KUR-World

Matters of National Environmental Significance

Chapter 19.0

Environmental Impact Statement

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Abbreviations used in this chapter are as follows:

Abbreviation	Meaning
ALA	Atlas of Living Australia
asl	Above Sea Level
CHMP	Cultural Heritage Management Plan
DEHP	Department of Environment and Heritage Protection
DNRM	Department of Natural Resources, Mines and Energy
DTMR	Department of Transport and Main Roads
EMP	Environmental Management Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERA	Environmentally Relevant Activities
ESCP	Erosion and Sediment Control Plan
FNQROC	Far North Queensland Regional Organisation of Councils
GBR	Great Barrier Reef

Abbreviation	Meaning
GBRNHP	Great Barrier Reef National Heritage Place
GBRMPA	Great Barrier Reef Marine Park Authority
GBRMP	Great Barrier Reef Marine Park
GBRWHA	Great Barrier Reef World Heritage Area
Ha	Hectares
MNES	Matters of National Environmental Significance
MSC	Mareeba Shire Council
MSES	Matters of State Environmental Significance
MUTCD	Manual of Uniform Traffic Control Devices
NRA	NRA Environmental Consultants
PMAV	Property Map of Assessable Vegetation
PMST	Protected Matters Search Tool
RE	Regional Ecosystem
SRI	Significant Residual Impact
UDIA	Urban Development Institute of Australia
WSUD	Water Sensitivity Urban Design
WTQNHP	Wet Tropics of Queensland National Heritage Place
WTQWHA	Wet Tropics of Queensland World Heritage Area
WWTP	Waste Water Treatment Plan

19.0 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

19.1 Background information

The purpose of this Chapter is to:

- Describe the existing Commonwealth and United Nations regulatory frameworks regarding the assessment of the project within the context of world heritage and national heritage values and other Matters of National Environmental Significance (MNES)
- Provide the findings of the survey work undertaken on the site
- Identify the impacts of the project on the above values
- Identify current regulatory management tools
- Provide mitigation and management measures to support those regulatory tools which will be applicable throughout the life of the project.

This Chapter addresses the MNES associated with KUR-World. It assesses the potential impacts of the project on The Wet Tropics of Queensland World Heritage Area, The Great Barrier Reef World Heritage Area, the Wet Tropics of Queensland National Heritage Place, the Great Barrier Reef National Heritage Place, the Great Barrier Reef Marine Park and upon listed threatened species (including migratory) and ecological communities. It also summarises the overall environmental impacts and mitigation strategies.

To present a comprehensive view of the project, the Chapter summarises information from different environmental studies and technical reports, particularly those of the Flora and Fauna Technical Report, Visual Impact Assessment, Cultural Heritage, Water Quality, Traffic and Social and Economic Impact Assessments.

19.1.1 Context

KUR-World is an Integrated Eco-Resort proposed near Myola in the Mareeba Shire. Conceived by Reever & Ocean Developments Pty Ltd (R&O), the approximately 648.3 hectare site, located over 10 titles, will include a combination of short-term and permanent residential options, as well as education, recreation, wellbeing/rejuvenation and rural tourism facilities.

Preliminary investigations and feasibility works were completed in late 2015. An application seeking consideration of the KUR-World Integrated Eco-Resort project ('the project') as a 'Coordinated Project' was submitted on 30 May 2016 and on 12 July 2016 the project was declared a 'Coordinated Project' (QLD Gov 2016).

On 24 May 2016 a Referral was lodged with the Department of Environment and Energy (DoEE) pursuant to the Environment Protection and Biodiversity Conservation Act 1999 ('EPBC Act') to determine whether the project is a controlled action. The DoEE EPBC Decision 2016/7710 made on 27 June 2016, decided the proposed action is a controlled action and the relevant controlling provisions are:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and 15C)
- Listed threatened species and communities (sections 18 and 18A)
- Great Barrier Reef Marine Park (sections 24B and 24C).

The project boundary is located two kilometres west and south of the Wet Tropics of Queensland World Heritage Area (WTQWHA), 8.5 km west of the Great Barrier Reef World Heritage Area (GBRWHA) and 25km upstream of the GBRWHA.

The final Terms of Reference (ToR) for the KUR-World EIS require an assessment of the MNES that may be potentially impacted by the project. Where listed threatened species are both MNES and Matters of State Environmental Significance (MSES) their assessment will be undertaken in this Chapter.

19.1.2 Project description

KUR-World aims to deliver a combination of short-term and permanent residential options, as well as education, recreation, rejuvenation and nature-based activities, along with rural experiences. The land comprises 10 titles on approximately 648.3 ha covering rainforest, regrowth vegetation, watercourses and farmland. It is approximately 30 minutes' drive from Cairns International Airport and less than six km from Kuranda. The development features the following key elements:

- Farm Theme Park and Equestrian Centre
- Queenslander Lots
- Produce Garden
- Lifestyle Villas
- KUR-Village
- Business and Leisure Hotel and Function Centre
- KUR-World Campus
- Sporting Precinct
- Golf Clubhouse and Function Centre
- Golf Course
- Premium Villas
- Five Star Eco-Resort
- Health and Well-Being Retreat
- Glamping
- Environmental Areas
- Rainforest Education Centre and Adventure Park
- Services/Infrastructure

A staged development plan is proposed over 9-years.

Stage 1A includes:

- Farm Theme Park and Equestrian Centre (Phase 1)
- Queenslander lots
- Produce garden
- Services and infrastructure

Stage 1B includes:

- Farm Theme Park and Equestrian Centre (Phase 2)
- KUR-Village (Phase 1)
- Equestrian Centre
- Lifestyle Villas
- Premium Villas
- Four Star Business and Leisure Hotel and Function Centre (Phase 1)
- Rainforest Education Centre and Adventure Park
- Services and infrastructure

Stage 2 includes:

- KUR-Village (Phase 2)
- Four Star Business and Leisure Hotel and Function Centre
- Golf Club House and Function Centre
- Golf Course
- Sporting Precinct
- Premium Villas
- Infrastructure and Services

Stage 3 includes:

- Health and Wellbeing Retreat
- Five Star Eco-Resort
- KUR-World University Campus
- Premium Villas
- Infrastructure and Services

The development footprint would comprise about 157.33[1] ha out of a total project area of about 673.7 ha[2]. Figure 19-1 identifies the project site and proposed development footprint which is predominantly in the northern portion of the project site. The KUR-World Overall Site Master Layout Version G and vision have been developed following extensive site assessments, field studies and feedback from numerous parties as detailed in the Stakeholder Engagement Plan (Chapter 11.2).

The project area supports forests in various states of condition, though overall habitat integrity is moderate to high. Habitats in the northern third of the site are in poorer condition (higher predominance of weeds, more fragmented, higher edge to area ratio) relative to habitats in the south. The northern portion of the project area has been used for cattle grazing since the early to mid-20th century and remains in use for this purpose. The majority of this northern portion was largely or partially cleared of woody vegetation on a number of occasions from the 1940s to the early 1990s. During the 1990s, regrowth vegetation began to re-establish. In 2014, approximately 46 ha of this regrowth vegetation was cleared to reinstate pasture. The southern portion of the project area is dominated by remnant vegetation. Historical aerial photographs indicate localised and episodic vegetation clearing events, though regrowth vegetation has since established over most of the previously cleared land.

The site is located near the Wet Tropics of Queensland World Heritage Area, the Great Barrier Reef World Heritage Area, the Wet Tropics of Queensland National Heritage Place and the Great Barrier Reef National Heritage Place. These environmental values are MNES.

[1] Includes: (a) the total area of all precincts (excluding Precinct P – Environmental Area); (b) the total area of the proposed internal road network (about 19.4ha); (c) 0.1 hectares for Zip Line tower establishment; (d) 0.1 hectares for helipad establishment; and (e) 2.1 hectares for the proposed new external access road. Excludes: (a) 2.7ha required within Precincts F, I, J and K for habitat retention; and 12.6ha required within Precinct F, I, J, K and O identified for recommended additional habitat retention.

[2] This total area includes the total area of all Precincts as defined in the KUR-World Concept Master Layout Revision H, in addition to (a) the proposed new access road; and (b) road reserve within and between lots comprising the site. Note that the identified developable area and/or the identified developable area percentage are not relative to the site area of 648.3ha (which is a lesser area as it does not constitute areas of road reserve).

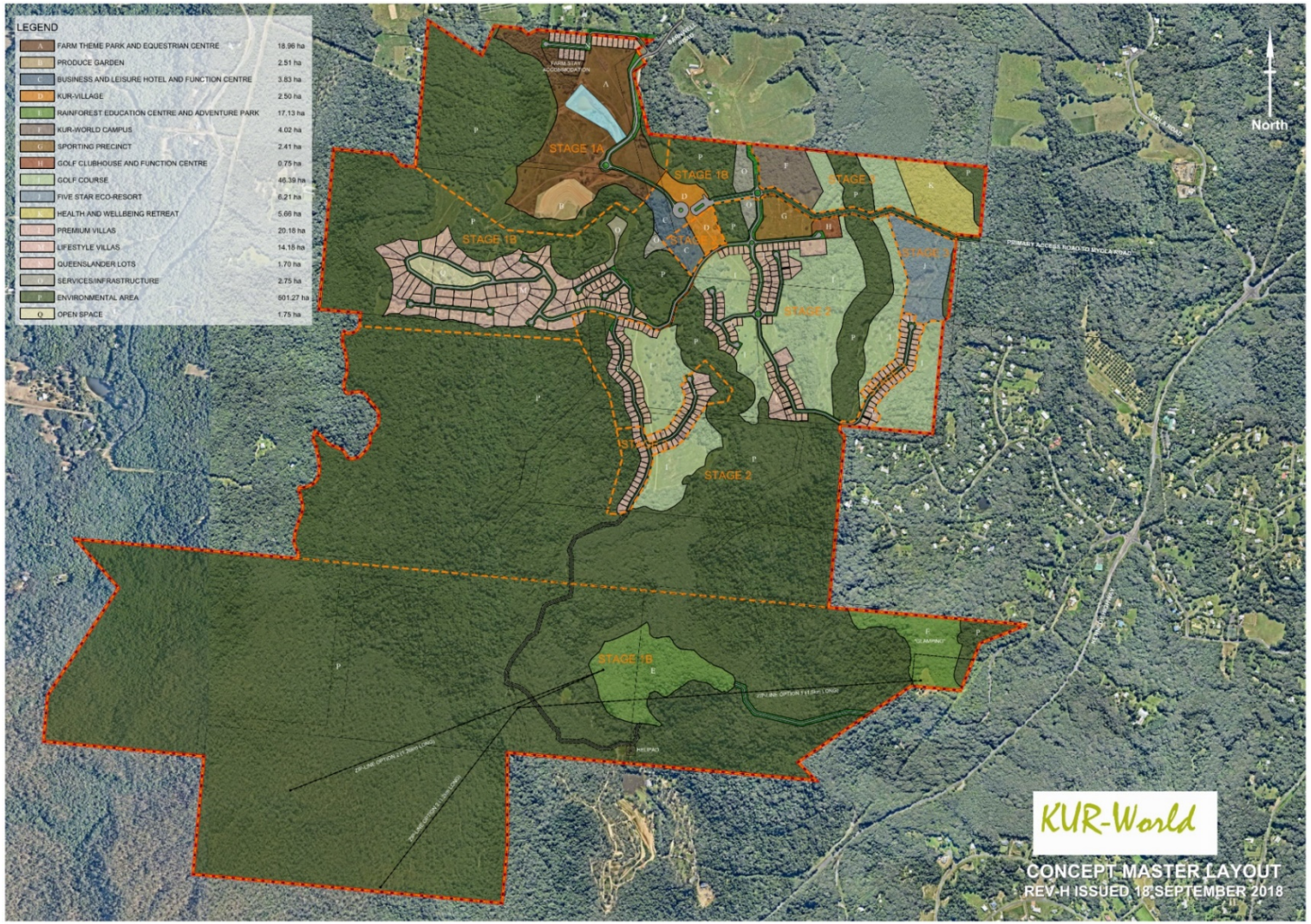


Figure 19-1 Project site and proposed development footprint[3].

[3] For the purposes of data analysis and technical reporting revision G, was utilised. The current (2018) master plan is Revision H, which should be considered interchangeable with revision G. With the exception of 'Glamping' being removed from the environmental area in revision H.

19.1.3 Purpose of chapter

The content of this Chapter has been developed to address Section 13 of the *Terms of Reference* (ToR) for the preparation of an EIS for the KUR-World project. The purpose of this Chapter is to provide a stand-alone description and assessment of the impacts of the project on the relevant controlling provisions under the EPBC Act inclusive of avoidance, mitigation and offset measures, if needed.

This Chapter provides details of the:

- MNES known or likely to occur within the project footprint
- Potential impacts to MNES by project activities
- The cumulative impacts related to all known proposed developments in the region with respect to each controlling provision and all identified consequential actions
- The indirect, cumulative and facilitated impacts that may result from the project on listed threatened species and communities
- Avoidance, mitigation and management measures that will be implemented to address those potential impacts through each project phase
- Conclusions in relation to whether the project will have a significant impact on MNES and whether there are any residual risks that need to be offset and/or managed.

19.1.4 Matters of National Environmental Significance (MNES)

Controlling provisions are the MNES under the EPBC Act on which the proposed development may have a significant impact. This chapter will address the impacts of the project on the following matters of national environmental significance:

- Wet Tropics Queensland World Heritage Area
- Great Barrier Reef Marine Park World Heritage Area
- Wet Tropics Queensland National Heritage Place
- Great Barrier Reef Marine Park National Heritage Place
- Listed threatened species and communities
- Great Barrier Reef Marine Park.

19.1.5 Protected Matters search

The EPBC Act Protected Matters Search Tool (PMST) was used to generate a Protected Matters Report for the project area within a 10 km radius of point -16.8306, 145.6032 (DoEE 2017a). This report was used to determine whether MNES or other matters protected by the EPBC Act are likely to occur within the project area. Supplementary database and mapping searches were used to identify additional potential MNES present:

- DEHP Wildlife Online database (DEHP 2017). Report was generated for the area within a 10 km radius of point -16.8306, 145.6032
- Atlas of Living Australia search (ALA 2017). Review of specific species records and a database search within a 5 km radius of point -16.8306, 145.6032
- Regional Ecosystem (RE) mapping (Version 8.0) (DNRM 2017a)
- Reports relevant to the project area: Astrebla (2015a, 2015b); Hoskin (2016 and 2017)
- Literature relevant to flora, fauna, ecosystems and values known to occur in the region.

Based on the Protected Matters Report (DoEE 2017a) the MNES that may occur in, or may relate to, the project area includes:

- World Heritage Properties
- National Heritage Places
- Listed Threatened Species and Ecological Communities
- Listed Migratory Species.

The remaining four MNES protected under the EPBC Act are not relevant to the project, therefore are not discussed. These are:

- Wetlands of international importance
- Commonwealth marine areas
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

The Great Barrier Reef Marine Park is not included on the Protected Matters Search Tool Report. However, since the project site is part of the Great Barrier Reef catchment, and this MNES is also included in the final Terms of Reference for KUR-World, the impacts of the project on The Great Barrier Reef Marine Park are discussed.

A summary of the MNES relevant to the project area is presented in Table 19-1, below.

Table 19-1: Assessment of MNES as Controlling Provisions

EPBC Act MNES	EPBC Act Protected Matters Search Tool results	EPBC Act Controlling Provision
World heritage properties	1 identified (Wet Tropics of Queensland)	World heritage properties
National heritage places	2 identified (Wet Tropics of Queensland and Wet Tropics World Heritage Area (Indigenous Values))	National heritage places
Wetlands of international importance (Ramsar)	None identified. The project area is not located within a Wetland of international importance. The closest Wetland of international importance is Bowling Green Bay, approximately 400 km to the south-east of the project area	Not applicable. The project area is not located within or adjacent to a Wetland of international importance. The closest Wetland of international importance is Bowling Green Bay, approximately 400 km to the south-east of the project area.
Listed Threatened species and ecological communities	50 Threatened species (or their habitat) and 1 Threatened ecological community are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10km search radius from the centre point of the search area.	Listed Threatened species and ecological communities.
Listed Migratory species protected under international agreements	22 listed Migratory species (or their habitat) are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10km search radius from the centre point of the search area.	Listed Migratory species protected under international agreements.
Commonwealth marine areas	None identified. The project area is remote (> 10 km) from the closest point of the Commonwealth marine area.	Not applicable. The project area is remote (> 10 km) from the closest point of the Commonwealth marine area.
Great Barrier Reef Marine Park	None identified. The project area is remote (> 10 km) from the closest point of the Great Barrier Reef Marine Park.	Great Barrier Reef Marine Park. The project area is remote (> 10 km) from the closest point of the Great Barrier Reef Marine Park. However, as the project site is part of the Great Barrier Reef catchment, the impacts

EPBC Act MNES	EPBC Act Protected Matters Search Tool results	EPBC Act Controlling Provision
		of the project on The Great Barrier Reef Marine Park are discussed.
Nuclear actions	Not applicable. The action will not be a nuclear action.	Not applicable. The action will not be a nuclear action.
A water resource, in relation to coal seam gas development and large coal mining development	Not applicable. The action will not be in relation to coal seam gas development or large coal mining development.	Not applicable. The action will not be in relation to coal seam gas development or large coal mining development.
Other matters protected by the EPBC Act		
Commonwealth Land	None identified. The project area is not located on Commonwealth Land.	Not applicable. The project area is not located on Commonwealth Land.
Commonwealth Action	Not applicable. The project is not a Commonwealth Action.	Not applicable. The project is not a Commonwealth Action.
Commonwealth Heritage Places	None identified. The project area is not a Commonwealth Heritage Place.	Not applicable. The project area is not a Commonwealth Heritage Place.
Listed Marine species	27 listed Marine species are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10km search radius from the centre point of the search area.	Not applicable. The project area is not located on Commonwealth Land and no impacts are expected on listed Marine species in a Commonwealth marine area.
Critical Habitats	None identified. No values on the Register of Critical Habitat are relevant to the project area[4].	Not applicable. Critical habitat is given meaning under the EPBC Act (subsection 207A) as habitat identified on the Register of Critical Habitat. No values on the Register of Critical Habitat are relevant to the project area.
Commonwealth Reserves (Terrestrial and Marine)	None identified. There are no registered Commonwealth Reserves within the 10 km search radius from the centre point of the search area.	Not applicable. There are no registered Commonwealth Reserves within the 10 km search radius from the centre point of the search area.

