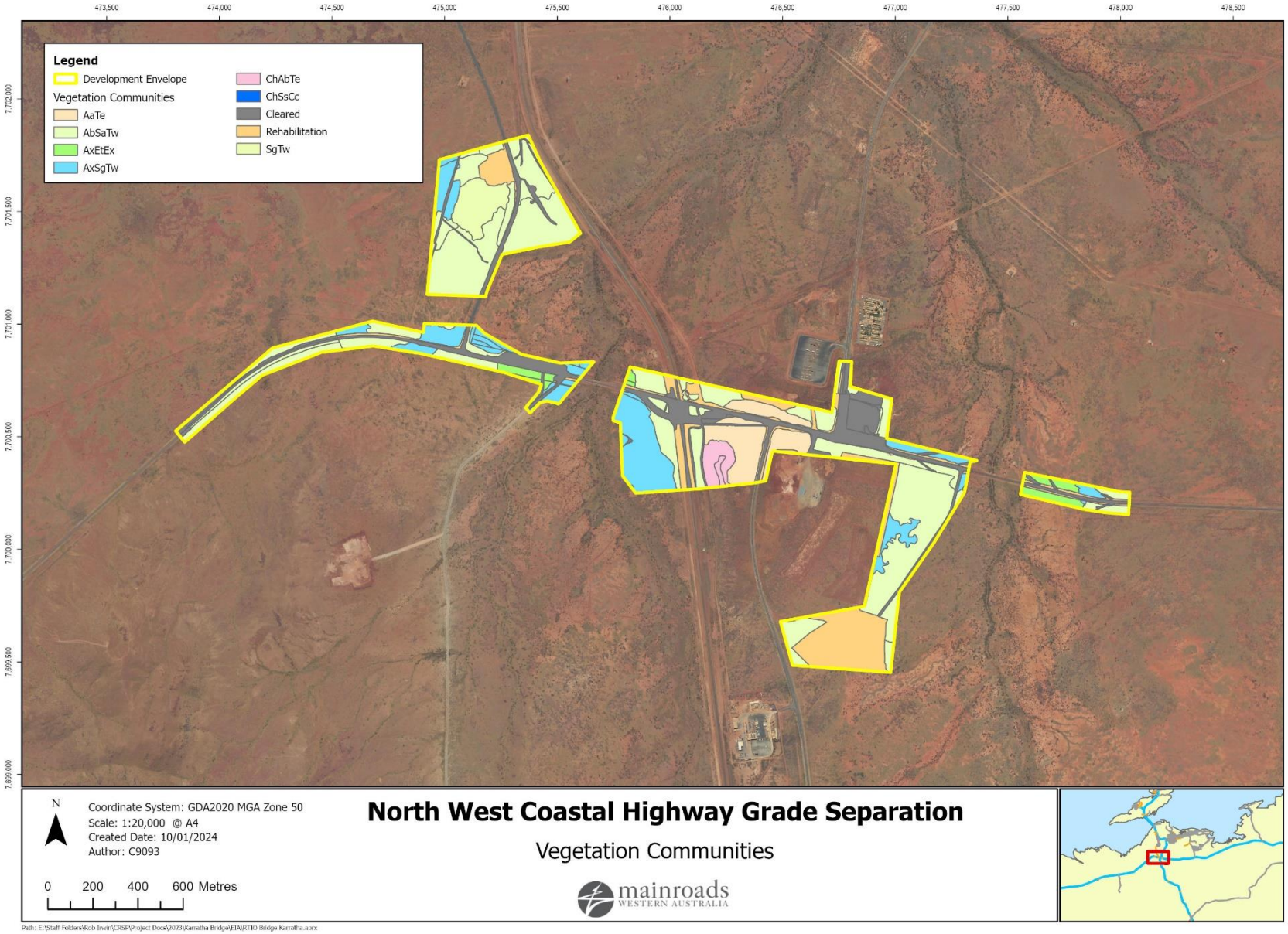

Figure 2. Vegetation Communities within the Development Envelope

1.5 Alternatives to Native Vegetation Clearing Considered During Proposal Development

The following alternatives to clearing were considered during the development of the proposal:

- No construction of the bridge, however this will potentially result in a poorer safety outcome and may result in future fatalities or serious injuries, and will increase wait times along North West Coastal Highway due to continued interaction at the level crossing between road traffic and the railway.
- Main Roads retains frangible vegetation where a clear zone is to be established for road projects. For this project, however, clearing is required to accommodate the road formation, bridge construction, floodway upgrades and material sourcing, with no clear zone being established. Accordingly, the retention of frangible vegetation does not apply to this proposal.
- Reducing the speed limit to minimise clearing requirements, while still balancing safety (driver fatigue) and freight efficiency. Speed Limits are an essential mechanism to ensure the safe and efficient operation of road networks. The application of appropriate speed limits and other traffic management measures is a key mechanism in managing vehicle speeds to achieve desired safety, mobility, traffic management, local amenity, and road user expectations. There are several factors involved in road safety, including road conditions, driver behaviour and overall road design. Except in special situations, reducing speed limits below national standards on state and national roads is not typically supported as it has the potential to contribute to driver frustration, impatience, tiredness and recklessness. The environmental values protected by reducing the speed limit, do not justify the impacts on freight efficiencies nor road user safety. The nature of the works proposed aims to reduce the interaction of rail and vehicular traffic. Accordingly, the reduction of the speed limits to avoid clearing of native vegetation for this proposal is not proposed.

1.6 Measures to Avoid, Minimise, Reduce and Manage Proposal Clearing Impacts

The design and management measures implemented to avoid and minimise the potential clearing impacts of the Proposal are provided in Table 1.

Table 1. Measures Undertaken to Avoid, Minimise, Reduce and Manage the Proposal Clearing Impacts

Design or Management Measure	Discussion and Justification
Alternative alignment located within pasture or degraded areas	Proposed clearing is predominantly within degraded areas adjacent to existing road corridors and other infrastructure (rail lines, parking bays and material pits).
Simplification of design to reduce number of lanes and/or complexity of intersections	The acceleration lane and intersection upgrade scope of works cannot be further simplified whilst retaining the necessary safety benefits. The works have been selected to support the Port facility upgrades and relieve traffic congestion, whilst improving safety for road users.
Steepen batter slopes	Batter slope angles to reduce clearing whilst remaining effective have been considered in the design and implemented where possible and appropriate.

Design or Management Measure	Discussion and Justification
Installation of barriers	The installation of barriers has been considered in the design and implemented where possible and appropriate.
Installation of kerbing	The installation of kerbing has been considered in the design and implemented where possible and appropriate.
Use of existing cleared areas for access tracks, construction storage and stockpiling	As much as possible the design has been developed to utilise the existing road alignment, existing cleared areas for laydowns and utilise existing material source areas to support the project.
Drainage modification	Culverts are being installed to maintain the existing hydrological regime.

1.7 Approved Policies and Planning Instruments

The clearing of native vegetation in Western Australia is regulated under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations).

In addition to the matters considered in accordance with section 51O of the EP Act, Main Roads has also had regard to the below instruments where relevant.

Other Legislation potentially relevant for assessment of clearing and planning/other matters:

- *Biodiversity Conservation Act 2016* (WA) (BC Act)
- *Conservation and Land Management Act 1984* (WA) (CALM Act)
- *Country Areas Water Supply Act 1947* (WA) (CAWS Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Planning and Development Act 2005* (WA) (P&D Act)
- *Soil and Land Conservation Act 1945* (WA)
- *Rights in Water and Irrigation Act 1914*
- *Aboriginal Heritage Act 1972* (WA).

Environmental Protection Policies:

- Environmental Protection (Peel Inlet - Harvey Estuary) Policy 1992
- Environmental Protection (Western Swamp Tortoise Habitat) Policy 2011.

Other relevant policies and guidance documents:

- Environmental Offsets Policy (Government of Western Australia, 2011)
- A guide to the assessment of applications to clear native vegetation (Government of WA, December 2014)
- Procedure: Native vegetation clearing permits (Government of WA, October 2019)
- Environmental Offsets Guidelines (Government of Western Australia, 2014)
- Technical guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016)
- Technical guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020)
- Approved conservation advice under section 266B of the EPBC Act for threatened flora/fauna/vegetation communities.
- EPBC Act Referral guideline for the endangered Northern Quoll Dasyurus hallucatus (Department of the Environment, 2016)
- National Recovery Plan for the Northern Quoll (Department of Natural Resources, Environment Arts and Sport, 2010).