19.1.5.1 Listed Threatened species, Ecological Communities and Migratory Species

Listed Threatened Species, Ecological Communities and Migratory Species are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10km search radius from the centre point of the search area. As these values are described in detail within Chapter 8 of the EIS, and within the Flora and Fauna and Biosecurity Technical Reports (Appendix 5 and Chapter 16 of the EIS), and in section 19.7 of this chapter only an introductory summary is presented below.

[4] Habitat that is critical to the survival of a species is a separate matter linked to Listed Threatened species and ecological communities that is not be confused with Critical Habitat.

19.1.5.2 Listed Threatened species

Fifty (50) Threatened species (or their habitat) are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10 km search radius from the centre point of the search area. Of these, 23 are flora species and 27 are fauna species.

19.1.5.3 Flora

One Endangered Flora species of national significance was identified within the project area. Details of the species of national significance identified within the project area are provided below.

- Myola Palm (*Archontophoenix myolensis*) (EPBC Act Endangered). All of the *Archontophoenix* plants found in the project area were either young plants or plants not in flower. This circumstance precludes definitive identification to species level. However, all potential specimens are being treated as Myola Palm. Palms tentatively identified as Myola Palms, along with potential habitat for this species, are shown on Figure 19-2. All were recorded along drainage lines, the species' preferred habitat[5].

Database searches identified the potential presence of other EPBC Act Threatened Flora species within the project area. The likely presence of these species on the project site was assessed using information obtained during the desk-based review and field surveys (survey details presented in Section 19.7.2). The results of this assessment are provided in Appendix 5, Section 4.2.4. Species of national environmental significance are presented below. Potential habitat mapping for these Flora species is shown on Figure 19-2.

- Probable occurrence (potentially suitable habitat present though species not recorded despite targeted searches):
  - Endlicher's Filmy Fern (*Polyphlebium endlicherianum*) (EPBC Act Endangered).
  - Smooth-bark Rose Apple (*Syzygium hodgkinsoniae*) (EPBC Act Vulnerable).
  - Velvet Jewel Orchid (*Zeuxine polygonoides Syn, Rhomboda polygonoides*) (EPBC Act Vulnerable).
- Possible occurrence (possibly suitable habitat present though species not recorded):
  - Rat's Tail Tassel-fern (*Phlegmariurus filiformis*) (EPBC Act Endangered).
  - *Cajanus mareebensis* (EPBC Act Endangered).

For further details on species of national significance, refer to Chapter 8 – Flora and Fauna and Appendix 5 – Flora and Fauna technical report.

[5] This habitat will be protected by the vegetation buffers along creeks.

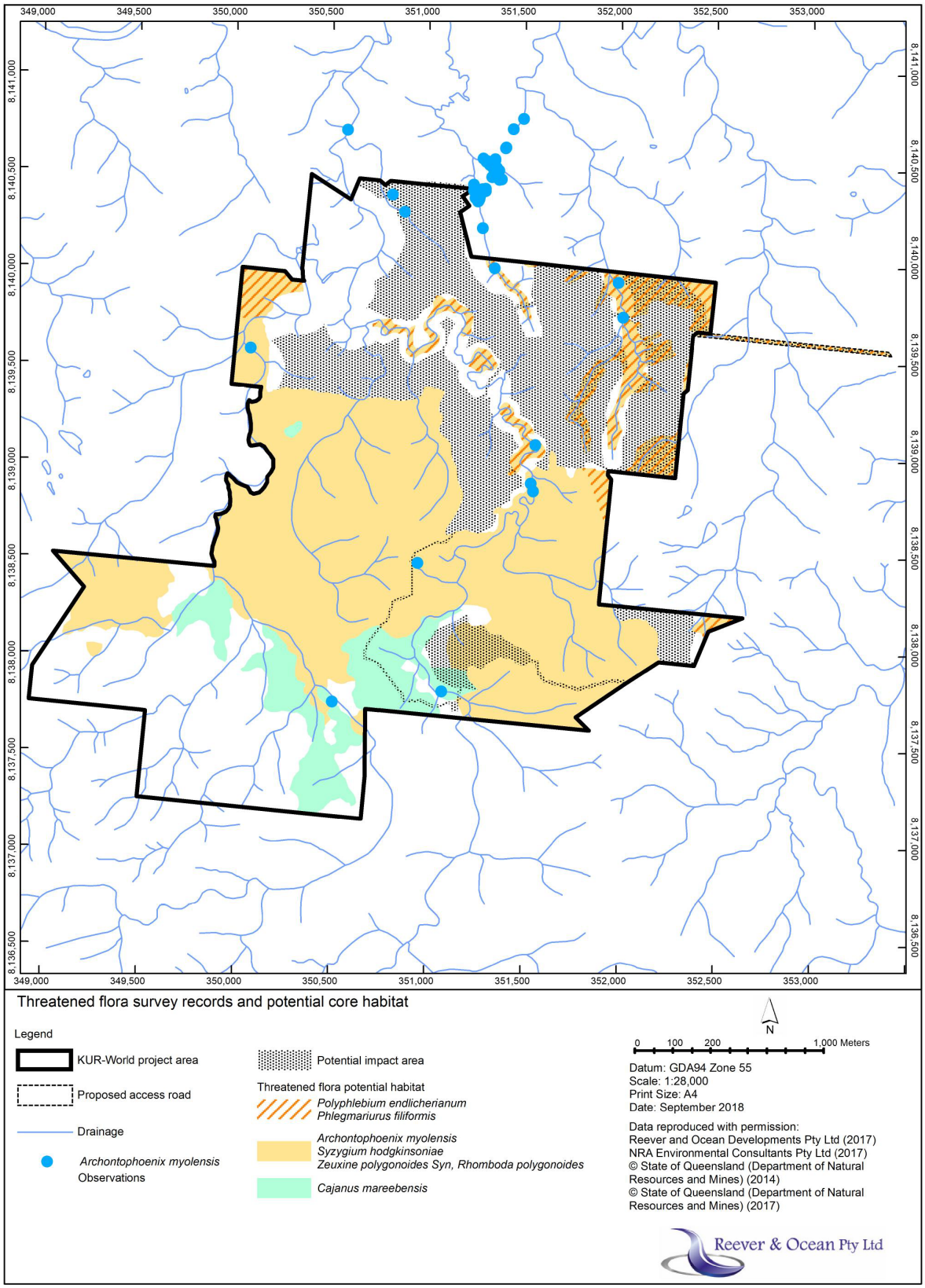


Figure 19-2: Threatened flora records, potential core habitat and potential impact area[6]

[6] For the purposes of data analysis and technical reporting revision G, was utilised. The current (2018) master plan is Revision H, which should be considered interchangeable with revision G. With the exception of 'Glamping' being removed from the environmental area in revision H.

19.1.5.4 Fauna

Five EPBC Threatened Fauna species were recorded during the field surveys (survey details presented in Section 19.7.3). The observed location of these species and verified or potential core habitat within the project area are presented in Figure 19-3 to Figure 19-6. A list of the recorded EPBC Threatened Fauna species and their legislative status is listed below.

- Kuranda Tree Frog (*Litoria myola*). Endangered EPBC Act.
- Gouldian Finch (*Erythrura gouldiae*). Endangered EPBC Act[7].
- Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus*). Vulnerable EPBC Act.
- Greater Large-eared Horseshoe Bat (*Rhinolophus philippinensis*). Vulnerable EPBC Act.
- Spectacled Flying-fox (*Pteropus conspicillatus*). Vulnerable EPBC Act.

Further information relating to these species, the Southern Cassowary (*Casuarius casuarius johnsonii*), and the Red Goshawk (*Erythrotriorchis radiatus*) is provided in Appendix 5 (refer to Section 4.3.2) and section 19.7.3 (this Chapter). Non-definitive evidence of Southern Cassowary and Red Goshawk presence was recorded on the project area and discussion is warranted given the potential interest associated with these species.

A list of the EPBC Threatened Fauna species not recorded during field surveys though identified in the database search areas is provided in Appendix 5 (refer to Table 11). The likelihood of these species occurring on the project area was assessed taking into account published information about the ecology and distribution of each species, habitat types and conditions observed on-site. Based on this assessment, eight species of national significance may occur within the project area and one species is likely to occur within the project area; these species and their legislative status are listed below.

- Likely to occur.
  - Southern Cassowary (southern population) (*Casuarius casuarius johnsonii*). Endangered EPBC Act.
- May occur.
  - Australian Lacelid (*Litoria dayi*). Endangered EPBC Act.
  - Northern Bettong (*Bettongia tropica*). Endangered EPBC Act.
  - Northern Quoll (*Dasyurus hallucatus*). Endangered EPBC Act.
  - Red Goshawk (*Erythrotriorchis radiatus*). Vulnerable EPBC Act.
  - Semon's Leaf-nosed Bat (*Hipposideros semoni*). Vulnerable EPBC Act.
  - Masked Owl (northern) (*Tyto novaehollandiae Kimberli*). Vulnerable EPBC Act.
  - Greater Glider (*Petauroides Volans*). Vulnerable EPBC Act.
  - Ghost Bat (*Macroderma gigas*). Vulnerable EPBC Act.

The Australian Lacelid, Red Goshawk, Northern Quoll and the Ghost Bat are likely to be non-resident on the project area – their presence is more likely to be intermittent. The presence of Southern Cassowary is also likely to be intermittent. The pattern of occurrence of the remaining species is difficult to predict due to limited information on species distribution and/or ecology – their occurrence may range from frequent to intermittent (Appendix 5, Table 11).

[7] *Vagrant or aviary escapee. Viable habitat for the species does not occur on the project area.*

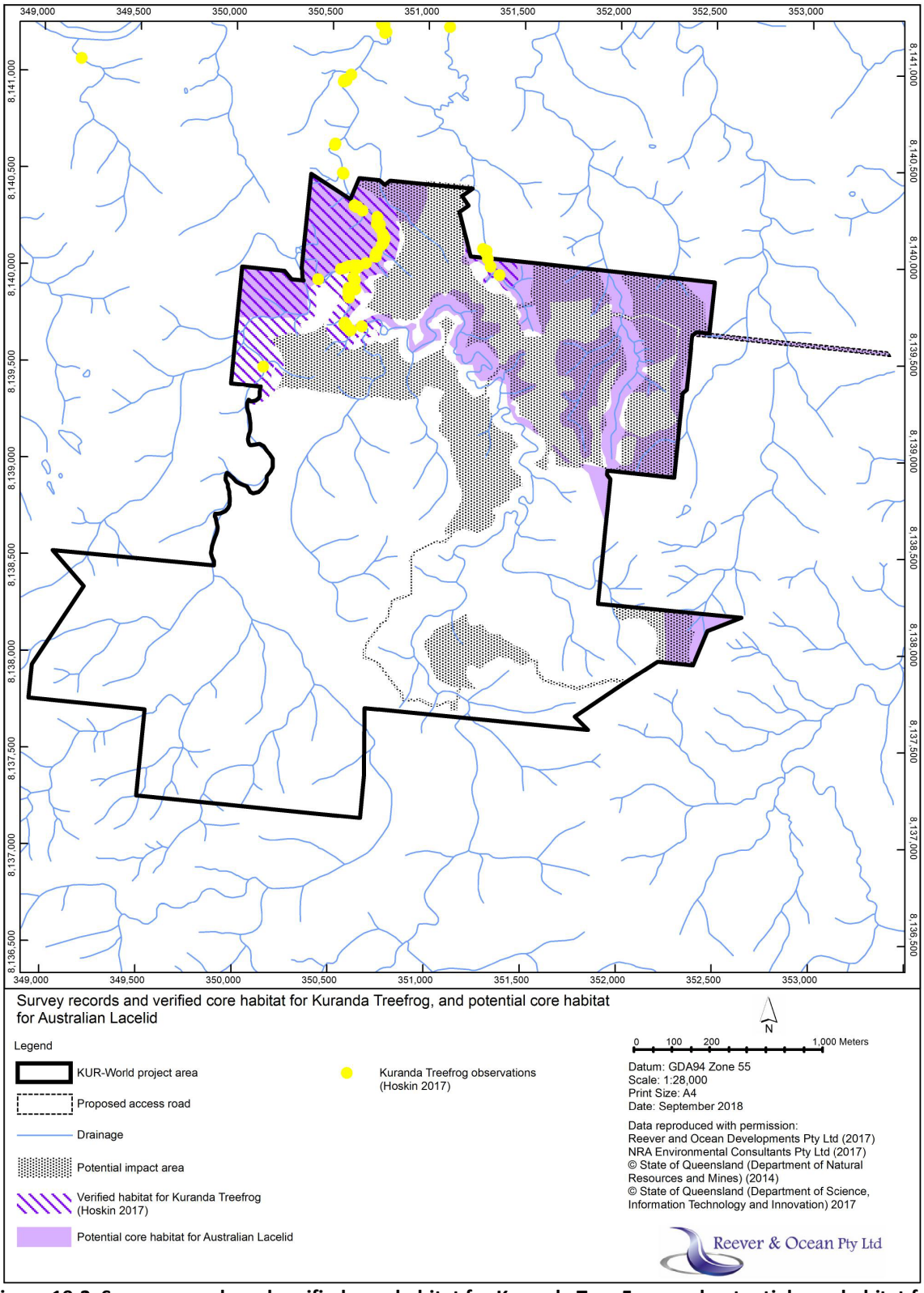


Figure 19-3: Survey records and verified core habitat for Kuranda Tree Frog, and potential core habitat for Australian Lacelid[8]

[8] For the purposes of data analysis and technical reporting revision G, was utilised. The current (2018) master plan is Revision H, which should be considered interchangeable with revision G. With the exception of 'Glamping' being removed from the environmental area in revision H.

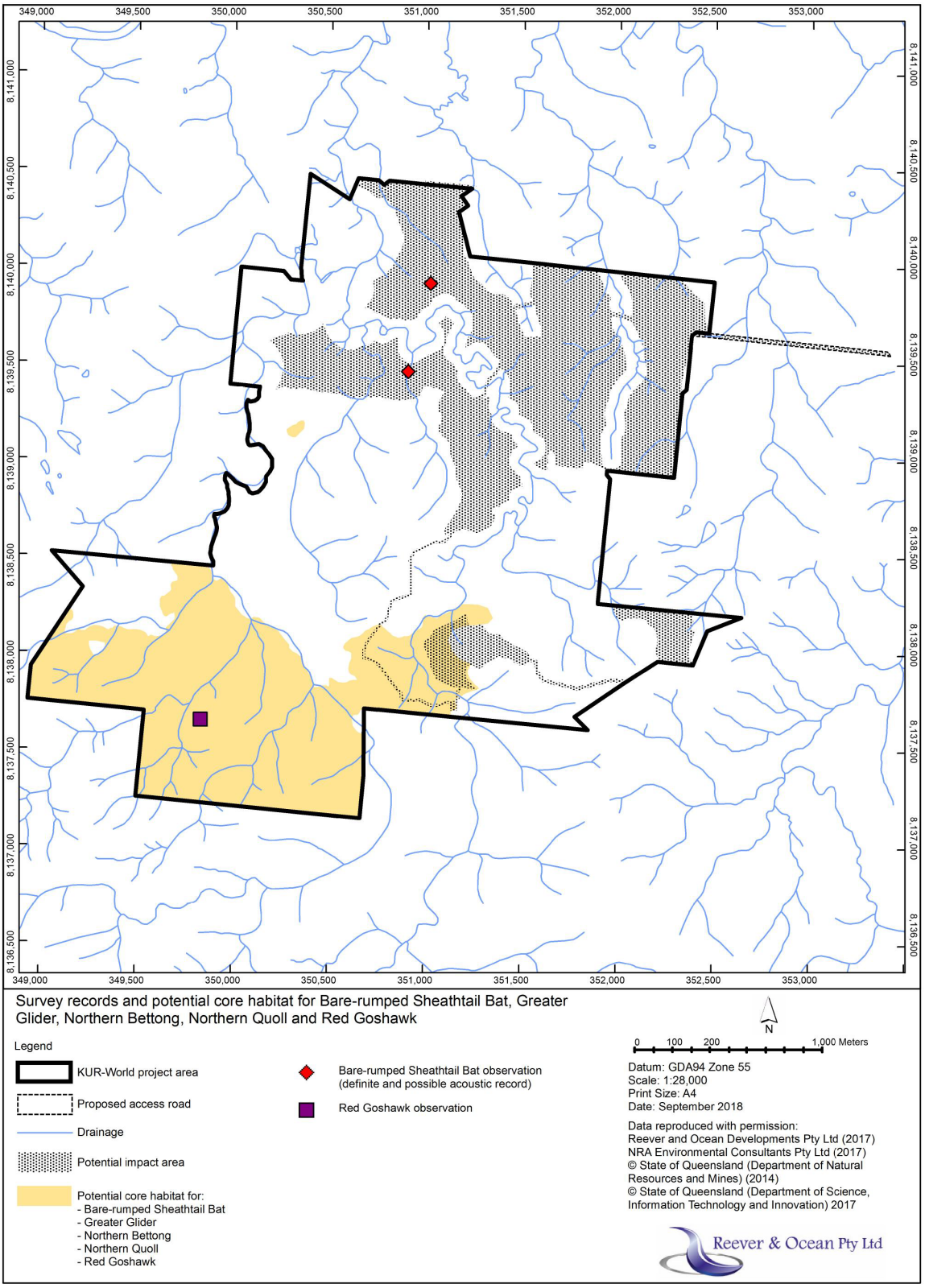


Figure 19-4: Survey records and potential core habitat for Bare-rumped Sheathtail Bat, Greater Glider, Northern Bettong, Northern Quoll and Red Goshawk[9]

[9] For the purposes of data analysis and technical reporting revision G, was utilised. The current (2018) master plan is Revision H, which should be considered interchangeable with revision G. With the exception of 'Glamping' being removed from the environmental area in revision H.