2 SCOPE AND METHODOLOGY OF CLEARING ASSESSMENT

Native vegetation will be cleared to accommodate this Proposal. This clearing will be undertaken using a project-specific Clearing Permit.

The CAR outlines the key activities associated with the Proposal, the existing environment and an assessment of native vegetation clearing. This assessment provides an evaluation of the vegetation clearing impacts associated with the Proposal using the ten Clearing Principles listed under s50 of the *Environmental Protection Act 1986* (EP Act) and strategies used to manage native vegetation clearing.

2.1 Report Terminology and Sources

The following terms are used in this Clearing Report:

- **Biological Survey** – Includes field fauna and flora survey of the Survey Area conducted by Eco Logical Australia (ELA) in 2022 as well as an additional desktop assessment by ELA in August 2023 of an additional 2.59 ha required to be surveyed due to a change in project design.

- **Extrapolated Area** – A small area of extrapolated GIS vegetation condition and fauna habitat mapping to ensure complete coverage of the Development Envelope.

- **Development Envelope** – The maximum extent that will be cleared. This envelope is larger than the construction footprint and allows for minor changes to the construction footprint as the design process continues, and to account for minor and unexpected changes that may occur during construction. This flexibility allows the site personnel to make modifications to the Proposal to avoid areas that may contain better environmental values. The CAR has assessed all environmental values within the Development Envelope as though all of these values will be impacted, up to the amount specified within the Clearing Area.

- **Study Area** – Area covered by the Desktop Assessment. The Study Area for the Proposal is confined to a local area of a 40km radius.

- **Survey Area** – Area covered by the Biological Survey that is typically larger that the Development Envelope.

2.2 Desktop Assessment

A desktop assessment of the Development Envelope was undertaken by viewing internal datasets and other government agency managed databases, and consulting with relevant stakeholders where necessary.

GIS layer viewing and mapping is done using ArcMap and/or Main Roads corporate mapping system known as iMaps. Referencing of the GIS layers accessed is done under the relevant methodology section of each clearing principle. Government managed databases were searched to locate additional information, which are found under References in Section 6.

2.3 Surveys and Assessments

The following surveys and assessments were undertaken to inform this CAR:

- Karratha Rail Bridge Biological Survey (Eco Logical, 2022).
- Karratha Rail Bridge Extension Areas Desktop Survey (Eco Logical, 2023).
- Main Roads, extrapolation of Eco Logical provided spatial data of vegetation condition and fauna habitat (December 2023).

Surveys conducted for the proposal are outlined in

The design of the project was modified following the Eco Logical Biological Survey having been undertaken which resulted in a slight increase to the proposal area and clearing footprint. The Eco Logical survey did not cover small sections of the increased proposal area; therefore, a desktop assessment was undertaken by Eco Logical. For the purpose of this report the survey data obtained from these two surveys have been combined and referred to as the Karratha Rail Bridge Biological Survey.

Due to further changes to the project design, Main Roads extrapolated the survey information to ensure full coverage of the increased proposal area. This involved Main Roads extrapolating information for the modified design using information obtained from the Eco Logical Karratha Rail Bridge Biological Survey of the Vegetation Condition and Fauna Habitat information.

Furthermore, a site visit to confirm the information obtained during this extrapolation process was accurate occurred in December 2023 (Appendix 3). This area represents 9.07 ha (7%) of the total Proposal Area.

Table 2 and a summary of the findings in these reports are presented in Sections 3.1 to 3.5.

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Table 2. Summary of Biological and Targeted Surveys Relevant to the Proposal

Consultant & Survey Name	Survey Details
Karratha Rail Bridge Biological Survey (Eco Logical, 2022). Karratha Rail Bridge Extension Areas Desktop Survey (Eco Logical, 2023).	**Survey Area:** The total survey area comprised 227.33 hectares adjacent to North West Coastal Highway from SLK 1096.15 to 1099.85. **Type:** A detailed flora and vegetation survey (224.74 ha) was conducted including vegetation type mapping, vegetation condition mapping and identification of any weeds of national significance. Methods included quadrats, opportunistic sampling, and one releve. A targeted flora survey to determine significant flora and ecological communities within areas considered suitable habitat, using meandering transects. Further vegetation mapping to extrapolate the original survey using meandering transects. Desktop Survey: Eco Logical extrapolated survey information for the modified design using information obtained from the original survey. Extrapolated Area of the Vegetation Type, Condition and Fauna Habitat (2.59 ha). **Timing:** Fieldwork was conducted from 20-24 June 2022, including a targeted flora survey, and on 3 August 2022. Desktop mapping was undertaken in October 2023. **Shapefile TRIM Ref:** D24#77567 **Document TRIM Ref:** D24#77592
Main Roads (2023) Extrapolated Area Data Mapping	**Extrapolated Area:** Main Roads extrapolated a further 8.94 hectares of Eco Logical field and desktop data to incorporate all information within the Development Envelope was captured. **Type:** Main Roads extrapolated survey information for the modified design using information obtained from the Karratha Rail Bridge Biological Survey of the Vegetation Condition and Fauna Habitat information. **Timing:** Desktop extrapolation of Eco Logical data was undertaken in December 2023. **Shapefile TRIM Ref:** D24#97840

3 SURVEY RESULTS

A copy of the relevant sections of the executive summary and report conclusions from the biological survey and/or field assessments are provided in Appendix 1.

3.1 Summary of Flora and Vegetation Surveys

Eco Logical Surveys 2022 and 2023

The Biological Surveys (Eco Logical 2022, 2023) included a 227.33 ha survey area for the Rail Separation footprint. A Detailed and Targeted flora and vegetation survey and Basic fauna survey were undertaken from 20 to 24 June 2022, and on 3 August 2022.

A further desktop survey was undertaken in October 2023, extrapolating Eco Logical Biological survey information for the modified design.

The Survey area includes 7 intact native vegetation communities that were delineated and mapped, covering a total area of 186.07 ha (81.80%). The remaining 41.26 ha (18.20%) comprises cleared and rehabilitated areas (i.e., current and historic borrow pits and prominent roadside batters). Vegetation condition ranged from Degraded to Very Good condition. The most widespread community is AbSaTw, which occurs across 81.30% of the vegetated area.

No ecological communities listed as Threatened under the EPBC Act or the BC Act occur or were inferred to occur within the Survey area. One community, Roebourne Plains gilgai grasslands (DBCA Priority 1 species) was considered as Likely to occur, given the Survey area lies within the known PEC buffer and vegetation community AxEtEx is considered to potentially represent floristic and soil/landform aspects of the PEC (Eco Logical, 2022, 2023).

A total of 160 flora taxa (151 native and 9 introduced) from 49 families and 104 genera were recorded across 23 quadrats established within the biological survey area and from opportunistic collections (Eco Logical, 2022, 2023). No Threatened flora species listed under the EPBC Act or the BC Act, or Priority listed species by DBCA were recorded within the biological survey area from the field survey.

Three fauna habitats covering a total area of 186.07 ha were identified and mapped within the Survey area. The most widespread habitat was Acacia shrubland over mixed grassland which occurred across 81.30% of the vegetated area (Eco Logical, 2022, 2023).

A total of 30 vertebrate fauna species (27 native and 3 introduced) were recorded within the Eco logical (2022, 2023) biological survey area, comprising 25 birds, 4 mammals and 1 reptile. No Threatened fauna species listed under the EPBC Act or the BC Act, or Priority listed species by DBCA were recorded within the biological survey area from the field survey. Based on a post-survey likelihood of occurrence assessment, 6 significant fauna species were considered as having the potential to occur within the Survey area:

- Northern Quoll (*Dasyurus hallucatus*; listed as EN under the EPBC Act and BC Act);
- Fork-tailed Swift (*Apus pacificus*; listed as MI under the EPBC Act and BC Act);
- Oriental Pratincole (*Glareola maldivarum*; listed as MI under the EPBC Act and BC Act);
- Northern Short-tailed Mouse (*Leggadina lakedownensis*; listed as P4 by DBCA);
- Lined Soil-crevice Skink (Dampier) (*Notoscincus butleri*; listed as P4 by DBCA); and
- Western Pebble-mound Mouse (*Pseudomys chapmani;* listed as P4 by DBCA).

This assessment is based on the close proximity of recent records and presence of potentially suitable habitat in the Survey area.

Main Roads 2023

Main Roads environmental officers utilised the Eco Logical (2023) mapped Vegetation Types to extrapolate data (including vegetation condition and fauna habitat) in areas outside the field and desktop survey area. This information is presented in Table 3 and mapped in Figure 3.