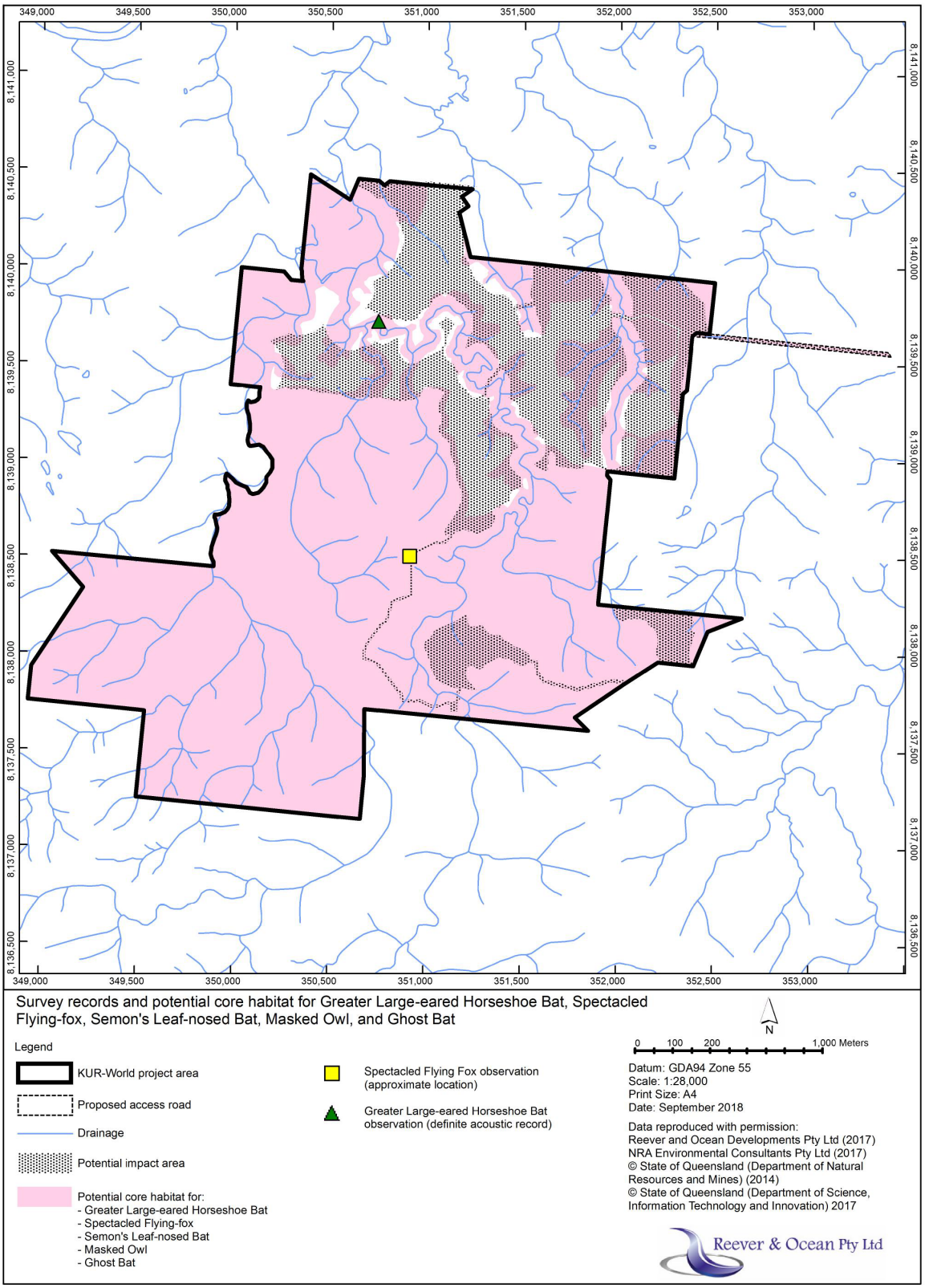


Figure 19-5: Survey records and potential core habitat for Greater Large-eared Horseshoe Bat, Spectacled Flying-fox, Semon's Leaf-nosed Bat, Masked Owl and Ghost Bat[10]

[10] For the purposes of data analysis and technical reporting revision G, was utilised. The current (2018) master plan is Revision H, which should be considered interchangeable with revision G. With the exception of 'Glamping' being removed from the environmental area in revision H.

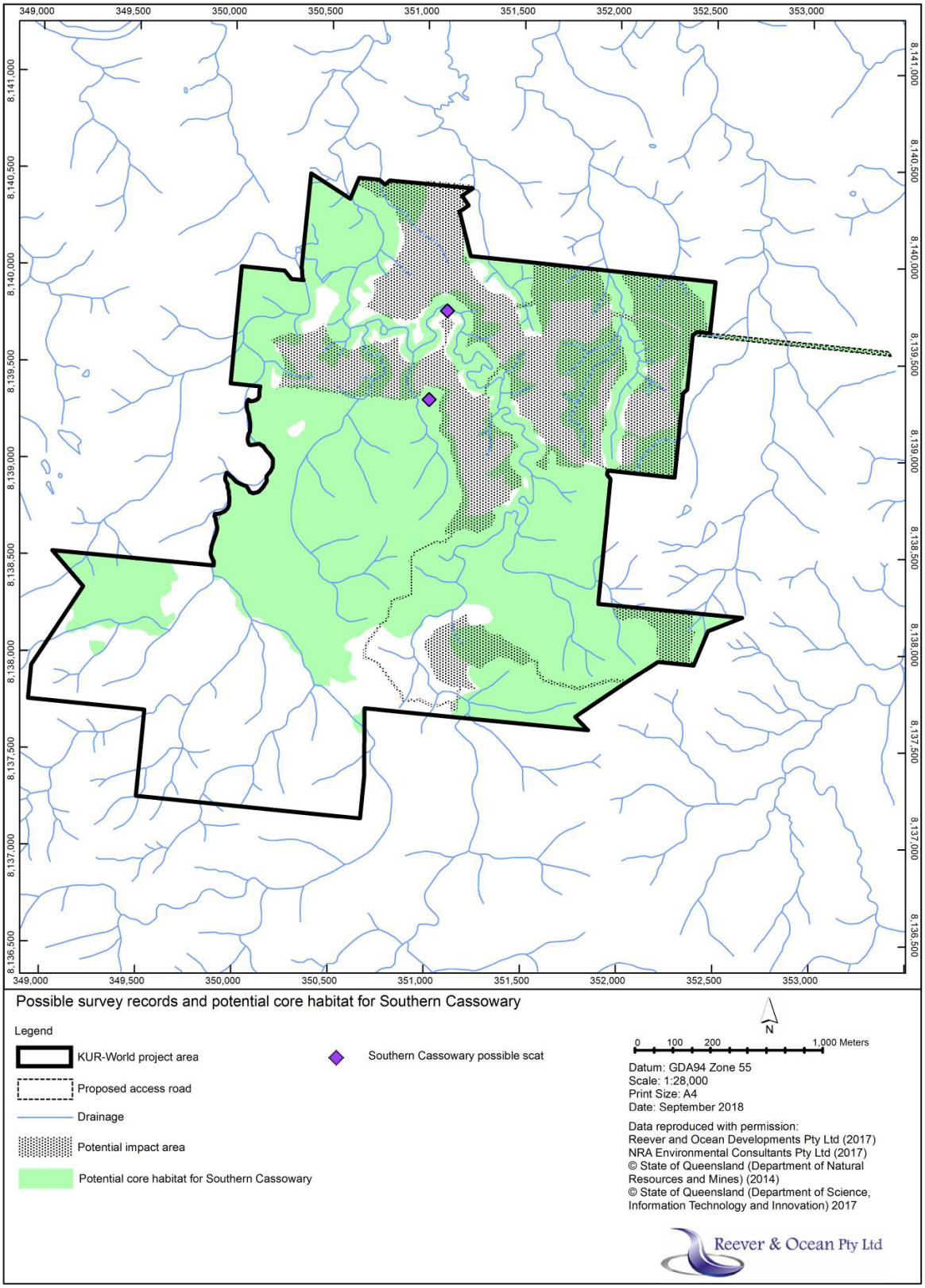


Figure 19-6: Possible survey records and potential core habitat for Southern Cassowary[11]

[11] For the purposes of data analysis and technical reporting revision G, was utilised. The current (2018) master plan is Revision H, which should be considered interchangeable with revision G. With the exception of 'Glamping' being removed from the environmental area in revision H.

19.1.5.5 Listed Ecological Communities

The EPBC Protected Matters Search Tool Report indicates the potential presence of the listed Threatened Ecological Community (TEC) Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland. However, this TEC is not present within the project area.

19.1.5.6 Listed Migratory species

Twenty-two listed Migratory species (or their habitat) are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10km search radius from the centre point of the search area. Further database searchers returned a total of 35 Migratory-listed fauna, of these species the Spectacled Monarch and the Rufous Fantail were recorded in the project area during the baseline surveys. Both species are relatively common locally and regionally. The Spectacled Monarch is likely to maintain a permanent or frequent presence on the project area, whereas the Rufous Fantail is a passage migrant and more likely to occur in the cooler months.

The majority of the remaining species are coastal or wetland species that are unlikely to occur on the project area due to the absence of suitable habitat. Migratory species that may or are likely to occur are described below, and further discussion is presented in Appendix 5 (refer to Section 4.3.2).

- Likely to occur:
  - White-throated Needletail (*Hirundapus caudacutus*).
  - Fork-tailed Swift (*Apus pacificus*).
  - Black-faced Monarch (*Monarcha melanopsis*).
- May occur:
  - Oriental Cuckoo (*Cuculus optatus*).
  - Barn Swallow (*Hirundo rustica*).
  - Eastern Osprey (*Pandion cristatus*).
  - Glossy Ibis (*Plegadis falcinellus*).

The project area may occasionally, and temporarily, support ecologically significant proportions of White-throated Needletail and Fork-tailed Swift populations based on national threshold values described in DoE (2015). There are insufficient data to assess the likelihood of the project area supporting ecologically significant proportions of the other Migratory species listed above. Based on the 2017 survey results, and the observed conditions on-site, the project area is probably unlikely to support ecologically significant proportions of other Migratory species. The possible exception is the Spectacled Monarch which may at times come close to the national threshold values described in DoE (2015).

19.1.5.7 Potential Impacts on Listed Threatened species, Ecological Communities and Migratory species

Potential impacts upon Threatened species and Migratory species are described in detail within section 19.7 of this Chapter, in Chapter 8 Flora and Fauna, and within the Flora and Fauna Technical Report and Biosecurity Chapter (Appendix 5 and Chapter 16 of the EIS).

19.2 Statutory framework

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as MNES.

The objectives of the EPBC Act are to:

- Provide for the protection of the environment, especially MNES.
- Conserve Australian biodiversity.
- Provide a streamlined national environmental assessment and approvals process.
- Enhance the protection and management of important natural and cultural places.
- Control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife.
- Promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.
- Recognise the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity.
- Promote the use of Indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.

The EPBC Act focuses Australian Government interests on the protection of MNES, with the States and Territories having responsibility for matters of State and local significance. The nine MNES are:

- World heritage properties
- National heritage places
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

Actions that will or may have a significant impact on MNES should be referred to the Commonwealth Department of the Environment and Energy for assessment under the EPBC Act.

In preparing this section, consideration has also been given to:

- *Environment Protection and Biodiversity Conservation Regulations 2000* (Cwlth) (EPBC Regulations)
- Matters of National Environmental Significance: Significant impact guidelines 1.1
- *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy
- *Environment Protection and Biodiversity Conservation Act 1999* Outcomes based conditions policy
- Wet Tropics Management Authority Strategic Plan 2013–2018
- Wet Tropics Conservation Strategy
- Wet Tropics Nature Based Tourism Strategy
- Approved conservation advice, recovery plans and threat abatement plans
- Convention Concerning the Protection of the World Cultural and Natural Heritage, UNESCO
- IUCN World Heritage Advice Note, UNESCO

- Operational Guidelines for the Implementation of the World Heritage Convention, UNESCO
- Intergovernmental Agreement on the Environment 1992

According to the World Heritage Convention, the following are considered as cultural heritage:

- Monuments: architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science.
- Groups of buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science.
- Sites: works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view.

According to the Convention natural heritage are:

- Natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view.
- Geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation.
- Natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

19.3 Wet Tropics of Queensland World Heritage Area

The project area is not located within a World Heritage Area. Its closest project boundary is located two kilometres west and south of the Wet Tropics of Queensland World Heritage Area (WTQWHA). The WTQWHA covers approximately 894,420 ha and is located along the north-east coast of Queensland extending from just south of Cooktown to just north of Townsville.

19.3.1 Identification of characteristics, values and integrity of the Wet Tropics of Queensland World Heritage area potentially affected

The project area is located on the western fringe of the Kuranda township with areas of large residential blocks to the east, north and west. Many of the surrounding areas were historically cleared for farming, particularly to the north and east; now occupied by residential areas and/or regrowth vegetation.

Parts of the project area feature characteristics of the WTQWHA, including similar rainforest and woodland communities and floral and faunal assemblages. Across the Wet Tropics Bioregion rainforest broadly occurs as a north-south band along and near the coastal range system. The project area occurs along the western edge of this band of rainforest, where the vegetation transitions into eucalypt forest and woodlands. The WTQWHA covers part of the rainforest in the region, its closest point being approximately 2 km to 4 km east, north and south-east of the project area. The north-south band of rainforest, and the WTWHA, narrows in the vicinity of Kuranda (and by default the project area) (Figure 19-7). For this reason, all remnant rainforests in this area are considered important for maintaining north-south connectivity.

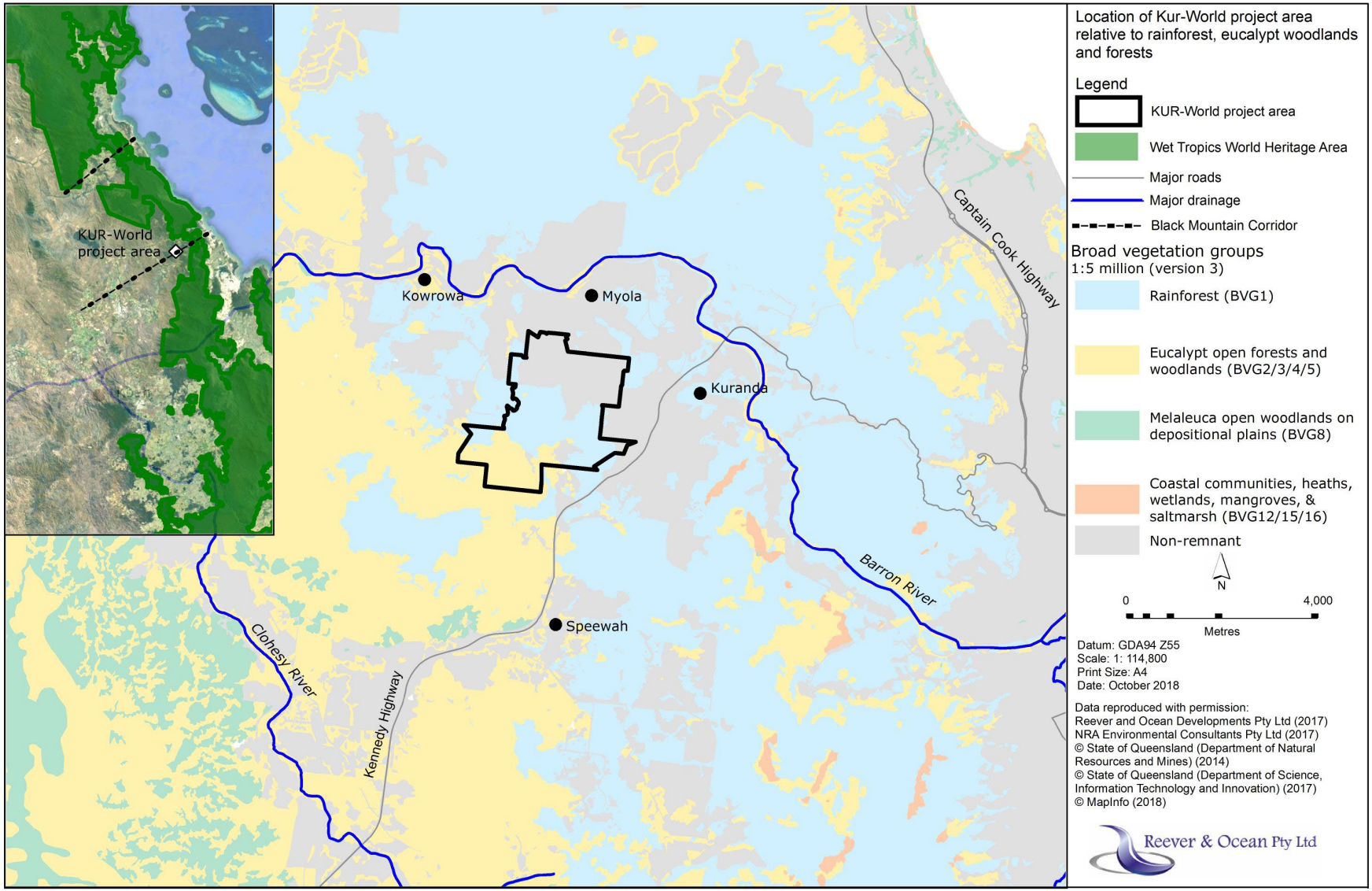


Figure 19-7: Location of KUR-World project relative to rainforest, eucalypt woodlands and forests.