Furthermore, Main Roads environmental officers conducted a site visit in November 2023 to confirm the information obtained during this extrapolation process was accurate. Photos of the site visit are presented in Appendix 3.

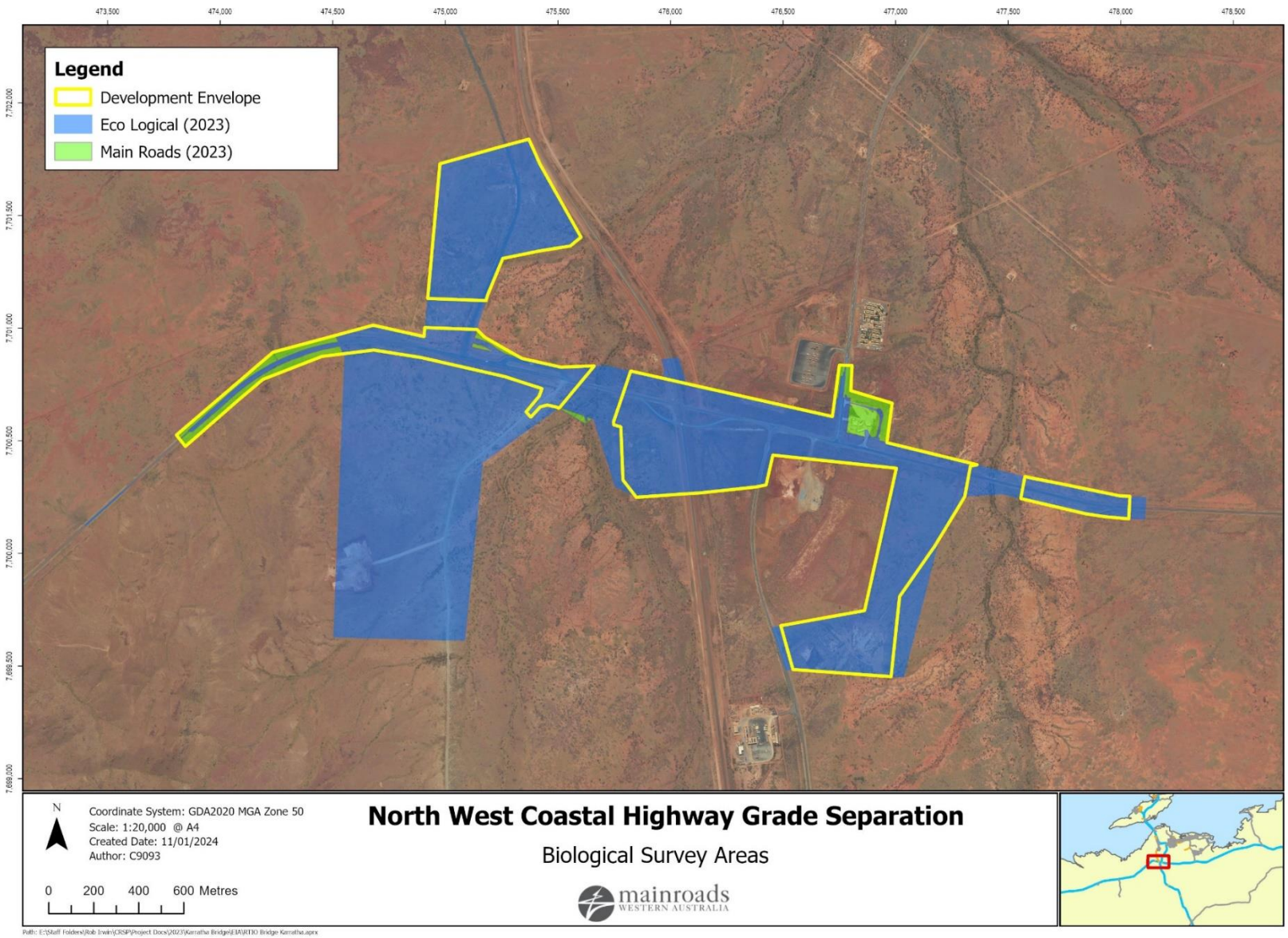

Figure 3. Biological Survey Areas

4 VEGETATION DETAILS

4.1 Proposal Site Vegetation Description

The vegetation in the Development Envelope is represented by seven vegetation types constituting one Vegetation Association and ranges from Poor to Very Good condition, including cleared and rehabilitated areas. Rehabilitated areas have been considered to represent native vegetation within this assessment.

Table 3 and Table 4 provide details of the vegetation types and their condition identified within the Development Envelope and the remaining extents of these associations. Rehabilitated areas have been considered to represent native vegetation within this assessment.

Table 3. Summary of Vegetation Types within Development Envelope

Vegetation Type	Extent within Development Envelope (ha)		Total Extent Mapped (ha) within Development Envelope	Vegetation Condition (EPA 2016)
	ELA Biological Survey (ha)	Mainroads Extrapolated (ha)		
AtEtEx	3.17 ha	0.00 ha	3.17 ha	Degraded to Very Good
AbSaTw:	50.65 ha	4.61 ha	55.26 ha	Degraded to Very Good
ChSsCC:	0.02 ha	0.00 ha	0.02 ha	Good
ChAbTe	2.40 ha	0.00 ha	2.40 ha	Degraded to Good
AaTe:	8.36 ha	0.00 ha	8.36 ha	Good
AxSgTw:	17.61 ha	0.66 ha	18.27 ha	Degraded to Very Good
SgTw	4.30 ha	0.00 ha	4.30 ha	Very Good
Rehabilitated	18.94 ha	0.00 ha	18.94 ha	-
Cleared	17.26 ha	3.67 ha	20.93 ha	-
Total	**122.71 ha**	**8.94 ha**	**131.65 ha**	

Table 4. Pre-European Vegetation Representation

Pre-European Vegetation Association	Scale	Pre–European Extent (ha)	Current Extent (ha)	% Remaining	% Current Extent in DBCA Managed Land (proportion of pre-European Extent)
Veg Assoc No. 589 Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) /	**Statewide**	807,698.58	802,713.40	99.38	2.10
	IBRA Bioregion Pilbara	728,768.20	724,695.82	99.44	2.10
	IBRA Sub-region PIL04 Roebourne	675,391.80	671,327.48	99.40	2.13

Pre-European Vegetation Association	Scale	Pre–European Extent (ha)	Current Extent (ha)	% Remaining	% Current Extent in DBCA Managed Land (proportion of pre-European Extent)
Hummock grasslands, grass steppe; soft spinifex	**Local Government Authority** City of Karratha	312,813.64	310,512.32	99.26	0.78

5 ASSESSMENT AGAINST THE TEN CLEARING PRINCIPLES

In assessing whether the Proposal's proposed clearing is likely to have a significant impact on the environment, the Proposal was assessed against the ten Clearing Principles (EP Act, Schedule 5).

Each principle has been assessed in accordance with the former Department of Environment Regulation (now Department of Water and Environmental Regulation (DWER) '*A Guide to the Assessment of Applications to Clear Native Vegetation*' (Department of Environment Regulation, 2014) and other relevant clearing permit application decision reports prepared by DWER.

The proposed clearing is not at, or not likely to be at variance with the ten Clearing Principles.

(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Proposed clearing is not likely to be at variance to this Principle.

Assessment

Flora
A total of 160 flora taxa (151 native and 9 introduced) from 49 families and 104 genera were recorded across 23 quadrats established within the biological survey area and from opportunistic collections (Eco Logical, 2022, 2023).

No known records of Threatened flora taxa were identified in the Study Area. Database searches (WA Herbarium, DBCA Threatened and Priority Flora list, NatureMap and EPBC Protected Matters) returned 18 Priority species from the Study Area, with 3 assessed as potentially occurring within the Survey Area.

No priority flora species were recorded within the Survey Area (Eco Logical, 2022, 2023).

Fauna
A total of 30 vertebrate fauna species (27 native and 3 introduced) were recorded within the Eco logical (2022, 2023) surveys, comprising 25 birds, 4 mammals and 1 reptile.

It is likely that the species diversity in the Development Envelope is lower than that of the surrounding areas due to the history of disturbance and the likelihood of edge effects due to the close proximity to an existing major road and railway.

Based on a post-survey likelihood of occurrence assessment, six significant fauna species were considered as having the potential to occur within the survey area. This assessment is based on the close proximity of recent records and presence of potentially suitable habitat in the survey area.