An important environmental feature of the project site in relation to the WTQWHA is the connectivity it provides. The site occurs in a broad section of landscape where north-south connectivity for certain rainforest fauna is relatively limited. The location of habitat corridors surrounding the project area is presented in Figure 19-8. Rainforest corridors occur in the vicinity of Barron River Falls and the general Kuranda-Myola-Kowrowa areas. The project area contributes to the Kuranda-Myola-Kowrowa corridor most substantially in the western portion of the corridor. Additionally, the area of Eucalypt woodland/open forest west of the project area may also be an important north-south wildlife corridor, especially for species that prefer sclerophyll habitats.

The corridors described above, although fragmented, are potentially important wildlife corridors for different species, including threatened species. For example, the rainforest corridors and ecotone areas may be important for the Southern Cassowary and the sclerophyll corridor and ecotone areas may be important for the Northern Quoll (*Dasyurus hallucatus*). The potential importance of these corridors to wildlife is recognised in various forums including the *Mareeba Shire Council Planning Scheme* and the *Wet Tropics Conservation Strategy 2004*.

The region is also of conservation value from an evolutionary perspective. Throughout history, rainforests in the Wet Tropics have experienced cycles of contraction and expansion in response to changing climatic conditions. Periods of rainforest contraction isolated many wildlife populations to small, mostly montane refugia. A major disjunction was centred on the Black Mountain Corridor (refer to Appendix 5, Figures 2 and 4), separating multiple small refugia in the north from larger refugial areas in the central Wet Tropics. A suture zone is thought to have formed across a broad area (encompassing Kuranda) 7,500-600 years ago when rainforest expanded and previously separated floral and faunal lineages came back into contact. These climatic shifts and suture zones can promote genetic and phenotypic divergence, and potentially speciation. The Kuranda Tree Frog (*Litoria myola*), which occurs in the Kuranda area (including the project site), is one of the better-known examples of speciation in response to these evolutionary processes.

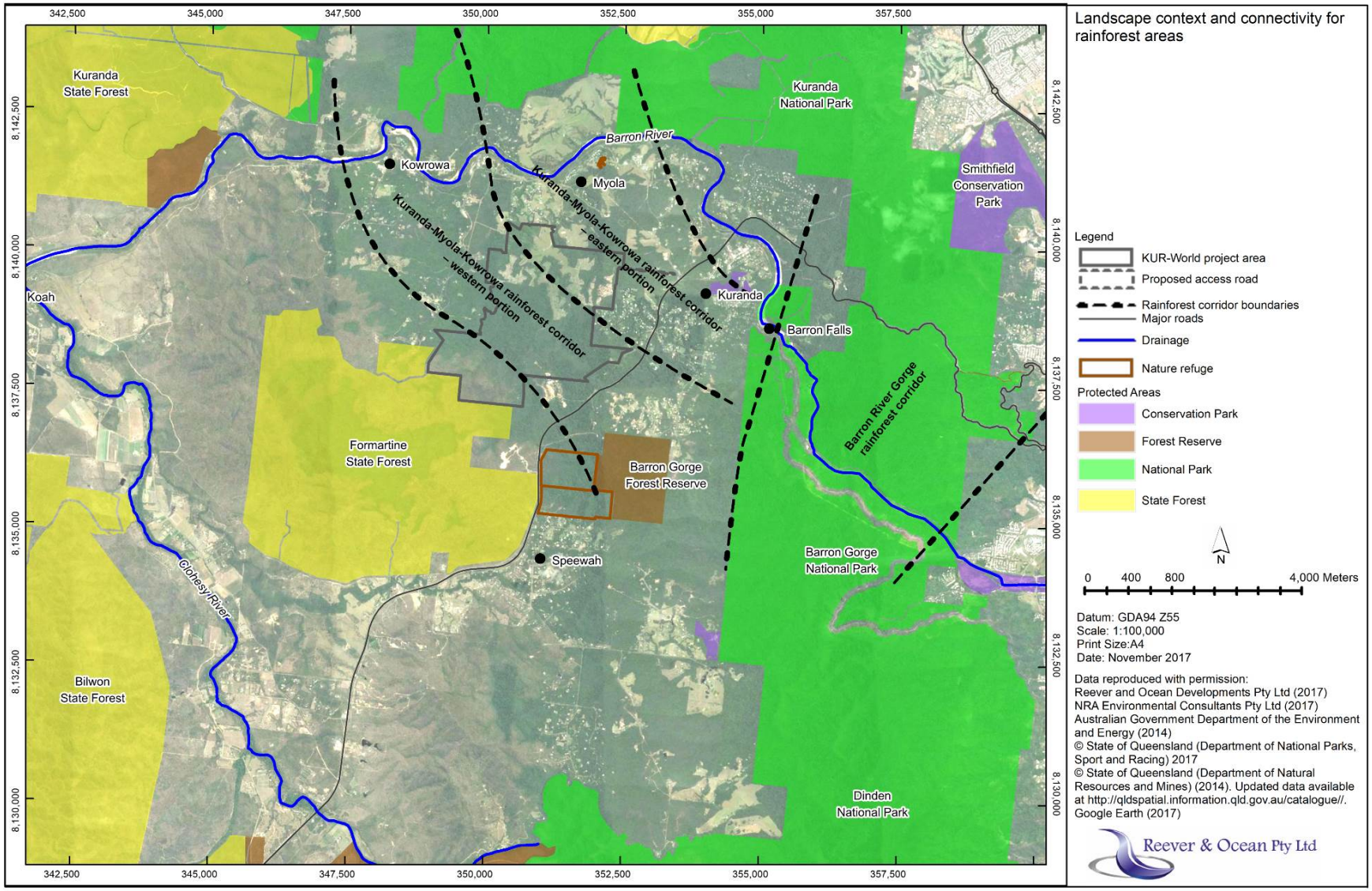


Figure 19-8: Landscape context and connectivity for rainforest areas.

According to UNESCO (2017a), The WTQWHA fulfils four criteria as displaying Outstanding Universal Value. Table 19-2 below summarises the four criteria and provides a comparison of the Project's values with those criteria.

Table 19-2: UNESCO Outstanding Universal Values

Criteria	Summary of Value	Corresponding Project Area Values
Criterion (vii)	The Wet Tropics exhibit exceptional natural beauty, with superlative scenic features highlighted by extensive sweeping forest vistas, wild rivers, waterfalls, rugged gorges and coastal scenery.	The project area possesses scenic values typical of the Kuranda area, including rainforest, woodlands, streams and pastures. Features include views across open paddocks to distant rainforested hillsides, rainforest streams and an elevated position in the south west of the property with views over the rainforest and open woodland areas. However, these features may not be known as local scenic areas.
Criterion (viii)	The Wet Tropics contains one of the most complete and diverse living records of the major stages in the evolution of land plants, from the very first pteridophytes more than 200 million years ago to the evolution of seed-producing plants including the cone-bearing cycads and southern conifers (gymnosperms), followed by the flowering plants (angiosperms). In addition, all of Australia's unique marsupials and most of its other animals originated in rainforest ecosystems, and the Wet Tropics still contains many of their closest surviving members. This makes it one of the most important living records of the history of marsupials as well as of songbirds.	The project area contains a representative assemblage of the flora and fauna of the eastern tablelands area within a historically fragmented landscape. Historical farming activities have altered habitat and corridor values. The remnant area includes habitat for one confirmed listed species of flora and five[12]confirmed fauna-listed species.
Criterion (ix)	The Wet Tropics provides outstanding examples of significant ongoing ecological processes and biological evolution. The area supports high levels of diversity of both flora and fauna, with over 3,000 vascular plant species in 224 families, of which 576 species and 44 genera are endemic, including two endemic plant families. Vertebrate diversity and endemism are also high, with 107 mammal species including 11 endemic species and two monotypic endemic genera. In terms of avifauna, there are 368 bird species, of which 11 species are endemic. For reptiles, there are 113 species of which 24 species are endemic, including three monotypic endemic genera. The diversity of amphibians includes 51 species of which 22 are endemic.	The project area contains a representative assemblage of the flora and fauna of the eastern tablelands area within a historically fragmented landscape. Historical farming activities have altered habitat and corridor values. The baseline flora and fauna surveys conducted for the project recorded 395 plant species and 173 vertebrate fauna species in the project area (refer Appendix 5).

[12]*Unlikely vagrant or aviary escapee. Viable habitat for the species does not occur on the project area.*

Criteria	Summary of Value	Corresponding Project Area Values
Criterion (x)	The Wet Tropics holds significant species of flora and fauna with hundreds of endemic species, many of which are classified as threatened. The majority of these plant species have restricted distributions. Many monotypic plant genera and several species of marsupials, frogs and reptiles have very restricted distributions either as isolated or disjunct populations, reflecting the refugial nature of the rainforests found in several locations. The diversity of the plant communities and animal habitats of the Wet Tropics is recognised as being the most floristically and structurally diverse in Australia.	The project area contains a representative assemblage of the flora and fauna of the eastern tablelands area within a historically fragmented landscape. Historical farming activities have altered habitat and corridor values. Baseline studies for the project have determined the presence of the Kuranda Tree Frog (*Litoria myola*) (EPBC Act Endangered) and the Gouldian Finch (*Erythrura gouldiae*)[13] (EPBC Act Endangered). The Myola Palm (*Archontophoenix myolensis*) (EPBC Act Endangered) has been tentatively identified within the project area. The Kuranda Tree Frog and the Myola Palm are restricted to and immediately around the project area, showing high endemism.

19.3.2 Potential impacts and analysis of all phases of the project

The project is located outside of the WTQWHA. Therefore, no direct impacts on habitat within the WTQWHA are anticipated. Potential impacts on Threatened flora and fauna (and their habitats) are discussed in Section 19.7.

[13] *Unlikely vagrant or aviary escapee. Viable habitat for the species does not occur on the project area.*

19.3.3 Impacts on other users of the area

The project area is located two kilometres west and south of the WTQWHA. In part it is surrounded by rural residential development. The development footprint would comprise 171 ha of the total project area (excluding proposed habitat retention areas, refer section 19.7 for further details) of 648.3 ha and is predominantly in the northern portion of the project site. Habitats in the northern third of the site are in poorer condition (higher predominance of weeds, more fragmented, higher edge to area ratio) relative to habitats in the south. The northern portion of the project area has been used for cattle grazing since the early to mid-20th century and remains in use for this purpose. The majority of this northern portion was largely or partially cleared of woody vegetation on a number of occasions from the 1940s to the early 1990s.

Although direct impacts, such as clearing related, are avoided as the project site is outside of the WTQWHA, indirect impacts have the potential to affect other users of the area. Some residents are concerned about the impacts on the WTQWHA of noise, visual amenity, habitat loss and water resources (including water quality). These aspects have been considered with the detailed assessments presented in the preceding chapters. In the absence of management measures, activities from the project site have the potential to impact on other users of the WTQWHA. Unfettered development would predictably contribute to a potential decline in values of the nearby WTQWHA and thus impact on other users. Appropriate management measures have, however, been identified.

Where practicable, management measures have been implemented to remove altogether the potential for unacceptable impacts. For example, through project design at the Concept Master Plan stage the conflict between clearing activities proposed in the Initial Advice Statement (IAS) and the Kuranda Tree Frog habitat were determined, and the conflict resolved by altering the development. Where impracticable to avoid potential impacts, appropriate mitigation measures have been determined to mitigate the risk. For example, water quality objectives are not being achieved under baseline conditions in the waters of the project area *i.e.* the current water quality (pre-development) does not meet the quality standards for the relevant environmental values. Historic or existing land-use practices upstream and on the project site have contributed to impacts on water quality, which is preventing the achievement of nominated water quality objectives for waters within and downstream of the project area. In practice, this circumstance means that the receiving environment has no further assimilative capacity for some water quality indicators. The most important existing impact on surface water quality is accelerated soil erosion and an increased load of total suspended solids and associated turbidity, metals and nutrients. This has important implications for the proposed management of discharges to receiving waters and has been considered in the planning of the project and the development of mitigation measures, including but not limited to Erosion and Sediment Control (ESC).

The management measures, both avoidance and mitigation, that are detailed in the preceding chapters are commitments made by the proponent and are further reported in the environmental monitoring and management plan (EMP) (Chapter 21).

19.3.4 The potential impacts on important amenities, navigation, water quality, threatened or migratory species or sensitive habitat

The project has been designed to predominantly occur in previously cleared areas of the site. Key to impact avoidance, is the proposed retention of approximately 500 ha of habitat. This habitat predominantly occurs in the western portion of the Kuranda-Myola-Kowrowa rainforest corridor, potentially a significant wildlife corridor. The overall project design aims to reduce potential project-related environmental impacts by protecting remnant vegetation, vegetation buffers along creeks and restoring vegetation where needed.

The proposed project will not have significant visual impacts (refer Chapter 6.2 and Appendix 3C) and does not include any components that could affect navigation. However, visitors to KUR-World could increase visitor numbers to the Wet Tropics rainforest cruises (Kuranda Riverboat Cruises). This 45 minutes Wet Tropics rainforest cruise departs from the riverside jetty below the Kuranda Railway Station and provides the only public navigation option in the area.

Historic or existing land-use practices upstream and on the KUR-World site have contributed to impacts on water quality (of relevance to, for example, the Kuranda Tree Frog) which is preventing the achievement of nominated Water Quality Objectives for waters within and downstream of the project area (refer to Chapter 9). This has important implications for the proposed management of discharges to receiving waters and has been considered in the planning of the project and the development of mitigation measures. Therefore, water management for KUR-World should ensure that receiving water quality progressively improves and that the project design and operation aim to have a net positive impact on water quality.

The potential impacts to surface water and groundwater from the KUR-World development include spills of hazardous chemicals, land clearing, stormwater and waste water; these are expected to be mitigated through appropriate on-site management of hazards. Other potential impacts to water quality, are addressed in section 19.4 - Great Barrier Reef World Heritage Area.

Potential impacts to Threatened flora, Threatened and Migratory fauna and their habitats are discussed in Section 19.7.

19.3.5 Consequential impacts on the Wet Tropics of Queensland World Heritage Area Outstanding Universal Value from any increased road traffic movement.

To assess the impacts of increased road traffic movement due to the construction and operation phases of the development, it is important to separate the effects of background traffic, construction traffic and operational traffic, to assess the relative impact of each. Background traffic refers to the traffic that will be present regardless of the development.

The future level of background traffic was predicted by applying a growth factor to surveyed traffic volumes. For the purpose of the traffic assessment, the growth rate of traffic within the study area was determined from a comparison of the historical traffic growth rate and forecast traffic volumes in the Cairns Strategic Transport Model (CSTM) on roads within the study area.

Historical growth rates based on historical traffic survey data for roads within the study area ranged between -3.25% and 7.5% per annum (average of 1.6% per annum), while growth rates within the CSTM ranged between 1.8 and 2.2% per annum. The average growth rate assumed for KUR-World project was therefore assumed to be two (2) percent per annum. This provides a realistic estimate of the future traffic volumes considering the historical and forecast growth rates and accounting for any expected development in the area.

The Kuranda Range is the only road that KUR-World will use that crosses some sections of the WTQWHA. Based on the data and assumptions presented previously, the daily volume of traffic on the Kuranda Range, with and without KUR-World was calculated. This calculation was based on the assumed peak hour traffic generation to determine any changes to the traffic peaks. Figure 19-9 below, shows that there are no changes to the timing of traffic peaks, with development traffic expected to increase the traffic volumes within the exiting peak periods, not changing the timing of the peak periods on the Kuranda Range. As the expected peak hour traffic generation of the development is anticipated to be consistent across all affected road links and with similar peak hours, the development is not expected to alter the occurrence of the peak periods on any affected road links.As the expected peak hour traffic generation of the development is

anticipated to be consistent across all affected road links and with similar peak hours, the development is not expected to alter the occurrence of the peak periods on any affected road links.