Likelihood of Occurrence: Likely to Occur
Endangered EPBC Act and BC Act
- Northern Quoll (*Dasyurus hallucatus)*

Migratory EPBC Act and BC Act
- Fork-tailed Swift (*Apus pacificus)*
- Oriental Pratincole (*Glareola maldivarum)*

Priority 4 BC Act
- Northern Short-tailed Mouse (*Leggadina lakedownensis)*

Likelihood of Occurrence: May Occur
Priority 4 BC Act

- Western Pebble Mound Mouse (*Psuedomys chapmani)*
- Lined Soil-crevice Skink (*Notoscincus butleri)*

Northern Quoll (*Dasyurus hallucatus)*
The Northern Quoll has been previously recorded 36 times within 3 kms of the Survey Area, primarily from remote sensor cameras located at Mount Regal (3km south west of the Development Area). Mount Regal is located within the Rocklea land system which is the preferred habitat of the species which is not the primary land system of the Development Area (Eco logical, 2022, 2023).

Northern Quoll makes its dens in rock crevices, tree holes or occasionally termite mounds. Whilst the Survey Area does not have suitable denning habitat, it is considered that the Northern Quoll may utilise all three fauna habitats present within the Development Envelope for foraging purposes and moving through the landscape (Eco logical, 2022, 2023).

The Development Envelope is located primarily along the existing road corridor which has been previously disturbed and is subject to ongoing edge effects and disturbance from road and rail activities. The Development Envelope is unlikely to constitute preferred foraging habitat when more abundant and undisturbed habitat is available outside of the Development Envelope. Whilst the species has some potential to occur in the area, it was not observed during the survey and the availability of preferred habitat in undisturbed areas adjacent, would further reduce the likelihood of occurrence in the Development Envelope. The proposal will not significantly impact the Northern Quoll.

Northern Short-tailed Mouse (*Leggadina lakedownensis*)
Suitable foraging habitat for the Northern Short-tailed Mouse occurs within the Development Envelope in the Acacia Shrubland over mixed grassland and *Corymbia* and Acacia open woodland fauna habitats. The availability of foraging habitat extends across 80% of the survey area. Proposed clearing represents only a small portion of suitable foraging and dispersal habitat in the context of available habitat within the local area and is adjacent to existing disturbed areas and roadway. This species was not observed during the survey and would likely be in low abundance if they did occur. Impacts on these species are not considered significant with available foraging and dispersal habitat in adjacent and surrounding areas in equal or better condition.

Western Pebble Mound Mouse (*Psuedomys chapmani*) and Lined Soil-crevice Skink (Dampier) (*Notoscincus butleri*)

The Lined Soil-crevice Skink (Dampier) and Western Pebble-mound Mouse may utilise the rocky hill habitat type within the Development Envelope, however neither were observed during the survey and if they did occur, they would likely be in low abundance. These species may forage in the rocky hill habitat type, however the small area of this habitat type within the DE (4.3 ha) is insignificant when considering the abundance of this habitat type in comparatively better condition both in the locality and regionally.

The rocky hill habitat is aligned with vegetation community SgTw occurring in the North West materials area in the Development Envelope.
SgTw, mapped within the combined survey area aligns with Beard's vegetation association mapping. Pre-European vegetation associations mapped within the combined survey area have more than 95% of their extent remining within Western Australia (Eco logical, 2022, 2023).

The small amount of clearing of this vegetation type in the Development Envelope would not significantly impact on these species given they can readily move to abundant areas adjacent that provide habitat in better and undisturbed condition.

Fork-tailed Swift (*Apus pacificus)* and Oriental Pratincole (*Glareola maldivarum*)
The Fork-tailed Swift (*Apus pacificus)* and Oriental Pratincole (*Glareola maldivarum*) are non-breeding migrants to Australia and breed in the northern hemisphere. These species have a wide range of

occurrence across Australia and the extent of suitable foraging habitat within the Development Envelope is very limited. Suitable foraging habitat is available in the local area outside of the Development Envelope and more broadly across the region. No significant, if any, impacts on these species will occur.

Vegetation Types

Seven vegetation types were recorded in the Development Envelope (Eco Logical, 2022, 2023) (Table 3).

The Priority Ecological Community (PEC) buffer for the Roebourne Plains gilgai grasslands (Priority 1 DBCA) overlaps the majority of the Survey Area.

Vegetation community AxEtEx was conservatively considered by Eco Logical (2023) to potentially represent floristic and soil/landform aspects of the PEC. Areas within this community often comprised cracking clay, with alluvial soils and light clays creating an admixture on the periphery of these smaller centralised depressions. Proximity of these areas to major road verges and associated artificial drainage has likely led to altered natural waterflows; however, the presence of cracking clays supporting a dominant suite of native tussock grass was still evident. A precautionary approach has therefore been taken to infer the presence of this PEC within the AcEtEx vegetation community.

The biological survey identified 9.47 ha of this Vegetation Community. Within the Development Envelope, up to 1.60 ha of AxEtEx vegetation is proposed to be cleared of which 90% (1.44 ha) is next to the road in Degraded condition, 5% (0.08 ha) in Good condition and 5% (0.08 ha) in Very Good condition. This amount of clearing represents 50% of the AxEtEx vegetation recorded within the Development Envelope (3.17 ha) and 17% of the AxEtEx vegetation recorded within the Survey Area (9.47 ha) (Figure 4).

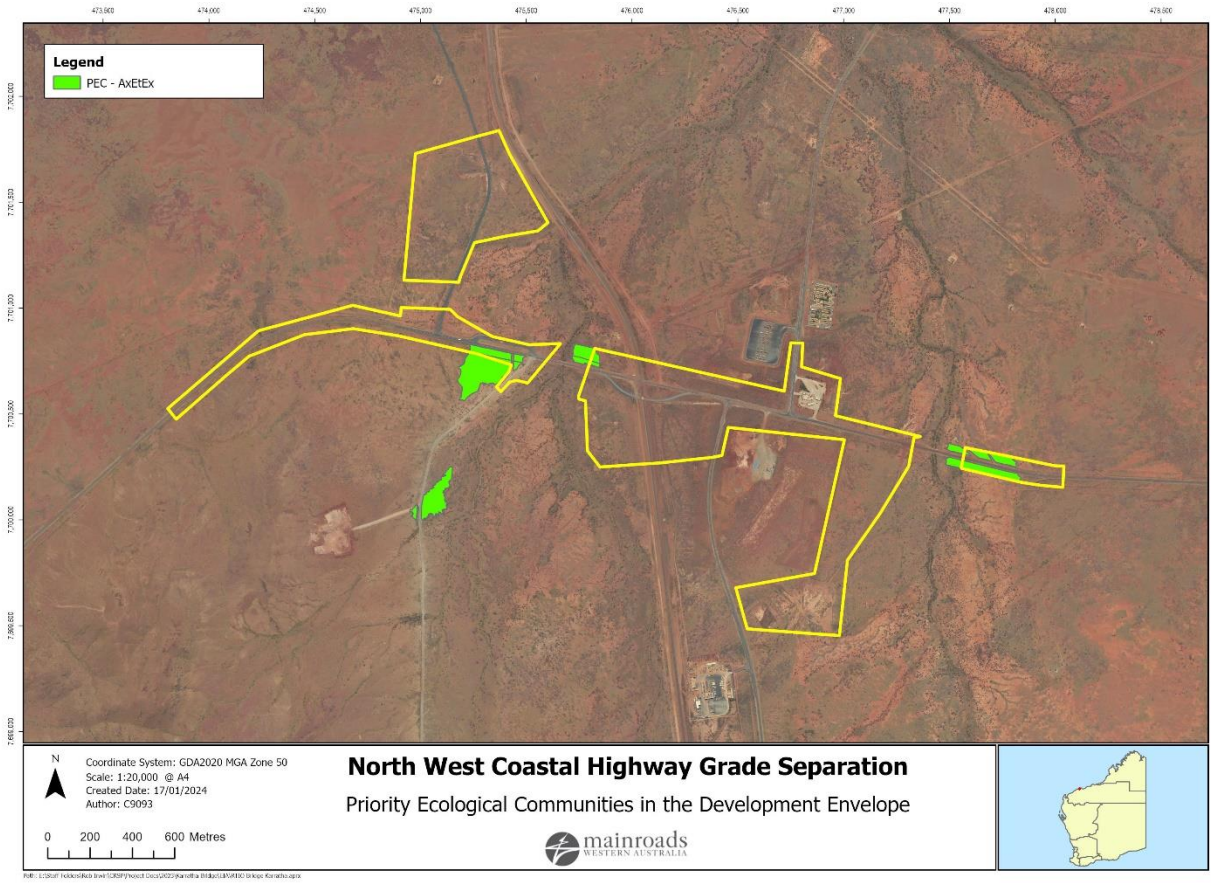

Figure 4. Priority Ecological Community within the Development Envelope

The Western Australian Environmental Protection Agency notes there remains approximately 6,394.9 ha of AxEtEx vegetation at the regional scale (EPA, 2023). The EPA also notes that PECs associated with the AxEtEx vegetation that are classified as in 'Good' or better vegetation condition are of high conservation value.