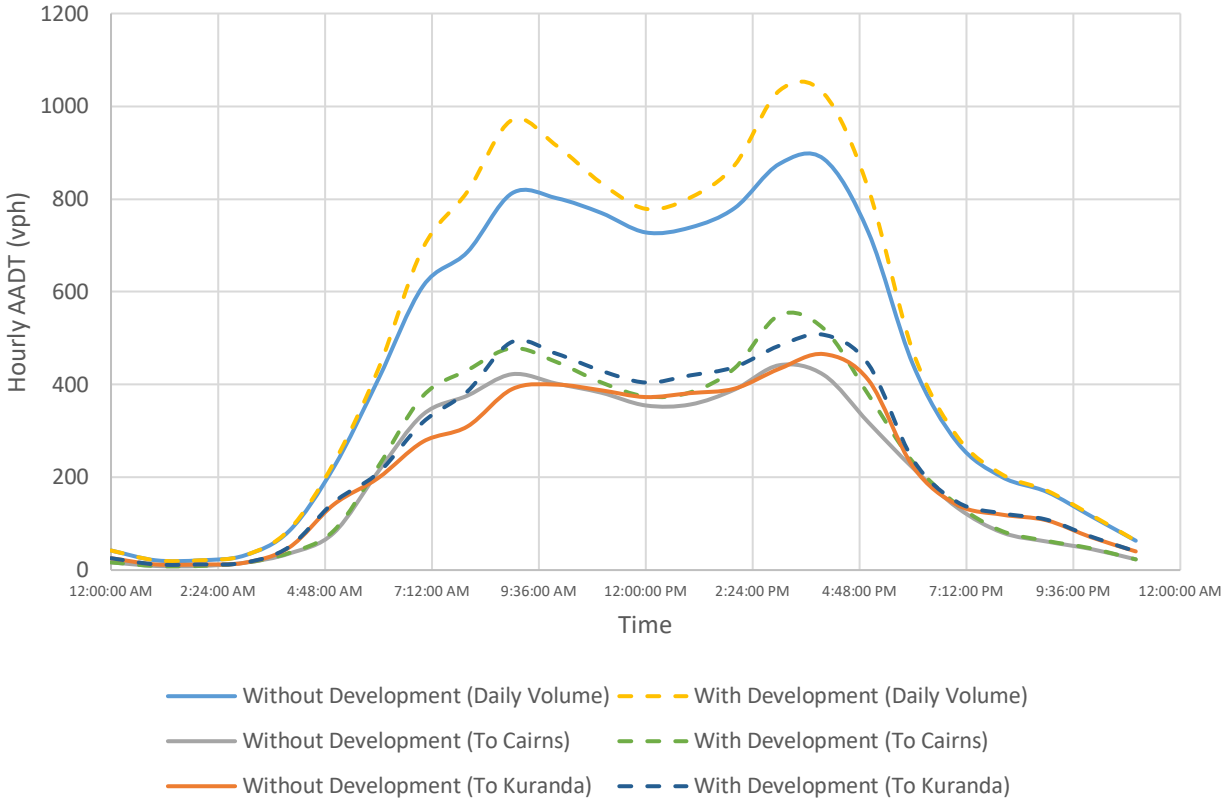


Figure 19-9: Kuranda Range Road hourly vehicle volumes with and without KUR-World (2027.)

Therefore, traffic generated by KUR-World will not significantly increase the existing impacts on the WTQWHA Kuranda Range section. Notwithstanding this outcome, the practical effect of increased traffic, irrespective of the cause of the increase, is the potential for vehicle strike to fauna. Traffic is a known cause of death and injury to fauna. Roadkill is the major cause of Cassowary mortality in the Wet Tropics area and a major threat to the species. Careful planning and design can greatly reduce the risk of fauna being killed or harmed by vehicle strike; however, a residual threat is likely to remain. Traffic management measures that apply to the Kuranda Range Road (the local name for that part of the Kennedy Highway – Cairns/Mareeba section which links the township of Smithfield on the Cairns coastal plain with Kuranda on the northern Atherton Tablelands) are not consistent with those management measures that will apply for the project site in the context of fauna management. The traffic management measures for the Kuranda Range Road are the practicable available measures.

The level of predicted increase in traffic and associated management measures within the WTQWHA resulting from the KUR-World development will not significantly impact on scenic and aesthetic values.

For the project site traffic calming measures are to be incorporated in design. Measures include though not limited to maximum speed limit of 40 km/hr in areas of designated habitat that are under the control of the proponent. A maximum 50 km/hour speed limit should apply to the access roads, though the need for further speed reductions, and speed reduction furniture, should be considered during the design phase. Roads through forest areas, notably the proposed access roads, are to be designed to minimise the barrier effects to fauna movements and to reduce the likelihood of fauna being hit by vehicles. A suitably qualified

and experienced ecologist is to be involved with the designs. All fauna groups to be considered, though specific attention is to be given to threatened stream-dwelling frogs and Southern Cassowary. Clearing widths (construction and operation) are to be kept as low as possible and strategies to reduce the impact of light and acoustic pollution, especially near streams, are to be incorporated into designs. Bridges are to be used over larger streams, and designed to permit fauna movements (including Southern Cassowary) and minimise ground disturbance.

19.3.6 Predicted impacts, management, minimisation and mitigation measurements.

The KUR-World Concept Master Layout and vision have been developed following extensive site assessments, field studies and feedback from numerous parties. The Concept Master Layout is cognisant of the site's environmental, cultural, historical and community values and all the studies conducted for the Environmental Impact Statement (EIS) have provided sufficient data to understand the current and potential impacts on the KUR-World site.

KUR-World seeks to contribute to regional sustainable development. It will therefore be developed and constructed with best practice measures and in accordance with the Urban Development Institute of Australia's Enviro-Development certification system (EnviroDevelopment & Urban Development Institute of Australia [UDIA] 2013). The six key elements for this certification are: Ecosystems, Waste, Energy, Materials, Water and Community. KUR-World will seek certification of the development during the detailed design and construction phases of the staged development. This commitment is in addition to management measures described in preceding chapters. The management measures, both avoidance and mitigation, that are detailed in the preceding chapters are commitments made by the proponent and are further reported in proponent commitments (Appendix 20) and the Environmental Monitoring and Management Plan (EMP) (Chapter 21).

19.3.7 Mitigation and management measures

19.3.7.1 Significant impact criteria for World Heritage properties

Although the KUR-World site lies outside of the WTQWHA, the proposed development has been reviewed against the Significant Impact Criteria for World Heritage Properties (DoE 2013), with particular respect to the following Biological and Ecological Values:

- *Reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property.* The project activities will be mostly restricted to historically cleared or disturbed portions (non-remnant vegetation) of the project area. These areas have low flora and fauna diversity, a high incidence of non-native flora species and exhibit existing and historical impacts from cattle and other rural activities. Proposed activities within areas featuring remnant vegetation will be small in scale.
- *Fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property.* The project activities will be largely restricted to historically cleared or disturbed portions (non-remnant vegetation) of the project area.
- *Cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property.*. Habitat is to be preserved and managed for rare, endemic or unique plant and animal populations such as the Kuranda Tree Frog (*Litoria myola*) and the Myola Palm (*Archontophoenix myolensis*) through the retention of vegetated waterway corridors and establishment of habitat buffers and conservation areas.
- *Fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property*. The proposed development footprint is predominantly in the northern portion of the project site. The project area supports forests in various states of

condition, though overall habitat integrity is moderate to high. Habitats in the northern third of the site are in poorer condition (higher predominance of weeds, more fragmented, higher edge to area ratio) relative to habitats in the south. The northern portion of the project area has been used for cattle grazing since the early to mid-20th century and remains in use for this purpose. The southern portion of the project area is dominated by remnant vegetation.

19.3.7.2 Mitigation and management measures

The different baseline studies that have been conducted to assess the current situation of the KUR-World site, evaluate potential impacts and suggest mitigation and management measures as set out below.

19.3.7.2.1 Water

The potential impacts to surface water and groundwater from the KUR-World development include spills of hazardous chemicals, land clearing, stormwater and waste water; these are expected to be mitigated through appropriate on-site management of hazards. (e.g. through a Hazardous Substances Management Plan and Environmental Management System), with spills contained and cleaned up. Potential impacts to the receiving environment will be mitigated by the capture and treatment of site waters through stormwater management Water Sensitivity Urban Design (WSUD) and a waste water treatment system.

An Erosion and Sediment Control Plan (ESCP) will be developed for construction and operation to minimise erosion and sediment loss. Nutrient loads from the Waste Water Treatment Plant (WWTP) discharge will be offset by improving water quality through mitigation measures in the catchment that receives discharge, and rehabilitation plans for improving frog habitat are expected to have a positive impact on water quality. Where on-site treatment alone is unlikely to allow direct discharge and achievement of the management intent as defined in the EPP (Water), additional mitigation measures have been proposed. Further information on impacts and mitigation and management measures are included in Mitigation and Management Measure for Fauna (below, Recommendations 9 to 14), Chapter 9 (Water Quality) and Section 19.4 (this Chapter – Great Barrier Reef World Heritage Area).

19.3.7.2.2 Flora and Fauna

Mitigation measures for Threatened flora, Threatened and Migratory fauna and their habitats are discussed in Section 19.7. The location of areas of habitat disturbance and retention are shown in Figure 19-10 below.

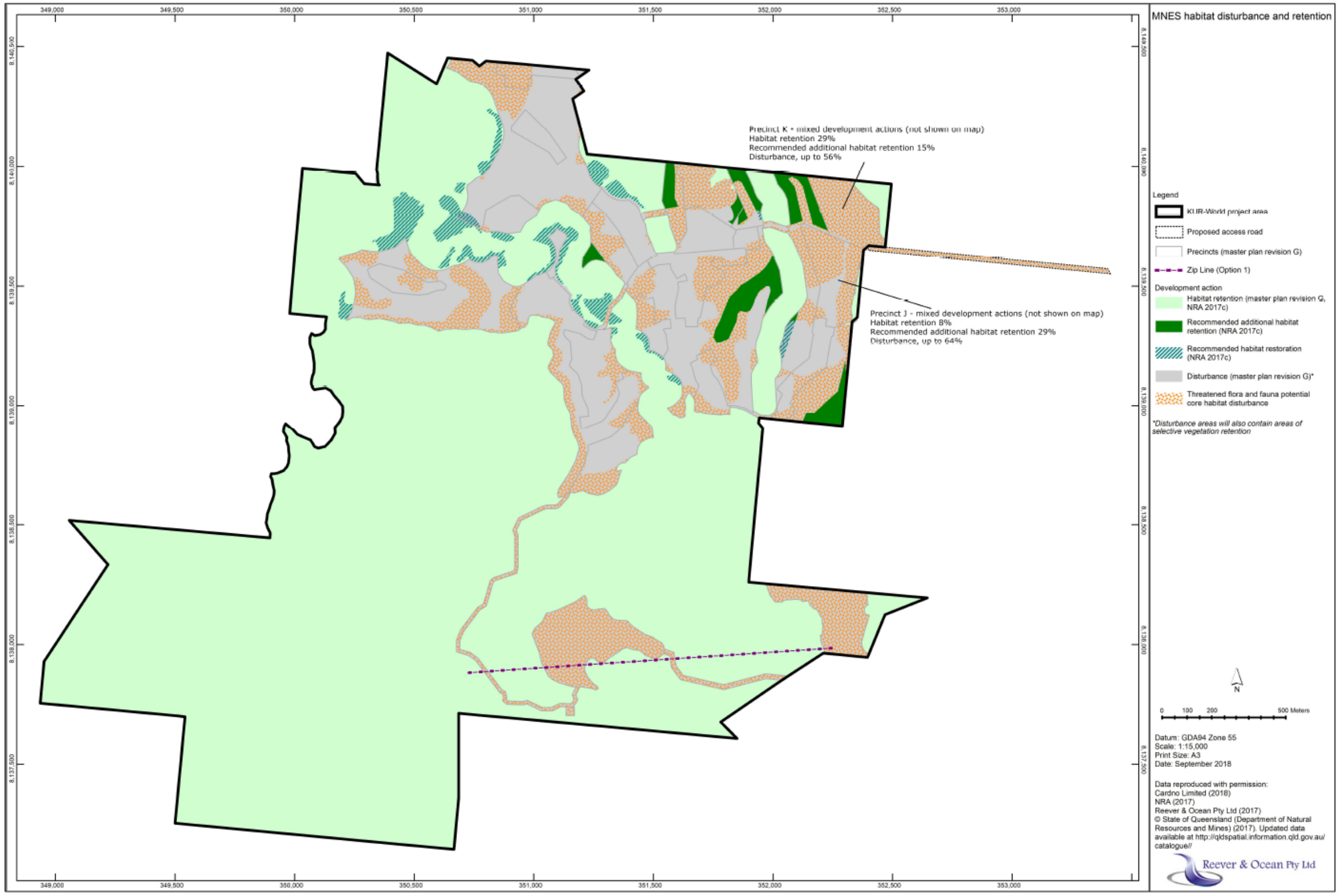


Figure 19-10: MNES habitat disturbance and retention[14].

[14] For the purposes of data analysis and technical reporting revision G, was utilised. The current (2018) master plan is Revision H, which should be considered interchangeable with revision G. With the exception of 'Glamping' being removed from the environmental area in revision H.

19.3.8 Residual impacts

19.3.8.1.1 Potential residual impacts to landscape integrity values

Given the relatively small extent of habitat loss, an SRI with respect to loss of connectivity is not anticipated. Key to avoiding an SRI is the proposed retention of approximately 500 ha of habitat in the Environmental Area (equating to approximately 74% of the project area). This habitat predominantly occurs in the western portion of the Kuranda-Myola-Kowrowa rainforest corridor (Figure 19-8), potentially a significant wildlife corridor.

19.3.8.1.2 Consistency with World Heritage Convention

Unfettered development would predictably contribute to a potential decline in values of the nearby WTQWHA and thus challenge consistency with Australia's obligations under the World Heritage Convention. Appropriate management measures have, however, been identified. Where practicable, management measures have been implemented to remove altogether the potential for unacceptable impacts. Where impracticable to avoid potential impacts, appropriate mitigation measures have been determined to mitigate the risk. The management measures, both avoidance and mitigation, that are detailed in the preceding Chapters are commitments made by the proponent and are further reported in the environmental monitoring and management plan (EMP) (Chapter 21). Given the potential impact and mitigation measures described the project is not inconsistent with Australia's obligations under the World Heritage Convention.

19.4 Great Barrier Reef World Heritage Area

The Great Barrier Reef is the largest coral reef ecosystem on Earth. At 348,000 square kilometres, the reef is one of the richest and most diverse natural ecosystems. The unique qualities of this ecosystem were recognised in 1981 when it was inscribed on the World Heritage List. The Great Barrier Reef (hereafter referred to as GBR) includes extensive cross-shelf diversity, stretching from the low water mark along the mainland coast up to 250 kilometres offshore.

This wide depth range includes vast shallow inshore areas, mid-shelf and outer reefs, and beyond the continental shelf to oceanic waters over 2,000 metres deep. Within the GBR there are some 2,500 individual reefs of varying sizes and shapes, and over 900 islands, ranging from small sandy cays to large rugged continental islands. Collectively these landscapes and seascapes provide some of the most spectacular maritime scenery in the world (DoEE 2017c).

19.4.1 Identification of characteristics, values and integrity of the sensitive area potentially to be affected

The values of the Great Barrier Reef include aquatic ecosystems, primary industries, recreation and aesthetics, and cultural and spiritual values. While there are no values associated with the GBRMP on the project area, the GBRMP is the ultimate receiving environment for drainage from the project site.
The world heritage criteria relevant to the Great Barrier Reef are:

- *Criteria (i) now (viii) — major stages of the Earth's evolutionary history* The Great Barrier Reef, extending 2300 kilometres along Queensland's coast, is a globally outstanding representation of the major stages of the Earth's evolutionary history.
- *Criteria (ii) now (ix) — ecological and biological processes.* The ecological and biological processes of the Region reflect the maturity of an ecosystem that has evolved over millennia. Globally, significant marine fauna groups include more than 4000 species of molluscs, more than 1625 species of fish, and a great diversity of sponges, anemones, marine worms, crustaceans, and many other taxonomic groups.

- *Criteria (iii) now (vii) — natural beauty and natural phenomena.* The Great Barrier Reef demonstrates superlative natural beauty above and below the water, providing spectacular scenery. It is one of a few living structures visible from space, appearing as a complex string of reefs along Australia's north-east coast.
- *Criteria (iv) now (x) — habitats for conservation of biodiversity.* The enormous size and diversity of the Region means it is one of the richest and most complex natural ecosystems on Earth, and one of the most significant for biodiversity conservation. The diversity of habitats supports tens of thousands of marine and terrestrial species, many of which are of global conservation significance (GBRMPA 2014a).

19.4.2 World heritage values

The location of the project site away from the GBRMP means that there are no values directly associated with the GBRMP within the project area.

19.4.3 Potential impacts and analysis of all phases of the project – water quality, habitat, sedimentation, erosion, impacts on other users of the area, navigation, threatened, migratory species and/or sensitive habitat

The project area is remote (8.5 km in a straight line) from the closest point of the Great Barrier Reef Marine Park (GBRMP). It will therefore not impact directly on the Great Barrier Reef World Heritage Area (GBRWHA). The project could have the potential to indirectly impact upon the GBRWHA, as all waterways within the project area drain to the Barron River and thence to the GBRWHA at Machans Beach, north of Cairns (some 25km downstream of the site). As identified in the *Reef Water Quality Protection Plan 2014*, during construction, and to a lesser degree operation, there is therefore some potential for sediments and/or pollutants to potentially be mobilised into waterways that could affect the GBR.

Water quality objectives are not being achieved under baseline conditions in the waters of the project area *i.e.* the current water quality (pre-development) does not meet the quality standards for the relevant environmental values. Historic or existing land-use practices upstream and on the project have contributed to impacts on water quality, which is preventing the achievement of nominated water quality objectives for waters within and downstream of the project area. In practice, this circumstance means that the receiving environment has no further assimilative capacity for some water quality indicators. The most important existing impact on surface water quality is accelerated soil erosion and an increased load of total suspended solids and associated turbidity, metals and nutrients. This has important implications for the proposed management of discharges to receiving waters and has been considered in the planning of the project and the development of mitigation measures, for example, the application of best practice erosion and sediment control measures.

The stormwater drainage strategy developed for the project area provides for WSUD management measures. Stormwater volumes will be managed to minimise flows and nutrient loads discharged to waterways. Stormwater discharges will be managed, where possible, to mimic pre-development discharge conditions (that is no significant net change in site run-off volume). Although the proposed WSUD meet the design objectives for stormwater quality management applicable to the Wet Tropics region, modelled stormwater discharge will exceed water quality objectives and the water quality measured in the receiving environment for some indicators. Therefore, although satisfying the design objectives for stormwater quality management applicable to the Wet Tropics region, additional ways to reduce or remove potential impacts associated with stormwater management need to be explored at the detailed design stage of the stormwater management features.