The clearing of 1.6 ha (0.025% of the remaining vegetation in the region), of which 90% has been classified as being in Degraded condition, and the ambiguity of the classification of vegetation community AxEtEx as the Roebourne Plains gilgai grasslands PEC, is not likely to change or impact the status and viability of the PEC. The Proposal is unlikely to cause a significant residual impact due to no significant reduction in the extent or distribution of the PEC on the Roebourne Plains and the proposal will not result in the PEC becoming threatened.

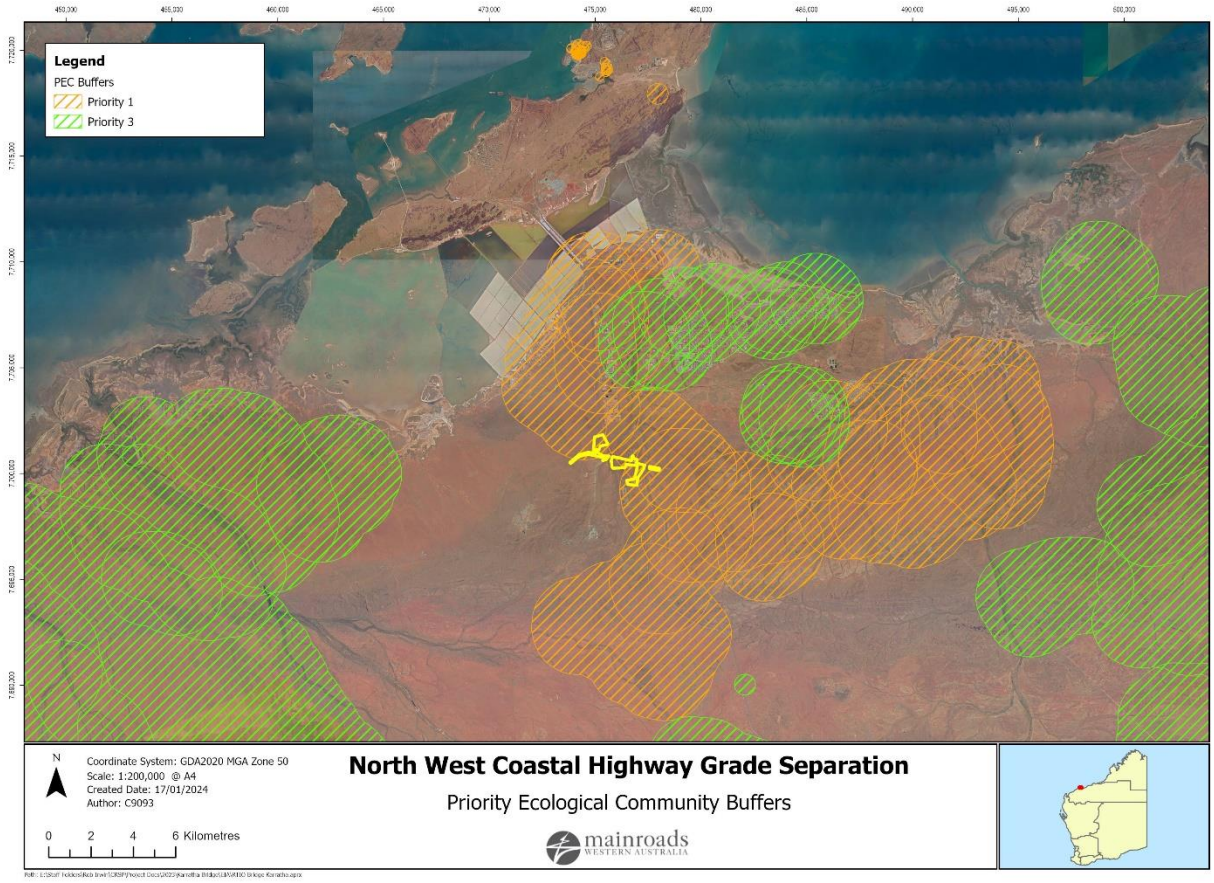

Figure 5. Priority Ecological Community Buffers

Vegetation condition within the Development Envelope ranges from Poor to Very Good as shown in Table 5 (Eco Logical, 2022, 2023).

Table 5: Vegetation Condition

Vegetation Quality	Hectares within DE	Percentage of DE
N/A (Cleared)	20.80	16%
Degraded	49.00	37%
Good	34.37	26%
Very Good	27.47	21%
Excellent	0	0
Total	**131.65 ha**	**100%**

Conclusion
The proposed clearing is not likely to be at variance to this Principle.

Methodology

- Department of Environment Regulation, 2014
- Biological Survey Eco Logical, 2022, 2023
- DCCEEW Protected Matters Search Tool Report
- Department of Natural Resources and Environment (2002)
- Environmental Protection Authority (2023)
- Government GIS Shapefiles:
  - DBCA Threatened and Priority Ecological Community database search (Accessed December 2022)
  - DBCA Threatened and Priority flora database search (Accessed December 2022
- Main Roads WA, 2023.
- Statewide Vegetation Statistics (Government of Western Australia, 2018)

(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna.

Proposed clearing is not likely to be at variance to this Principle.

Assessment

Fauna Habitat Types

Three fauna habitats were recorded within the Development Envelope in the Biological survey (Eco Logical, 2022, 2023). The most common habitat type found within the Development Envelope is Acacia shrubland over mixed grassland (Table 6).

Table 6: Fauna Habitat within the Development Envelope

Habitat	Ha of habitat within DE	% of DE	Ha of habitat within Survey Area
Acacia shrubland over mixed grassland	85.06 ha	64.61%	151.31 ha
Corymbia and Acacia open woodland	2.42 ha	1.83%	30.46 ha
Rocky Hill	4.30 ha	2.27%	4.30 ha
Subtotal:			**186.07**
Rehabilitation	18.94 ha		20.90 ha
Cleared	20.93 ha		19.01 ha
Total:	**131.65 ha**		**227.23 ha**

As outlined in Principle (a) above, a likelihood of occurrence assessment of all significant species identified in the Study Area was undertaken by Eco logical (2022, 2023) based on availability of suitable habitat and previous known records in the Study Area.

This likelihood of occurrence assessment was adapted for relevance to the Development Envelope and is discussed below.

Following the field Survey, six significant fauna species were assessed as likely, or may occur within the Survey Area. Three of the six species are nationally listed Threatened fauna species**.**

Endangered EPBC Act and BC Act

- Northern Quoll (*Dasyurus hallucatus)*

Migratory EPBC Act and BC Act

- Fork-tailed Swift (*Apus pacificus)*
- Oriental Pratincole (*Glareola maldivarum*)

Priority 4

- Northern Short-tailed Mouse (*Leggadina lakedownensis)*
- Lined Soil-crevice Skink (*Notoscincus butleri)*
- Western Pebblemound Mouse (*Psuedomys chapmani)*

Northern Quoll (*Dasyurus hallucatus)*

The Northern Quoll (*Dasyurus hallucatus*) is listed as Endangered under the EPBC and BC Acts. The Northern Quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (TSSC 2005). The Northern Quoll dens in rocky habitat and sometimes also in tree holes or termite mounds. The Northern Quoll is known to occur in the local area with records from Mount Regal in 2014/2015, 500 m south-west of the survey area that is in the Rocklea land system preferred by the Northern Quoll (Eco Logical 2022, 2023). No denning habitat is present within the Development Envelope, however it is likely that the Northern Quoll use the Development Envelope and surrounding habitat for dispersal and foraging (Eco Logical 2022, 2023). Habitat types located within the Development Envelope are not unique, are widespread on both a local and regional scale, and significant noise and vibration disturbance created by proximity to the North West Coastal Hwy and Rio Tinto's rail line reduces the likelihood that this species would favour the use of areas within the Development Envelope. As foraging habitat is more broadly available in the surrounding locality and only a small portion of potentially suitable low quality foraging and dispersal habitat is proposed to be cleared within the local area, impacts on this mobile species are not considered significant with accessible foraging and dispersal habitat available in adjacent and surrounding areas in equal or better condition.