In terms of effluent management, the greatest threat posed by the proposed effluent irrigation is not due to effluent re-use but the impact of the effluent that cannot be re-used and must be disposed of. According to the modelling undertaken (refer to Chapter 9), the likelihood, nature and scale of any potential impact to surface water increases as the project develops. If effluent that is surplus to demand is disposed of in waterways on the project site, it has the potential to impact on water quality and environmental values. There are several ways to reduce or remove potential impacts associated with effluent discharge and/or stormwater management that need to be explored at the detailed design stage.

19.4.4 Assessment of impacts against relevant reports

19.4.4.1 Significant Impact Criteria for World Heritage Properties

The proposed development was reviewed against the Significant Impact Criteria for World Heritage Properties (DoE 2013), with particular respect to the following Biological and Ecological Values of the GBR:

- *Reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property.* Project activities will be restricted to the project area and the management intent is to improve water quality (i.e. Water quality objectives are not being achieved under baseline conditions in the waters of the project area i.e. the current water quality (pre-development) does not meet the quality standards for the relevant environmental values). As a result of on-site water quality mitigation measures and distance from the GBRWHA, potential impacts to the GBRWHA from water runoff from the project area are unlikely.
- *Fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property.* The project is remote from the GBRWHA and activities will be restricted to the project area. Project activities will therefore not fragment, isolate or substantially damage habitat important for the conservation of biological diversity in the GBRWHA.
- *Cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property*. The project activities will be restricted to the project area, which is remote from the GBRWHA. Project activities will therefore not cause a long-term reduction in rare, endemic or unique plant or animal populations or species in in the GBRWHA.
- *Fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property*. The project activities will be restricted to the project area, which is remote from the GBRWHA. Project activities will therefore not fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in the GBRWHA.

19.4.4.2 Great Barrier Reef Region Strategic Assessment: Strategic assessment report

GBRMPA (2014b) notes that past and present impacts on the GBR can be grouped into four broad categories:

- Climate change
- Catchment run-off
- Degradation of coastal ecosystems
- Direct use

The potential contribution of each of these categories from the proposed project is discussed below.

Climate change - The proposed project will have a negligible impact on climate change. The scope of the project is relatively small, it does not involve manufacturing processes that produce carbon dioxide and other greenhouse gases. The project aims to retain most of the native vegetation currently present on the project site while managing and rehabilitating vegetation buffers around creeks.
Catchment Run-off – The implementation of on-site mitigation designed to improve water quality avoids and/or mitigates potential impacts associated with catchment run-off.

Degradation of coastal ecosystems - As described above, the project area is remote from coastal ecosystems and coastal ecosystems impacts are unlikely.
Direct Use - As the project area is remote from coastal ecosystems, it is not expected that the project will have impacts on this category. Additional visitation by tourists to the region as a result of the development may place added pressure on the GBR, but this is considered to be negligible in terms of existing and future influences.

19.4.4.2.1 Consistency with World Heritage Convention

As reported above in regard to WTQWHA, poorly-designed and implemented development could present a risk to the GBRWHA. However, appropriate management measures have been identified as an underlying principle of the KUR-World development. The management measures, both avoidance and mitigation, that are detailed in the preceding chapters are commitments made by the proponent and are further reported in the environmental monitoring and management plan (EMP) (Chapter 21) and proponent commitments (Appendix 20). Given the proposed impact and mitigation measures, the project is not inconsistent with Australia's obligations under the World Heritage Convention.

19.4.5 Mitigation, minimisation and management measures

Although catchment run-off from project activities is likely to be negligible compared with inputs from all GBR catchments, mitigation, minimisation and management will involve standard procedures, these include:

19.4.5.1.1 Groundwater

The following management measures are required to minimise impacts to groundwater from effluent irrigation and/or stormwater management.

- Only land identified as suitable for irrigation should be used for effluent disposal.
- Appropriate buffer zones/set-backs will be applied around creeks.

19.4.5.1.2 Surface water and aquatic ecology

There are several ways to reduce or remove potential impacts associated with effluent discharge and/or stormwater management that need to be explored at the detailed design stage of the Waste Water Treatment Plan (WWTP), these include:

- Increased storage volume and irrigated land area.
- Reduced nutrient content in effluent to the lowest practicable extent.
- Reduced stormwater and effluent production:
  - water saving and efficiency measures on-site.
  - non-potable uses other than irrigation
  - irrigable land with moderate slopes (12-20%) to be managed and land condition monitored to prevent run-off and accelerated erosion.
  - stormwater infiltration into the sewerage system through appropriate design, build specification and maintenance.
- Explore options to discharge surplus WWTP water to other on-site creeks less sensitive to impacts than Owen Creek (such as Cain Creek).
- Explore options for waste water and/or effluent discharge off-site into a less sensitive or already impacted waterway (such as the current location of the Kuranda WWTP outfall or the Barron River).

Any design that includes on-site effluent discharge must be accompanied by more detailed hydrological modelling to determine the potential impact on receiving water quality.

19.4.5.1.3 Stormwater

The proposed stormwater drainage strategy for KUR-World will overlap and replace elements of the erosion and sedimentation control measures for construction and operational phases presented in Chapter 9 (Section 9.7). The stormwater drainage strategy developed for the project area (ARUP 2017) provides the following WSUD management measures:

- Run-off captured from building roofs will be conveyed to rainwater tanks for re-use, with tank overflows draining to vegetated swales. Rainwater captured in tanks will be used for toilet flushing and irrigation.
- Run-off from all other catchment areas will drain directly to grassed swales and vegetated buffers.
- Within the more intensely developed commercial/retail/educational areas, stormwater will be treated by proprietary stormwater improvement devices prior to draining to the swales.
- Road run-off will be collected in a conventional kerb and channel/pipe and pit stormwater drainage network and will be treated by proprietary stormwater improvement devices prior to draining to swales and retention basins.
- Gross Pollutant Traps will act as primary treatment for each catchment to target litter capture.
- Gross Pollutant Traps flow to swales, which flow to bio-retention basins with discharge to creeks from multiple locations across the project area.

The stormwater drainage strategy developed for the project area provides for WSUD management measures. Stormwater volumes will be managed to minimise flows and nutrient loads discharged to waterways. Stormwater discharges will be managed, where possible, to mimic pre-development discharge conditions (that is no significant net change in site run-off volume). Although the proposed WSUD meet the design objectives for stormwater quality management applicable to the Wet Tropics region, modelled stormwater discharge will exceed water quality objectives and the water quality measured in the receiving environment for some indicators. Therefore, although satisfying the design objectives for stormwater quality management applicable to the Wet Tropics region, additional ways to reduce or remove potential impacts associated with stormwater management need to be explored at the detailed design stage of the stormwater management features.

There are several ways to reduce or remove potential impacts associated with stormwater management that need to be explored at the detailed design stage of the stormwater management features.

- Offset the nutrient loads from stormwater discharge by improving water quality through environmental works in the catchment that receives discharge.
- Reduce stormwater loads by minimising stormwater generation and enhancing nutrient and suspended solids removal by amending design specifications of proposed management features or installing additional features.

Detailed design must be accompanied by more detailed hydrological modelling to determine the mitigation measures required to protect receiving water quality and aquatic ecosystems.

19.4.6 Residual impacts

The location of the project site away from the GBRMP together with a management intent to improve water quality (i.e. water quality objectives are not being achieved under baseline conditions in the waters of the project area i.e. the current water quality (pre-development) does not meet the quality standards for the relevant environmental values) mean an impact to the GBRMP is unlikely.

19.5 Wet Tropics of Queensland National Heritage Place

The project boundary is located two kilometres west and south of the Wet Tropics of Queensland National Heritage Place (WTQNHP). The WTQNHP covers approximately 894,420 ha along the north-east coast of Queensland extending from just south of Cooktown to just north of Townsville. The Wet Tropics of Queensland was inscribed on the World Heritage List in recognition of its outstanding natural universal values:

- As an outstanding example representing the major stages in the earth's evolutionary history.
- As an outstanding example representing significant ongoing ecological and biological processes.
- As an example of superlative natural phenomena.
- Containing important and significant habitats for *in situ* conservation of biological diversity. (DoEE 2017d).

On 9 November 2012, the Wet Tropics World Heritage Area's Indigenous heritage values were included as part of the existing Wet Tropics of Queensland National Heritage Listing. The listing identifies Rainforest Aboriginal heritage as unique to the Wet Tropics and as a remarkable and continuous Indigenous connection with a tropical rainforest environment. The listing recognises that:

> "The Aboriginal Rainforest People of the Wet Tropics of Queensland have lived continuously in the rainforest environment for at least 5000 years and this is the only place in Australia where Aboriginal people have permanently inhabited a tropical rainforest environment. The distinctiveness of the traditions and technical innovation and expertise needed to process and prepare toxic plants as food and their uses of fire is of outstanding heritage value to the nation and are now protected for future generations under national environmental law (Department of the Environment and Energy, n. d.)"

The National Heritage listing criteria were:

- Criterion A Events and Processes (meets World Heritage criteria (vii), (ix) and (x))
- Criterion B Rarity (meets World Heritage criteria (x))
- Criterion C Research (meets World Heritage criteria (viii), (ix) and (x))
- Criterion D Principal characteristics of a class of places (meets World Heritage criteria (viii) and (ix))
- Criterion E Aesthetic characteristics (meets World Heritage criteria (vii))
- Criterion F Creative or Technical Achievement (The technical achievements that allowed rainforest Aboriginal people to utilise toxic plants are of outstanding heritage value to the nation)
- Criterion I Indigenous tradition (Traditions established by creation beings about the toxicity of plants and the techniques used to process toxic plants are unusual in an Australian context and are of outstanding heritage value to the nation) (DoEE 2017d).

19.5.1 Identification of characteristics, values and integrity of the sensitive area potentially to be affected

The project area features characteristics of the WTQNHP, including similar processes that have shaped the rainforest and woodland communities and the use of the forest by Aboriginal people. However, in its own right, the project site does not represent outstanding examples of the abovementioned values, due to historical disturbance.

Nonetheless, the land on which the KUR-World development is proposed is part of a broad cultural landscape that includes significant story places, campsites, plants and animals. Significant story places include those relating to the mythological travels of *Budadji*, the carpet snake and *Boondarah*, the

cassowary. Waterways and Aboriginal walking tracks in the project area are particularly significant according to local Aboriginal tradition.

Surveys undertaken reveal a 'hot spot' for occupation that was possibly a campsite and walking tracks that align with those identified in previous research. Surveys have also located eleven portable nut cracking rocks, a top stone/pounder, an axe blank and five quartz flakes in the project area (For details see chapter 17.1 and Appendix 15).

Bama are the rainforest Aboriginal people that occupied the Wet Tropics from Cooktown to Cardwell (Bottoms 1999). Prior to 1873, and the arrival of Europeans, *Bama* lived in tightly bound linguistic estates that typically incorporated coastal, riverine and tableland environments. *Bama* enjoyed a rich social and ceremonial life, centred around regular *boras* or *pruns* where groups would come together for feasting, socialising and to settle disputes. *Bama* maintained walking tracks which connected campsites, *boras* (pockets), resource collection sites and story places (Bottoms 1999; McCracken 1989).

The initial introduction of mining and pastoral activities in the region, and the large influx of European and Chinese that accompanied these activities, was a major disruption to *Bama* lifestyle.

The Djabugay-Yidinji-Gunggandji languages were spoken on the central Wet Tropics area, from around Port Douglas to Babinda. Within each of the three languages were clan groups, each with its own dialect. Djabugay[15], Yidinji and Gunggandji share common story-law and patterns of social structure (Bottoms 1999:11; Dixon 2009). For example, Djabugay, Bulway, Yirrgayndji, Yidinji, Ngadjon-ji and Gunggandji all had a social structure made up of two moieties. Each person was classified into one of the moieties, and could only marry an opposite moiety. These moieties were established and maintained through *Bulerru*, which translated means 'the Story Waters'. This is the local equivalent of what in other Aboriginal societies is known as the dreamtime. *Bulerru* were the laws and protocols which governed the traditional societies which all members of the society were obligated to follow.

In the Cairns region, the moieties were represented by two brothers, *Damarri* and *Guyula*, who were responsible for creating the landscape and establishing law. *Damarri* represents the *Gura-bana* moiety (*bana* means water) and *Guyala* the *Gura-minya* moiety, the dry season (*minya* means meat). According to oral history, *Guyala* wanted to make things easy for the people, providing meat for hunting and a comfortable climate while *Damarri* thought people should work hard and so made the rainforest seeds that were toxic, requiring extensive treatment before they could be eaten, and brought the summer rains and storms (Bottoms 2015). Through the stories, conflict between the brothers established a dual system of wet/dry seasons, plant/animal food and potential marriage partners.

In the past, *Bulerru* was integrated into every aspect of the lives of *Bama* in the Kuranda district and these stories continue to be a significant component of the living cultural landscape in the Cairns-Kuranda region.

Low level occupation of rainforest environments from 7,500 years ago was recorded on the Atherton Tablelands, coinciding with the expansion of rainforest species from dominant eucalyptus species, as indicated by pollen core analysis (Cosgrove 2005:50). Cosgrove (2005:53) links permanent settlement to the development of technology for treating toxic nuts, such as black bean (*Castanospermum australe*), cycad (*Lepidozamia hopei*) and particularly yellow walnut (*Beilschmiedia bancroftii*), which formed a staple of Rainforest Peoples' diet in the last 1,800 years.

Cosgrove *et al.* (2007:158) identify four phases of rainforest occupation:

- Occasional use during the late Holocene around 8000 BP, as seen in a low rate of discard of cultural material, coinciding with initial rainforest expansion.
- A hiatus observed from the late to mid Holocene, with reoccupation around 3300 BP.
- Low activity levels from 3300-2100 BP.
- Extremely elevated levels of activity associated with the appearance of incised grindstones, seed fragments and charcoal from 2000 BP to present.

The archaeological evidence suggests that the Wet Tropics was permanently settled in the last 1800 years. Table 19-3 below, contains a summary of post-contact Aboriginal use of the Kuranda/Myola areas.

Table 19-3: Summary of post-contact Aboriginal use of the Kuranda/Myola area.

Date	Post contact Aboriginal use of area
Late 1870s	Europeans using *Bama* walking tracks between the coast and Hodgkinson goldfield (e.g. Smith's track and Douglas Track).
1885	European settlement of the Kuranda district.
1886	Construction of the railway from Cairns. Native Police active in the Kuranda district. Railway follows Aboriginal walking track above the Barron Falls.
1888	Kuranda established. European settlement of Clohesy River. Native Police active.
1891	Aboriginal camp at Myola in use, corroboree observed there (Bottoms 1999:42).
1913	Mona Mona Mission opens, populated by local and non-local Aboriginal people.
1916	Some *Bama* continued living outside Mona Mona Mission. Tindale documents corrobboree in 1938 (Bottoms 1999:68).
1962	Mona Mona Mission closes, residents move to Mantaka, Kowowra, Oak Forest, Kuranda, Koah and elsewhere.

Despite historical disturbances on traditions and ways of life, The Wet Tropics region continues to hold great significance for local Aboriginal communities, who identify as 'Rainforest People'. Aboriginal traditional law and custom provides a conceptual framework that underpins the Rainforest Aboriginal People's technical achievement in processing toxic plants. These traditions describe the characteristics of plants and how to process them. Examples of traditions about the creation beings and toxic plants include the Kuku-Yalanji traditions about *Kubirri* and about the two sisters; the Djabugay-Yidinji-Gunggandji tradition about *Damarri* and *Guyala*; and the tradition about *Girugarr* (the eel man) from the southern region of the Wet Tropics. Parts of these stories are inscribed in the landscape of the Wet Tropics as land features or paths formed by the creation beings.

To assess cultural indigenous heritage on-site, A cultural heritage site listed on the database that is within the proposed development area was lodged with the Department of Aboriginal and Torres Strait Islander Protection (DATSIP) cultural heritage database in August 2016 (with reference number FN-0001). The database entry, centred on GPS coordinates 351033, 8139968 (UTM 55K) describes walking tracks, camp sites and the effects of the Mona Mona Mission.

Of note to the KUR-World site is:

- The number of pockets, identified in the FN-0001 site. One is on the Barnwell Homestead site and another is located to the north-east of the project site (i.e. current veterinary property).

- Access to water including creek access and permanent springs.
- Two walking tracks identified on a map created by Bottoms (1990). One of these crosses the project site from north to south, the other crosses the southeast corner of the property.

The DATSIP site record indicates the area that includes the project site is a rich Aboriginal cultural landscape.

Walking tracks are significant because they guided access through the dense impenetrable rainforest and linked campsites, pockets and resources as well as providing links between coastal and tableland resources and into neighbouring estates. Tracks through the Barron Gorge and Freshwater Creek (Crystal Creek) linked Tablelands and coastal Djabugay speakers (Buhrich & Djabugay Tribal Aboriginal Corporation 2009). Rainforest walking tracks had a key role in linking traditional land-holding estates, sites and resources in the often-impenetrable rainforest.

Surveys on the project site to locate important cultural heritage sites were conducted with two groups. The first group conducted ground surveys over previously cleared areas. The second group had a tour of the environmentally sensitive areas.

Nut cracking rocks were the primary site type located, most of which were portable stones with circular pits used for holding round nuts for cracking. Two nut cracking processing sites were recorded in creek beds, these were made by rocks that formed the creek bed with large numbers of circular pits used for cracking rocks. Processing sites also include edible and medicinal plants and running water possibly used for leaching. The cultural and environmental health of the broad environment were both identified as highly significant to the Aboriginal party, markers to identify cultural and environmental health were also noted.