Migratory species: Fork-tailed Swift (*Apus pacificus)* and Oriental Pratincole (*Glareola maldivarum*)

The Fork-tailed Swift (*Apus pacificus*) and Oriental Pratincole (*Glareola maldivarum*) are listed as Migratory under the EPBC and BC Acts. Both species are non-breeding visitors to Australia and utilise a wide variety of habitats for foraging. Both species may forage in habitats within the Development Envelope when visiting the region, however suitable foraging habitat is available in the local area outside of the Development Envelope and more broadly across the region. No significant, if any, impacts on these species will occur.

Priority 4 species - Northern Short-tailed Mouse (*Leggadina lakedownensis*)**, Lined Soil-crevice Skink** (Dampier) (*Notoscincus butleri*) **and Western Pebble-mound Mouse** (*Pseudomys chapmani*)

The Northern Short-tailed Mouse (*Leggadina lakedownensis*), Lined Soil-crevice Skink (Dampier) (*Notoscincus butleri*) and Western Pebble-mound Mouse (*Pseudomys chapmani*) are all listed as Priority 4 species by DBCA meaning they are rare, near threatened or other species in need of monitoring. None of these species were observed during the survey and if they did occur, they would likely be in low abundance. The rocky hill habitat for the Lined Soil-crevice Skink (Dampier) and Western Pebble-mound Mouse aligns with vegetation community SgTw within the Development Envelope. These species may forage in the rocky hill habitat type, however the small area of this habitat type within the DE (4.3 ha) is insignificant when considering the abundance of this habitat type in comparatively better condition both in the locality and regionally. SgTw, mapped within the combined survey area aligns with Beard's vegetation association mapping. Pre-European vegetation associations mapped within the combined survey area have more than 95% of their extent remining within Western Australia (Eco logical, 2022, 2023). The small amount of clearing of this vegetation type in the Development Envelope would not

significantly impact on these species given they can readily move to abundant areas adjacent that provide habitat in better and undisturbed condition...

CONCLUSION

While the Development Envelope may provide some foraging habitat value for some fauna, none were observed during surveys, and there is no identified breeding or roosting habitat present in the Development Envelope to support any of the species listed above. Furthermore, given there is a greater extent of habitat with similar native vegetation in better and undisturbed condition adjacent and contiguous to the Development Envelope, the vegetation is not considered to comprise the whole or part of, or be necessary for the maintenance of, a significant habitat for fauna.

The proposed clearing is not likely to be at variance to this Principle.

Methodology

- Biological Survey, Eco Logical, 2022, 2023
- DCCEEW Protected Matters Search Tool Report
- Government GIS Shapefiles:
  - DBCA Threatened and Priority fauna database search (Accessed December 2022)
- Species specific conservation listing advice and recovery plans
- Main Roads WA, 2023.

(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.

Proposal is not at variance to this Principle.

Assessment

A desktop search identified no species listed as Threatened flora under either State or Commonwealth legislation and none have been recorded in the Study Area (Eco Logical, 2022, 2023).

A targeted flora survey did not record any Threatened flora within in the Survey area or specifically within the Development Envelope.

The proposed clearing is not at variance to this Principle.

Methodology

- Biological Survey (Eco Logical, 2022, 2023).
- Government GIS shapefiles:
  - DBCA Threatened flora database search (Accessed December 2022)
- Species specific conservation listing advice and recovery plans
- Main Roads WA, 2023.

(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

Proposed clearing is not at variance to this Principle.

Assessment

No Threatened Ecological Communities (TEC) occur within the Survey area or within the Development Envelope.

Two TECs are listed for the Pilbara: Themeda grasslands on cracking clays (Hamersley Station, Pilbara)", and Ethel Gorge aquifer stygobiont community. Both TECs are restricted to the Hamersley subregion and do not occur in the Survey Area (GIS Database). None of the vegetation types recorded in the Survey Area represent a listed TEC (Eco Logical, 2022, 2023).

The proposed clearing is not at variance to this Principle.

Methodology

- Biological Survey (Eco Logical, 2022, 2023)
- Government GIS shapefiles:
  - DBCA Threatened Ecological Community database search (Accessed December 2022)
- Main Roads WA, 2023.

(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

Proposed clearing is not at variance to this Principle.

Assessment

The Development Envelope falls within the Pilbara Bioregion of the Interim Biogeographic Regionalisation for Australia (IBRA). Approximately 99.7% of pre-European vegetation still exists in the IBRA Pilbara Bioregion (Government of Western Australia, 2018). Table 7 identifies the vegetation types within the Development Envelope. The vegetation within the Development Envelope is broadly mapped as Beard vegetation association 589, of which greater than 99% of the pre-European extent of this vegetation association remains uncleared at all scales (Table 8) (Government of Western Australia, 2019).

Table 7. Summary of Vegetation Types within Development Envelope

Vegetation Type	Extent within Development Envelope (ha)	Total Extent Mapped (ha) within Survey Area	Vegetation Condition (EPA 2016)
AtEtEx	3.17 ha	9.47 ha	Degraded to Very Good
AbSaTw:	55.26 ha	99.7 ha	Degraded to Very Good
ChSsCC:	0.02 ha	3.36 ha	Good
ChAbTe	2.40 ha	27.09 ha	Degraded to Good
AaTe:	8.36 ha	8.40 ha	Good
AxSgTw:	18.27 ha	32.71 ha	Degraded to Very Good
SgTw	4.30 ha	4.30 ha	Very Good
Rehabilitated	18.94 ha	20.92 ha	-
Cleared	20.93 ha	21.35 ha	-
Total	**131.65 ha**	**227.23 ha**	

Table 8. Pre-European Vegetation Association

Pre-European Vegetation Association	Scale	Pre–European Extent (ha)	Current Extent (ha)	% Remaining	% Current Extent in DBCA Managed Land (proportion of pre-European Extent)
Veg Assoc No. 589 Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex	**Statewide**	807,698.58	802,713.40	99.38	2.10
	IBRA Bioregion Pilbara	728,768.20	724,695.82	99.44	2.10
	IBRA Sub-region PIL04 Roebourne	675,391.80	671,327.48	99.40	2.13
	Local Government Authority City of Karratha	312,813.64	310,512.32	99.26	0.78

The proposed clearing does not represent a significant remnant of native vegetation in an area that has been extensively cleared due to the extent remaining.

The proposed clearing is not at variance to this Principle.

Methodology

- Biological Survey (Eco Logical, 2022, 2023).
- Government GIS shapefiles:
  - Pre-European vegetation (Accessed 28/12/2022)
- Main Roads WA, 2023.
- Statewide Vegetation Statistics (Government of Western Australia 2019)

(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Proposed clearing is not at variance to this Principle.

Assessment

There are no known wetlands of significance or Ramsar sites within 40km of the Survey area (Eco Logical, 2022, 2023). The closest major waterway is a major tributary to the Maitland River approximately 8km to the south of the Development Envelope.

While two unnamed minor non-perennial watercourses are located adjacent to the Development Envelope, native vegetation proposed to be cleared under this proposal is not mapped as, or representative of vegetation growing in, or in association with a watercourse or wetland.

The proposed clearing is not at variance to this Principle.

Methodology

- Biological Survey (Eco Logical, 2022)
- Government GIS shapefiles:
  - Watercourses (Accessed 28/12/2022)
  - RIWI Act Rivers (Accessed 28/12/2022)
- Main Roads WA, 2023.

(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Proposed clearing is not likely to be at variance to this Principle.

Assessment

Geology of the Roebourne subregion comprises quaternary alluvial and older colluvial coastal and subcoastal plains. There are two land systems within the Development Envelope, clay plains of the Horseflat System and hills and rides of the Ruth System. The majority of the Development Envelope occurs within the Horseflat system. The Horseflat system are extensive level plains with clay soils and gilgai microrelief, also stony plains and very gently inclined slopes marginal to major rivers, both with non-gilgaied clay soils (Eco Logical, 2022). The Ruth system comprises hills and ridges of volcanic and other rocks supporting shrubby hard spinifex and occasionally soft spinifex grasslands (Eco Logical, 2022, 2023).

For the majority of the Development Envelope, there is a Low risk of acid sulphate soils.
The works will primarily be undertaken around the existing road reserve and the majority of the surrounding area remains vegetated, minimising the risk of land degradation. Clearing to support the proposed works is unlikely to impact existing levels of surface runoff and therefore, is unlikely to cause appreciable land degradation.

The proposed clearing is not likely to be at variance to this Principle.

Methodology

- Biological Survey Eco Logical 2022, 2023
- Government GIS Shapefiles:
  - Acid Sulphate Soil Risk Map (Accessed January 2023)
  - Watercourses (Accessed January 2023)
- Main Roads WA, 2023.

(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Proposed clearing is not at variance to this Principle.

Assessment

The Development Envelope does not intersect any known Conservation Areas or DBCA managed lands, and there are no DBCA managed lands in close proximity.

The nearest Conservation Areas are Murujuga National Park approximately 15 km north of the Survey area on the Burrup Peninsula, and ESAs approximately 20 km north in the Dampier Archipelago.

Given the distance from these areas, the proposed clearing will not impact on the values of any Conservation Areas.

The proposed clearing is not at variance to this Principle.

Methodology

- Biological Survey Eco Logical, 2022, 2023.
- Government GIS Shapefiles:
  - DBCA Legislated Lands and Waters & Lands of Interest (Accessed December 2022)
  - Ramsar Wetlands (Accessed December 2022)
  - Important Wetlands (Accessed December 2022)
- Main Roads WA, 2023.

(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Proposed clearing is not likely to be at variance to this Principle.

Assessment

The Development Envelope is located within the Port Hedland Coast Basin and Karratha Coast sub-catchment. The Survey area is approximately 10 km south of the coast and 8 km north of the Maitland River.

The Development Envelope does not lie within any public drinking water source areas, with the closest P1 protection area located 35 km to the south-east.

The proposed clearing does not involve excavation below the water table and is not likely to impact existing levels of surface runoff or adversely alter surface and underground water quality with areas surrounding the proposed clearing areas remaining largely vegetated.

The proposed clearing is unlikely to cause deterioration in the quality of surface or underground water as there is little to no potential for interaction with surface and underground water.

The proposed clearing is not likely to be at variance to this Principle.

Methodology

- Biological Survey Eco Logical, 2022, 2023.
- Main Roads WA, 2023.

(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Proposed clearing is not likely to be at variance to this Principle.

Assessment

The Development Envelope is located within the Roebourne bioregion which experiences an arid (semi-desert) tropical climate with highly variable rainfall, falling mainly in summer (Kendrick and Stanley 2001). Based on climate data from the nearby Bureau of Meteorology (BoM) Karratha Aero weather station (station number 4083; climate data 1971 - current) the region receives an annual average rainfall of 297.5 mm, with most rainfall occurring during the summer months of December to March (BoM 2022a; Figure 2).

The Development Envelope is approximately 10 km south of the coast and 8 km north of the Maitland River.

The majority of soils in the Development Envelope are the Horseflat system gilgaied clay plains. These are extensive level plains with clay soils and gilgai microrelief, also stony plains and very gently inclined slopes marginal to major rivers, both with non-gilgaied clay soils (Eco Logical, 2022, 2023).

Due to the potential for large amounts of rainfall during the wet season from cyclonic systems, the proposed works will be completed in the dry season. No changes to the existing levels of flooding are anticipated.

The proposed clearing is adjacent to existing roads with areas surrounding to remain largely vegetated, therefore it is unlikely the proposed works will cause or exacerbate the incidence or intensity of flooding.

The proposed clearing is not likely to be at variance to this Principle.

Methodology

- Biological Survey Eco Logical, 2022, 2023.
- BoM Website (Accessed 2022).
- Main Roads WA, 2023.

6 VEGETATION MANAGEMENT

Main Roads will avoid clearing native vegetation where possible. Where clearing cannot be avoided then this clearing is kept to a minimum. Clearing of Vegetation will be managed in accordance with Main Roads standard management measures.

7 REHABILITATION, REVEGETATION & OFFSETS

7.1 Revegetation and Rehabilitation

No temporary clearing will be undertaken as part of the Proposal activities.

8 STAKEHOLDER CONSULTATION

Main Roads will undertake stakeholder consultation as required.

9 REFERENCES

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10 APPENDICES

Appendix 1

Karratha Rail Bridge Biological Survey Executive Summary

Main Roads Western Australia (Main Roads) is proposing a rail separation along North West Coastal Highway due to the planned increase in traffic (the project). The project area is located in the City of Karratha, approximately 5 km south-west of Karratha, Western Australia. The project area includes the biological surveys area (227.33 ha) and the desktop study area (40 km radius from the biological survey area and extrapolation area). Eco Logical Australia was engaged by Main Roads to undertake a desktop assessment and biological survey to inform the environmental assessment and approvals process, with the results of the assessment also assisting in the preparation of Environmental Impact Assessment documentation. The Biological Surveys included a 227.33 ha survey area for the Rail Separation footprint. A Detailed and Targeted flora and vegetation survey and Basic fauna survey were undertaken from 20 to 24 June 2022, and on 3 August 2022.

A further desktop survey was undertaken in October 2023, extrapolating Eco Logical Biological survey information for the modified design.

Due to further changes to the project design Main Roads extrapolated the survey information in December 2023 to ensure full coverage of the increased proposal area. This involved Main Roads extrapolating information for the modified design using information obtained from the Eco Logical Karratha Rail Bridge Biological Survey of the Vegetation Condition and Fauna Habitat information.

Flora and Vegetation Surveys

A total of 160 flora taxa (151 native and 9 introduced) from 49 families and 104 genera were recorded across 23 quadrats established within the biological survey area and from opportunistic collections. A species accumulation curve determined that approximately 85% of the flora species potentially present within the biological survey area were recorded, resulting in sufficient data to define and assess the presence, extent and significance of vegetation communities within the biological survey area. No Threatened flora species listed under the EPBC Act or the BC Act, or Priority listed species by DBCA were recorded within the biological survey area from the field survey. A total of nine introduced flora were recorded within the biological survey area, representing 5.6% of the total number of species recorded.

No ecological communities listed as Threatened under the EPBC Act or the BC Act occurred or were inferred to occur within the combined survey area. One community, Roebourne Plains gilgai grasslands (Priority 1 by DBCA) was considered as being Likely to occur, given the combined survey area lies within the known PEC buffer and vegetation community AxEtEx is considered to potentially represent floristic and soil/landform aspects of the PEC.

Fauna Surveys

A total of three fauna habitats were identified and mapped within the combined survey area, covering a total area of 186.07 ha (81.80%). The remaining 41.26 ha (18.20%) comprised cleared areas and rehabilitation (i.e., current and historic borrow pits and prominent roadside batters). The most widespread habitat was Acacia shrubland over mixed grassland which occurred across 81.3% of the vegetated area. A total of 30 vertebrate fauna species (27 native and three introduced) were recorded within the biological survey area, comprising 25 birds, four mammals and one reptile. No Threatened fauna species listed under the EPBC Act or the BC Act, or Priority listed species by DBCA were recorded within the biological survey area from the field survey. Based on a post-survey likelihood of occurrence assessment, six significant fauna species were considered as having the potential to occur within the combined survey area. This assessment is based on the close proximity of recent records and presence of potentially suitable habitat in the combined survey area.

Report Conclusions

Flora

No ecological communities listed as Threatened under the EPBC Act or the BC Act occurred or were inferred to occur within the survey area. One priority ecological community, Roebourne Plains gilgai grasslands (P1 by DBCA) was considered as being Likely to occur, as the buffer overlaps the majority of the combined survey area. This community is described briefly as 'these grasslands occur on microrelief on strongly gilgaied self-mulching cracking clays, and emergent depositional surfaces' and is restricted to the Karratha area. One vegetation community, AxEtEx, likely represents floristic and landform elements of this PEC. This community is locally variable, with a suite of tussock grasses occurring at various densities including *Eragrostis xerophila*, *Chrysopogon fallax* and *Panicum decompositum*.

Areas within this community often comprised cracking clay, with alluvial soils and light clays creating an admixture on the periphery of these smaller centralised depressions. Proximity of these areas to major road verges and associated artificial drainage has likely led to altered natural water flows, however the presence of cracking clays supporting a dominant suite of native tussock grasses was still evident. A precautionary approach has therefore been taken to infer the presence of this PEC within the AxEtEx vegetation community.

Condition of intact vegetation within the combined survey area ranged from Degraded to Very Good based on Trudgen (1988) vegetation scale provided in the EPA Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (2016). Majority of the intact vegetation within the combined survey area was recorded as being in Very Good condition. Disturbances included the presence of weeds, grazing and historical clearing.

Fauna

Fauna habitats present within the combined survey area are considered to provide suitable habitat for terrestrial and avian fauna, providing a mixture of suitable vegetation, substrate and microhabitats suitable for a variety of fauna species. Majority of bird species recorded during the initial field survey are widespread and common species, including nectivores, insectivores and granivores. Whilst no Threatened or Priority fauna species were recorded in the biological survey area, three Threatened fauna species and three Priority fauna species identified from the desktop assessment have the potential to occur within the combined survey area.