The locations of the sites recorded during surveys are presented in Figure 19-11 below.

Individual sites were recorded. These consisted of:

- 11 portable nut cracking rocks;
- 5 quartz flakes associated with portable nut cracking rocks;
- 2 nut cracking holes in the creek bed;
- 1 axe blank; and
- 1 circular top stone/pestle.

For details on individual artefacts refer to the complete Aboriginal Cultural Heritage Assessment (Appendix 15).

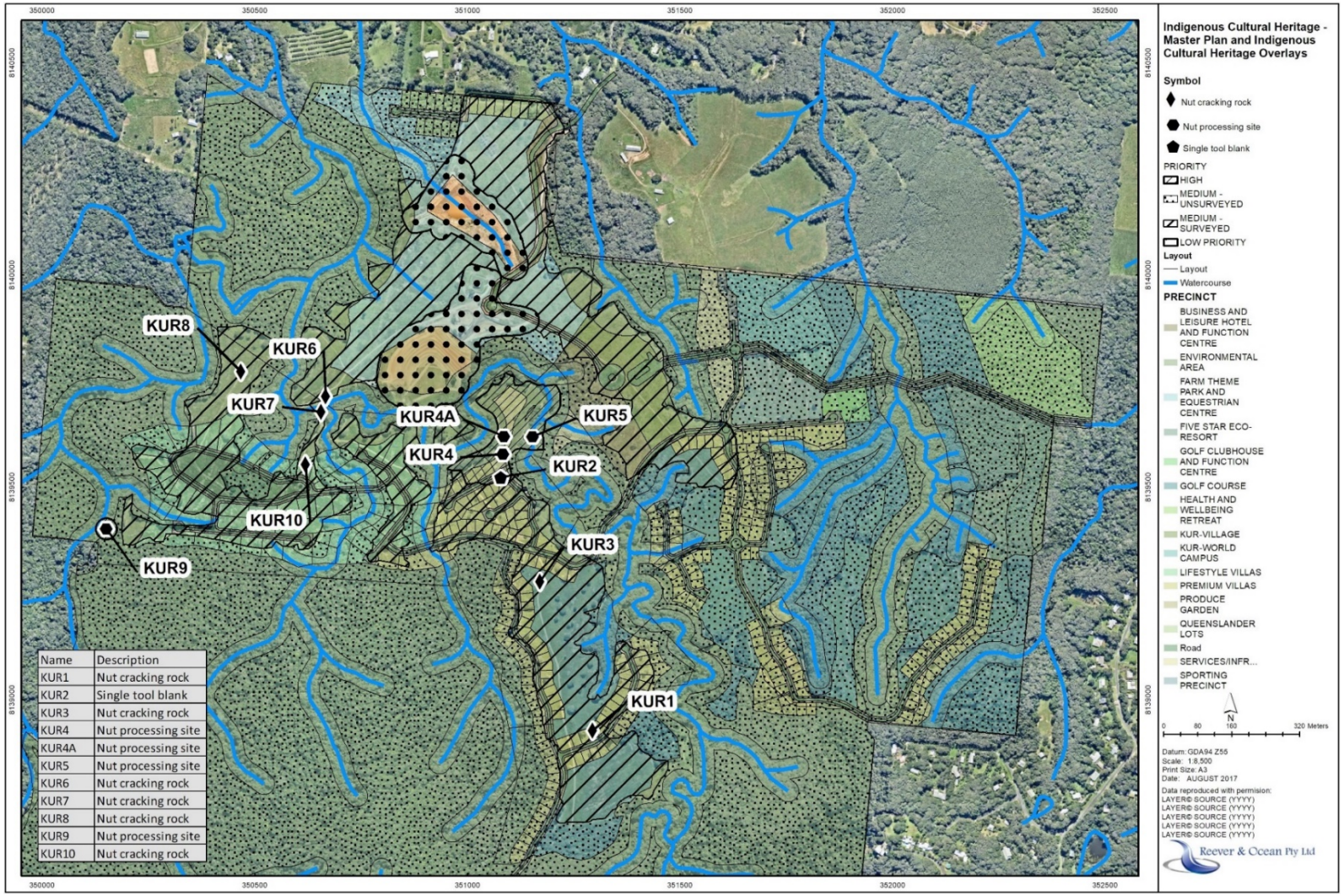


Figure 19-11: Aboriginal Cultural Heritage sites recorded during surveys and high, medium and low priority areas for cultural heritage.[16]

[16] For the purposes of data analysis and technical reporting revision G, was utilised. The current (2018) master plan is Revision H, which should be considered interchangeable with revision G. With the exception of 'Glamping' being removed from the environmental area in revision H.

19.5.2 Potential impacts and analysis of all phases of the project

Although located outside the boundary of the WTQNHP the project area features characteristics of the WTQNHP. However, in its own right the project site does not represent outstanding examples of the above-mentioned values due to historical disturbance. Therefore, no significant impacts to the WTQNHP are expected.

Nevertheless, the project site should be recognised as part of the living cultural landscape that includes significant story places, campsites, plants and animals. To achieve this, high, medium and low priority areas for cultural heritage have been identified; for each category, different recommendations have been made (refer map 19-9).

- Low Priority Areas: these are places where there has been extensive land disturbance and the presence of cultural heritage material is unlikely. One low priority area has been identified. It includes the homestead, dam and produce garden. Extensive ground disturbance in this area means it is unlikely that Aboriginal cultural material remains.
- Medium Priority Areas: these are places that have had some level of disturbance, usually in association with the past pastoral and agricultural activities. Aboriginal stone tools were found on medium-priority areas during ground surveys; which suggests that Aboriginal cultural heritage remains despite disturbance such as the removal of vegetation and grazing. As shown in Figure 19-11 most of the paddocks in the northern part of the KUR World site are considered of medium potential for Aboriginal cultural heritage. There is the potential for Aboriginal cultural material to be located under the surface in these areas. Monitoring of future ground disturbance is recommended.
- High Priority Areas: these are the 'hotspots' identified during ground surveys and areas where there have been no pre-construction surveys. High priority areas include:
    1. The unsurveyed southern section of the KUR-World site. Ground surveys should be completed prior to construction and advice taken from the Aboriginal party on how to protect the cultural heritage values identified in this area.
    2. All creeks and natural water bodies. These are linked to Gudju Gudju/Budadji and form a significant component of the Aboriginal cultural landscape.
    3. The possible camp site identified during ground surveys (incorporating KUR 2, 4, 4A, 5). If impacts to this area cannot be avoided, salvage excavations are recommended to locate and collect sub-surface archaeology deposits prior to construction.
    4. A nut cracking site on Owen Creek (KUR 9). This site should be managed in consultation with the Aboriginal parties.

In addition to the recommended cultural heritage protection measures, several ancillary issues were raised during visits. Consideration should be given to:

- Facilitating the provision of timber to local Aboriginal artists for artefact production.
- Conducting a skills audit of local Aboriginal people and providing a mechanism for local Aboriginal people to apply for contracts during the management, construction and maintenance phases of the project.
- Encouraging partnerships between local Landcare groups and the Aboriginal party in environmental restoration.

The Cultural Heritage Management Plan provides guidelines to avoid and/or mitigate any potential impacts to Aboriginal Cultural Heritage.

19.5.3 Indigenous community consultation

The Indigenous cultural heritage assessment was carried out in two parts. The cultural heritage study was conducted through consultation and site inspections with the Aboriginal party and is documented in chapter 17.1. The aim of the cultural heritage study was the production of a Cultural Heritage Management Plan (CHMP), developed with the Aboriginal party that creates a plan to minimise any potential harm to Aboriginal cultural heritage.

A separate process, consisting of interviews with the broader Aboriginal communities, including residents of nearby Aboriginal townships, Mantaka and Kowowra, contributed to the social impact assessment. This is documented in the Social Issues Paper (Appendix 16).

Buda-dji Aboriginal Development Association is part of a group of Corporations, collectively referred to as the Djabugay Aboriginal Corporations (DAC). DAC works across a wide range of areas including, Community Development, Native Title, Land Management, business, and economic development. These corporations share the same board and governance structure. Within DAC, Buda-dii Aboriginal Development Association Aboriginal Corporation is the administrative centre. Buda-dji undertook a sub-consultancy to facilitate meetings with the broader Kuranda Aboriginal community. Buda-dji Senior Project Officer Barry J Hunter assisted with preparing and organising the interviews and hired two local Kuranda Aboriginal women to assist with the interviews; Shiela Brim and Maria Grauner. Before the interviews took place, the Buda-dji staff undertook consultation and facilitation of meetings to discuss the KUR-World EIS with the local Aboriginal Kuranda community. This included the identification, liaison, consultation, and provision of cultural advice for discussions with the Djabugay speaking clan groups and broader Kuranda Indigenous Community.

An information package about the interview process was prepared by Hunter and his team, and a list of potential people to interview was put together. Deciding who should be approached for an interview was based on several things including: age, gender, locality, knowledge about the KUR-World project and the project site, and being prepared to share information and concerns. Shiela and Maria spent two days approaching Djabugay descendants now residing in the Mantaka, Kowrowa, Kuranda and Koah townships and created a short-list of people to follow up for an interview. During these initial meetings, people were provided with a KUR-World fact sheet and an opportunity to air any concerns they may have before the interview. A list of people selected to be interviewed and their individual concerns about the project was presented at a pre-start meeting on the first day of interviews, held at the DTAC office in Kuranda Village. This preparatory work by Shiela and Maria guaranteed that the interviews went smoothly, prepared people with information about the interview process, and provided them with some time to think about what concerns or issues they would like to talk about in the interviews.

Informal interviews were carried out with a small number of members from the Aboriginal communities with the aim to identify potential impacts on the broader affected Indigenous communities. The interviews were constructed around cultural mapping methodology, using visual materials such as aerial photographs of the property, the KUR-World Master Plan (dated March 2017), historical maps from the late 19th century, and photographs of artefacts and cultural sites on the property taken during the cultural heritage survey. These visual aids facilitated discussions about the project and the development site and the potential social impacts it could have on local Aboriginal communities and the surrounding environment. Participants also shared information about any known Aboriginal cultural heritage within the project area (For details on Indigenous heritage, methodology and results, refer to Chapter 17.1 and Appendix 16, for details on the consultation process, refer to Chapter 11 and Appendix 9).

19.5.4 Mitigation and management measures

Although located outside the boundary of the WTQNHP the project area features characteristics of the WTQNHP. In its own right the project site does not represent outstanding examples of the WTQNHP values due to historical disturbance. Therefore, no significant impacts to the WTQNHP are expected. Nonetheless, a Cultural Heritage Management Plant (CHMP) has been developed to manage activities, avoid harm to Aboriginal Cultural Heritage; and to manage all identified and as yet unidentified Aboriginal Cultural Heritage within the Project area.

Mitigation and management measures include:

- Pedestrian surveys will be conducted in all previously unsurveyed areas of the northern project area prior to construction.
- Analysis of stone artefacts and other cultural materials will be undertaken according to best professional practice. All stone artefacts which the Aboriginal (Endorsed) Party wish to document will be catalogued, recorded and analysed.
- Development areas should be monitored by the Aboriginal (Endorsed) Parties during ground disturbance in low, medium and high priority areas in accordance with a Detailed Works Program prior to any further disturbance. The depth of monitoring should be between 300mm (for lower priority areas) and 600mm (for higher priority areas) with the relevant areas to be negotiated between both parties prior to ground breaking activities.
- KUR-World must ensure that all of its Key Employees and Principal Contractors performing Activities have been given appropriate information through an Aboriginal Cultural Heritage awareness induction program to:
    1. Promote knowledge, understanding and respect for the traditions and culture of the Aboriginal (Endorsed) Parties, the nature of the Aboriginal Cultural Heritage in the CHMP Area and the relationship between the Aboriginal (Endorsed) Parties, the Aboriginal Cultural Heritage and the traditional lands.
    2. Create familiarity with the obligations of KUR-World under relevant State and Commonwealth legislation regarding Aboriginal Cultural Heritage.
    3. Foster good relations with the Endorsed Parties and the Endorsed Parties Personnel.

19.5.5 Residual impacts

The project site does not represent outstanding examples of the WTQNHP values due to historical disturbance. The implementation of the Cultural Heritage Management Plan will avoid and/or mitigate any impacts; therefore, no residual impacts to the WTQNHP are expected.

19.6 Great Barrier Reef National Heritage Place

In 1981, the Great Barrier Reef became Queensland's first World Heritage Area. In May 2007, the Great Barrier Reef was placed on the National Heritage List. The National Heritage List is Australia's list of natural, historic and Indigenous places of outstanding significance to the nation. The Great Barrier Reef was deemed to meet the criteria for inclusion on the National Heritage List based upon its World Heritage listing criteria (DoEE 2017e). The National Heritage listing criteria were:

- Criterion A Events and Processes
- Criterion B Rarity
- Criterion C Research
- Criterion D Principal characteristics of a class of places
- Criterion E Aesthetic characteristics.

The values of the Great Barrier Reef National Heritage Place (GBRNHP) are as for the Great Barrier Reef World Heritage Area (Section 19.4).

19.6.1 Identification of characteristics, values and integrity of the sensitive area potentially to be affected

The values of the Great Barrier Reef include aquatic ecosystems, primary industries, recreation and aesthetics, and cultural and spiritual values. There are no values associated with the GBRNHP found on the project area. The GBRNHP is the receiving environment for drainage from the site, however the relevant catchment area is small compared to the overall Barron River catchment. Since most of the Barron River catchment is highly altered, and the Barron River possesses relatively low water quality it would be expected that any events on-site would impact negligibly upon the GBRNHP.

19.6.2 National Heritage values

The values of the Great Barrier Reef include aquatic ecosystems, primary industries, recreation and aesthetics, and cultural and spiritual values. There are no national heritage values associated with the GBRNHP found on the project area.

19.6.3 Potential impacts and analysis of all phases of the project

The project area is remote (8.5 km) from the closest point of the GBRNHP, and some 25 kilometres (approx.) downstream. KUR-World has a low potential to indirectly impact upon the GBRNHP as all waterways within the project area drain to the Barron River and thence to the GBRNHP at Machans Beach, north of Cairns.

During construction, and to a lesser degree operation, there is the potential for sediments and/or pollutants to be mobilised into waterways on site. Given that the relevant catchment area is small compared to the overall Barron River catchment, which is highly altered, and that the Barron River possesses relatively low water quality it would be expected that any events on-site would impact negligibly upon the GBRNHP.

19.6.4 Mitigation and management measures

Site environmental management will include measures to minimise opportunities for transport of sediment and/or pollutants offsite. These will be detailed within the Erosion and Sediment Control Plan (ESCP) for the site developed for the construction and operation phases of the project, at the detailed design stage of the project.
Some mitigation measures to reduce and/or remove potential impacts associated with effluent discharge and/or stormwater management that need to be explored at the detailed design stage of the Waste Water Treatment Plan (WWTP) include:

- Offset the nutrient loads from stormwater discharge by improving water quality through environmental works in the catchment that receives discharge.
- Reduce stormwater loads by minimising stormwater generation and enhancing nutrient and suspended solids removal by amending design specifications of proposed management features or installing additional features.
- Increase storage volume and irrigated land area.
- Reduce nutrient content in effluent to the lowest practicable extent.
- Reduce stormwater and effluent production:
  - use water saving and efficiency measures on-site.
  - identify non-potable uses other than irrigation.
  - irrigable land with moderate slopes (12-20%) should be managed and land condition monitored to prevent run-off and accelerated erosion.

  - reduce stormwater infiltration into the sewerage system through appropriate design, build specification and maintenance.

- Explore options to discharge surplus WWTP water to other on-site creeks less sensitive to impacts than Owen Creek (such as Cain Creek).
- Explore options for waste water and/or effluent discharge off-site into a less sensitive or already impacted waterway (such as the current location of the Kuranda WWTP outfall or the Barron River).

Any design that includes on-site effluent discharge must be accompanied by more detailed hydrological modelling to determine the potential impact on receiving water quality. For further details refer to Chapter 9 (Water Quality).

19.6.5 Residual impact

The location of the project site and on-site water quality measures, together with a management intent to improve water quality (i.e. water quality objectives are not being achieved under baseline conditions in the waters of the project area i.e. the current water quality (pre-development) does not meet the quality standards for the relevant environmental values) mean an impact is unlikely.

19.7 Impacts upon Threatened species and Ecological Communities

This section describes the potential impacts upon threatened species and ecological communities present on the KUR-World site. The assessment of potential impacts of KUR-World on World Heritage values, National Heritage values, threatened species and communities and the Great Barrier Reef was undertaken in accordance with the Significant Impact Guidelines 1.1 Matters of National Environmental Significance and other guidelines issued by UNESCO, the Wet Tropics and/or Great Barrier Reef Marine Park Authorities.

19.7.1.1 Listed Threatened species, Ecological Communities and Migratory species

Listed Threatened Species, Ecological Communities and Migratory Species are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10km search radius from the centre point of the search area. As these values are described in detail within Chapter 8 of the EIS, and within the Flora and Fauna and Biosecurity Technical Reports (Appendix 5 and Chapter 16) of the EIS), a brief summary is presented below.

19.7.1.2 Listed Threatened species

Fifty (50) Threatened species (or their habitat) are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10 km search radius from the centre point of the search area. Of these, 23 are flora species and 27 are fauna species.

19.7.1.3 Flora

One Endangered flora species of national significance was identified within the project area. The location of the species and potential core habitat is presented on Figure 19-2. Details of the species identified within the project area are provided below.