Northern Quoll (*Dasyurus hallucatus*) is listed as Endangered under the EPBC Act and BC Act. The Northern Quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (TSSC 2005). Northern Quoll makes its dens in rock crevices, tree holes or occasionally termite mounds. The closest known records occur from remote cameras on Mount Regal, south-west of the combined survey area. Mount Regal occurs within the Rocklea land system which the species prefers. Whilst the combined survey area do not have suitable denning habitat, it is considered that the Northern Quoll would utilise all three fauna habitats present for foraging purposes and moving through the landscape. Northern Quoll consume a wide variety of prey including insects, fruit, nectar and vertebrates (TSSC 2005).

The Fork-tailed Swift (*Apus pacificus*) and Oriental Pratincole (*Glareola maldivarum*) are listed as Migratory under the EPBC Act and BC Act. Both species are non-breeding visitors to Australia and utilise a wide variety of habitats for foraging. The Fork-tailed Swift could potentially forage for insects above all three fauna habitats whilst the Oriental Pratincole could utilise the bare areas and short grassland within the 'Acacia shrubland over mixed grassland' habitat. A variety of Migratory birds are also known to utilise the terrestrial wetlands (i.e., Gap Ridge WWTP and Dampier salt ponds), approximately 5 km north of the combined survey area.

The Northern Short-tailed Mouse (*Leggadina lakedownensis*), Lined Soil-crevice Skink (Dampier) (*Notoscincus butleri*) and Western Pebble-mound Mouse (*Pseudomys chapmani*) are all listed as Priority 4 by DBCA which is a rare, near threatened or other species in need of monitoring. The Northern Short-tailed Mouse could utilise the sandy soils of the 'Acacia shrubland over mixed grassland' and 'Corymbia and Acacia open woodland' habitats, whilst the Lined Soil-crevice Skink and Western Pebble-mound Mouse could utilise the exposed small stones (pebbles) of the 'Rocky hill' habitat.

Appendix 2: Main Roads Site Photos of Extrapolated Areas

	
Photo 1. Looking South along North West Coastal Highway on the southern side of the road at SLK 1095 – Photo taken 25/11/2023	Photo 2. Looking North along North West Coastal Highway on the southern side of the road at SLK 1095 - Photo taken 25/11/2023

Photo 3. Looking South along North West Coastal Highway on the northern side of the road at SLK 1095 - Photo taken 25/11/2023

Photo 4. Looking South along North West Coastal Highway on the northern side of the road at SLK 1095 - Photo taken 25/11/2023

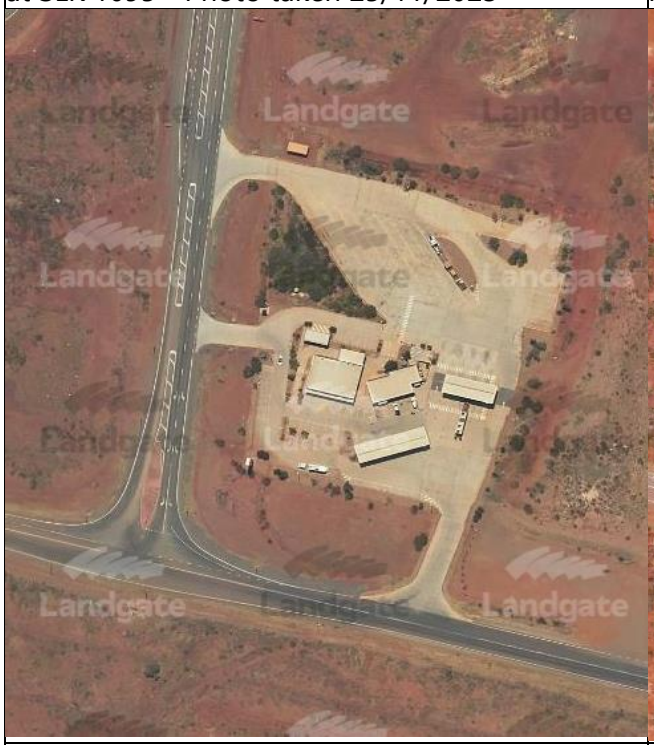

Image 1. Landgate image taken 23/09/2023 of extrapolated area at the intersection of North West Coastal Highway and Madigan Road that

Image 2. Landgate image taken 01/09/2016 of extrapolated area at the intersection of North West Coastal Highway and Madigan Road that

was extrapolated to represent vegetation type/condition as AbSaTw/Degraded and Cleared/Cleared	shows the extensive historic disturbance of the area extrapolated.

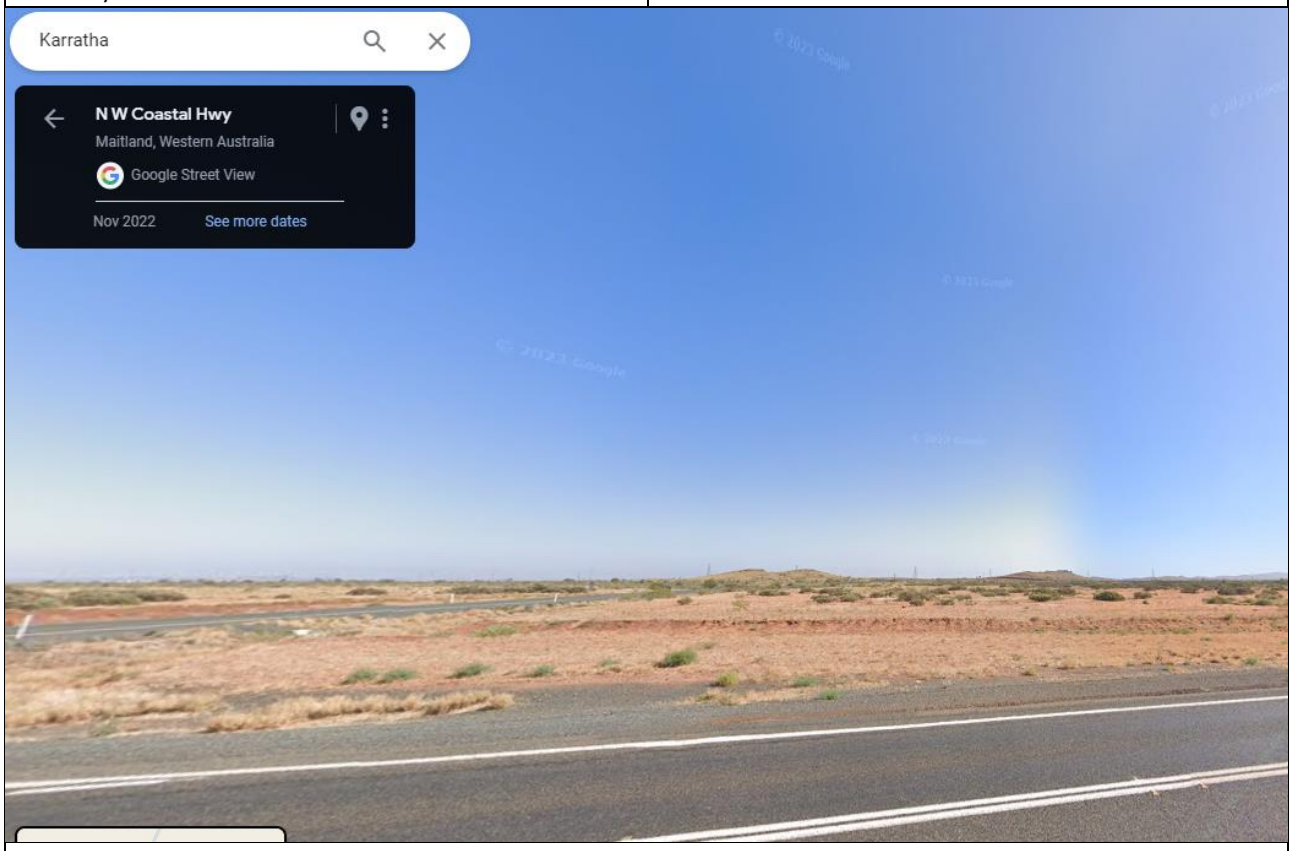

Image 3. Google Maps image taken November 2022 of extrapolated area at the intersection of North West Coastal Highway and Madigan Road that was extrapolated to represent vegetation type/condition as AxSgTw/Degraded