- Myola Palm (*Archontophoenix myolensis*) (NC Act and EPBC Act Endangered). All of the *Archontophoenix* plants found in the project area were either young plants or plants not in flower. This circumstance precludes definitive identification to species level. However, all potential specimens are being treated as Myola Palm. Palms tentatively identified as Myola Palms are shown on Figure 19-2. All were recorded along drainage lines, the species' preferred habitat, all of which are to be retained as 'buffers' within the development.

Database searches identified the potential presence of other plant species of national significance within the project area. The likely presence of these species on the project site was assessed using information obtained during the desk-based review and field surveys. The results of this assessment are provided in Appendix 5, Section 4.2.4 and summarised below.

- Probable occurrence (potentially suitable habitat present though species not recorded despite targeted searches):
  - Endlicher's Filmy Fern (*Polyphlebium endlicherianum*) (EPBC Act Endangered)
  - Smooth-bark Rose Apple (*Syzygium hodgkinsoniae*) (EPBC Act Vulnerable)
  - Velvet Jewel Orchid (*Zeuxine polygonoides Syn, Rhomboda polygonoides*) (EPBC Act Vulnerable).

- Possible occurrence (possibly suitable habitat present though species not recorded):
  - Rat's Tail Tassel-fern (*Phlegmariurus filiformis*) (EPBC Act Endangered)
  - *Cajanus mareebensis* (EPBC Act Endangered).

19.7.1.4 Fauna

Five threatened fauna species of national significance were recorded during the field surveys. The observed location of these species and the verified or potential core habitat within the project area are presented in Figure 19-3 to Figure 19-6. A list of the recorded threatened fauna species and their legislative status is listed below.

- Kuranda Tree Frog (*Litoria myola*). Endangered EPBC Act.
- Gouldian Finch (*Erythrura gouldiae*). Endangered EPBC Act[17].
- Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus*). Vulnerable EPBC Act.
- Greater Large-eared Horseshoe Bat (*Rhinolophus philippinensis*). Vulnerable EPBC Act.
- Spectacled Flying-fox (*Pteropus conspicillatus*). Vulnerable EPBC Act.

A list of the threatened fauna species not recorded during field surveys though identified in the database search areas is provided in Appendix 5 (refer to Table 11). The likelihood of these species occurring on the project area was assessed taking into account published information about the ecology and distribution of each species, habitat types and conditions observed on-site. Based on this assessment, 12 species may occur on the project area and one species is likely to occur on the project area; these species and their legislative status are listed below.

- Likely to occur.
  - Southern Cassowary (southern population) (*Casuarius casuarius johnsonii*). Endangered NC Act and EPBC Act.
- May occur.
  - Australian Lacelid (*Litoria dayi*). Endangered EPBC Act.
  - Northern Bettong (*Bettongia tropica*). Endangered EPBC Act.
  - Northern Quoll (*Dasyurus hallucatus*). Endangered EPBC Act.
  - Red Goshawk (*Erythrotriorchis radiatus*). Vulnerable EPBC Act.
  - Semon's Leaf-nosed Bat (*Hipposideros semoni*). Vulnerable EPBC Act.
  - Masked Owl (northern) (*Tyto novaehollandiae Kimberli*). Vulnerable EPBC Act.
  - Greater Glider (*Petauroides Volans*). Vulnerable EPBC Act.
  - Ghost Bat (*Macroderma gigas*). Vulnerable EPBC Act.

[17] *Unlikely vagrant or aviary escapee. Viable habitat for the species does not occur on the project area.*

19.7.1.5 Listed Ecological Communities

The EPBC Protected Matters Search Tool Report indicates the potential presence of the listed Threatened Ecological Community (TEC) Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland. However, this TEC is not present within the project area.

19.7.1.6 Listed Migratory species

Twenty-two listed Migratory species (or their habitat) are reported by the EPBC Act Protected Matters Search Tool as known to occur, likely to occur or may occur within the 10km search radius from the centre point of the search area. Further database searchers returned a total of 35 Migratory-listed fauna, of these species, the Spectacled Monarch and the Rufous Fantail were recorded in the project area during the baseline surveys. Both species are relatively common locally and regionally. The Spectacled Monarch is likely to maintain a permanent or frequent presence on the project area, whereas the Rufous Fantail is a passage migrant and more likely to occur in the cooler months.

The majority of the remaining species are coastal or wetland species that are unlikely to occur on the project area due to the absence of suitable habitat. Migratory species that may, or are likely to, occur are described below, and further discussion is presented in Appendix 5 (refer to Section 4.3.2).

- Likely to occur.
  - White-throated Needletail (*Hirundapus caudacutus*).
  - Fork-tailed Swift (*Apus pacificus*).
  - Black-faced Monarch (*Monarcha melanopsis*).
- May occur.
  - Oriental Cuckoo (*Cuculus optatus*).
  - Barn Swallow (*Hirundo rustica*).
  - Eastern Osprey (*Pandion cristatus*).
  - Glossy Ibis (*Plegadis falcinellus*).

The project area may occasionally, and temporarily, support ecologically significant proportions of White-throated Needletail and Fork-tailed Swift populations based on national threshold values described in DoE (2015). There are insufficient data to assess the likelihood of the project area supporting ecologically significant proportions of the other Migratory species listed above. Based on the 2017 survey results, and the observed conditions on-site, the project area is probably unlikely to support ecologically significant proportions of other Migratory species. The possible exception is the Spectacled Monarch which may at times come close to the national threshold values described in DoE (2015).

19.7.2 Flora methods

19.7.2.1 Desk-based reviews

The results of the desk-based reviews informed the design of the field surveys and predictions regarding the presence of potential species. The primary sources consulted were:

i. Databases:
   - EPBC Act Protected Matters Search Tool (DoEE 2017a). An EPBC Act Protected Matters Report was generated for the area within a 10km radius of point -16.8306, 145.6032 (refer to Appendix 5).
   - EHP Wildlife Online database (DEHP 2017). A report was generated for the area (parameters as above, refer to Appendix 5).
   - Atlas of Living Australia search (ALA 2017). Review of specific species records and a database search within a 5 km radius of point -16.8306, 145.6032 (refer to Appendix 5).

ii. Regional Ecosystem (RE) mapping (Version 8.0, DNRM 2017a) and Qld VM Act Regulated Vegetation mapping (DNRM 2017b).

iii. Qld NC Act Protected Plants Flora Survey Trigger Maps (EHP 2016, refer Appendix 5).
iv. Detailed surface geology – Queensland (DNRM 2011).
v. Matters of Qld State Environmental Significance Environmental Report (EHP 2017b, refer Appendix 5) for a 2 km search area radius around point -16.8306, 145.6032.
vi. Reports relevant to flora values of the project area: Astrebla (2015a-b) and Hoskin (2016-2017) (refer Appendix 5).
vii. Aerial imagery available via Google Earth and Queensland Globe[18] and QIMagery[19].

19.7.2.2 Field surveys

Field surveys were conducted over multiple mobilisations. The initial surveys were conducted between 18 and 22 January 2017. After reviewing preliminary results and identifying data deficiencies follow up surveys took place (May and September 2017). Approximately 14 days were devoted to field flora surveys.

In order to verify the Regional Ecosystem mapping across the project area, 19 secondary and 29 quaternary vegetation assessments were used following the method of Neldner *et al.* (2017). Field surveys were designed to ensure time was spent searching in all identifiable vegetation types, and the range of conditions in which each vegetation type occurred. Specific effort was devoted to searchers for Threatened species.

Searches for non-native plant species included locations that have a higher probability of harbouring weed species (i.e. waterways, tracks, forest/pasture edges, etc.).

19.7.3 Fauna methods

19.7.3.1 Desk-based reviews

The results of the desk-based reviews informed the design of the field surveys and predictions regarding the presence of potential species. The primary sources consulted were:

i. Databases:
   - EPBC Act Protected Matters Search Tool (DoEE 2017a). An EPBC Act Protected Matters Report was generated for the area within a 10km radius of point -16.8306, 145.6032 (refer to Appendix 5).
   - EHP Wildlife Online database (EHP 2017a). A report was generated for the area (parameters as above, refer to Appendix 5).
   - Atlas of Living Australia search (ALA 2017). Review of specific species records and a database search within a 5 km radius of point -16.8306, 145.6032 (refer to Appendix 5).
ii. Qld Regional Ecosystem (RE) mapping (Version 8.0, Qld DNRM 2017a) and Broad Vegetation Groups (BVG) mapping (Version 3, DSITI 2016).
iii. Hoskin's (2016, 2017) reports on the presence of threatened frogs in the study area (refer Appendix 5).
iv. Aerial imagery available via Google Earth and Queensland Globe[20] and QIMagery[21].

19.7.3.2 Field surveys

The field fauna survey program involved two independent studies:

[18] Accessed January to September 2017, https://www.business.qld.gov.au/running-business/support-assistance/mapping-data-imagery/queensland-globe
[19] Accessed January to September 2017, https://qimagery.information.qld.gov.au/

[20] Accessed January to September 2017, https://www.business.qld.gov.au/running-business/support-assistance/mapping-data-imagery/queensland-globe
[21] Accessed January to September 2017, https://qimagery.information.qld.gov.au/

1. A baseline terrestrial vertebrate fauna survey (hereafter 'baseline fauna survey') conducted in general accordance with the approach described in Eyre *et al.* (2014). Relevant to MNES, the survey included targeted sampling for Threatened and Migratory fauna species, with the exception of threatened frogs.
2. A specialised survey for threatened stream-dwelling frogs.

The baseline fauna survey involved systematic sampling at formal survey sites, targeted sampling for specific species and/or at specific areas of interest, and continuous observation. As per advice contained in Eyre *et al.* (2014), surveys were timed to occur in the early wet and early dry seasons. The survey schedule is summarised below.

- Early wet season (EWS): this survey occurred over five days in January 2017. A three-person team of ecologists was devoted to the task.
- Early dry season (EDS): most of this survey occurred over six days in May 2017. The survey team comprised four ecologists during the first and final day of the survey, and two ecologists for the remainder of the time. Additional acoustic bat detection/recording occurred in June 2017.

Surveys for threatened frogs occurred over eight days in January 2016 (reported in Hoskin 2016) and over nine days between February and March 2017 (reported in Hoskin 2017). The survey was conducted by James Cook University (NRA[22] assisted parts of 2017 surveys).
The following was considered when selecting formal survey sites:

- Preliminary development plans.
- Broad Vegetation Group (BVG 1:2M) mapping (DSITI 2016). Remnant and pre-clearing data were consulted.
- Field observations of habitat types and condition.
- Site accessibility and matters relating to animal welfare considerations.

Following the abovementioned considerations three survey sites were selected (for details, refer Appendix 5). These sites were sampled during the EWS and EDS surveys. Each site was sampled for five consecutive days during each survey. Surveillance cameras, Elliot funnel and pit traps were deployed at each site for a minimum of three nights per survey.
Targeted survey techniques were employed to supplement the baseline inventory and to assist with the detection of Threatened and Migratory species.
An inventory of incidental sightings was maintained during each survey. The baseline fauna survey was the primary method used to assess the presence of non-native terrestrial fauna.

19.7.3.3 Potential Impacts on Listed Threatened species, Ecological Communities and Migratory species

Potential impacts upon Listed Threatened Species and Migratory Species are described in detail within Chapter 8 of the EIS, and within the Flora and Fauna and Biosecurity Reports (Appendix 5 and Chapter 16 of the EIS).

The flora and fauna communities of the project area were described through reviews of available information and field surveys. To assess potential impacts to threatened, migratory species and/or sensitive habitat the current threats must be taken into account. Therefore, biodiversity and natural environmental values were identified, including Threatened and Migratory species, verified habitat, potential core habitat and habitat corridors. Existing threats to flora and fauna are listed below.

Existing Threats to Flora and Fauna Habitat
Vegetation communities on the project area are currently under the following threatening processes:

[22] NRA Environmental Consultants.

- Vegetation in the northern portion of the site has a high edge to area ratio, making this vegetation vulnerable to various edge effects including: higher light penetration, weed ingress and wind exposure.
- Livestock grazing and ground disturbance through hoof action is decreasing ground cover and reducing surface soil stability along forest edges. These impacts are more pronounced where patches of remaining vegetation are narrow (e.g. along some streams).
- Many weed species occur on the project area and pose a threat to habitat integrity. Within the forested areas the dominant weeds are Lantana, Giant Bramble and Sky Flower. A patch of Cat's Claw Creeper is also present, if left uncontrolled, this species could pose a threat to forest areas.
- Many of the forested habitats show signs of cyclone damage (i.e. damaged tree canopies and canopy gaps created by tree falls). This damage is more pronounced in the northern portion of the project area and along the edge of cleared land.
- The unsealed track network in the Eucalypt Open Forest to Woodland (EOFW) is a potential sediment source for the aquatic receiving environment. Further, uncontrolled public access to this track network increases the risk of weed invasion.

Potential impacts to Flora

The proposed development potentially creates direct threats and a range of indirect threats to some flora values. Direct threats include authorised vegetation clearing, which will be most pronounced during the construction phase. Indirect threats refer to those secondary threats that may occur as a result of the development. Their impacts may extend beyond the development footprint and throughout the operational life of the project. Potential project-related direct and indirect threats are described below and areas of disturbance indicated in Figure 19-10 (after section 19.3.7.2.2).

Direct threats - Threated flora

KUR-World has the potential to result in the direct loss of Threatened flora and their habitat. One threatened flora species, the Endangered (EPBC Act) Myola Palm occurs within the proposed project area. However, this species occurs along streams, therefore is unlikely to be directly affected by clearing since vegetated buffers around creeks will be retained. The potential loss of potential core habitat for threatened flora species known or predicted to occur on the project area is shown in Table 19-4 below.

Table 19-4: Threatened flora known or predicted to occur on the project area, their status, potential habitat and potential impact area.

Species	Presence[A]	EPBC Act Status	Potential Core Habitat (Regional Ecosystem)[B]	Potential Impact Area (ha) & Proportion (%)[C]
Myola Palm (*Archontophoenix myolensis*)	Verified[E]	Endangered	RE 7.11.1, RE 7.11.7 (streams).	30 (10%)
Endlicher's Filmy Fern (*Polyphlebium endlicherianum*)	Probable	Endangered	RE 7.11.1.	21 (43%)
Smooth-bark Rose Apple (*Syzygium hodgkinsoniae*)	Probable	Vulnerable	RE 7.11.1, RE 7.11.7 (streams).	30 (10%)
Velvet Jewel Orchid (*Zeuxine polygonoides* Syn, *Rhomboda polygonoides*)	Probable	Vulnerable	RE 7.11.1, RE 7.11.7 (streams).	30 (10%)
Rat's Tail Tassel-fern (*Phlegmariurus filiformis*)	Possible	Endangered	RE 7.11.1.	21 (43%)

Species	Presence[A]	EPBC Act Status	Potential Core Habitat (Regional Ecosystem)[B]	Potential Impact Area (ha) & Proportion (%)[C]
Cajanus mareebensis	Possible	Endangered	RE 7.11.44.	3 (6%)

A: Either 'Verified' as present during the NRA (Appendix 5) study, or, predicted to have a 'Probable' or 'Possible' presence on project area.

B: Habitats, as represented by Regional Ecosystems (REs), the species is most likely to occur in. Based on the parent RE (vegetation community variations not stated). Species typically associated with streams are indicated.

C: Area estimates are rounded to the nearest whole number. They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. Values calculated based on habitat mapping undertaken by NRA (shown in Figure 19-2). Proportions shown in parenthesis are the area of potential core habitat lost relative to what currently exists on project area.

E: Assumed present. Taxonomy of plants on project area is unresolved.

Indirect threats - Flora

Potential indirect threats to flora values associated with development projects are listed below.

- Edge effects. Clearing and subsequent development could result in changes to wildlife communities and environments along, and extending out from, the edge of disturbance. Clearing in linear patterns, such as along road easements may act to funnel winds along disturbance edges and the edge of cleared areas can favour non-native and disturbance adapted species.
- Inappropriate excavation or earthworks practices, during construction and/or operation, resulting in erosion and vegetation loss.
- Inappropriate vegetation clearing practices, during construction and/or operation, resulting in the inadvertent loss of vegetation (directly or indirectly due to erosion).
- Fugitive dust smothering vegetation, reducing plant health in the immediate receiving environment. This impact is most likely during the construction phase.
- Release of contaminated waters, excessive nutrients or hazardous substances to the natural environment resulting in reduced plant health, habitat degradation, habitat modification and/or loss of vegetation.
- During construction and operation, all developments have the potential to result in new biosecurity incursions and/or contribute to the spread of existing infestations. Reduced habitat quality is a potential consequence of both scenarios.

It is not possible to quantify the potential magnitude of impacts that may result from the above indirect threats. Some indirect threats are likely to be short-term and very localised in spatial extent (for example fugitive dust) whereas others, if not properly managed, may cause severe and/or irreversible impacts at the site, local and/or regional scales (for example biosecurity incursions). However, management and mitigation measures can play a vital role in avoiding and/or mitigating impacts. Proposed management measurements for flora impacts are listed in Chapter 8 and in section 19.7.3.4.1 (this chapter).

Potential impacts to Fauna

The project has the potential to generate a range of direct and indirect threats with the potential to impact on fauna values.

Direct threats - Fauna

Direct threats comprise the loss of habitat (and subsequent displacement of wildlife), and direct mortality or harm during clearing and excavation works. With respect to habitat loss, it is the loss of core, limiting, or critical habitat that poses the greatest direct threat. Habitats in the local area are frequently exposed to catastrophic weather events (for example severe tropical cyclones), therefore supporting or marginal habitats may also be important when other habitats are unavailable.

The potential magnitude of direct harm to Threated, Migratory-listed fauna, or fauna in general, as a consequence of vegetation clearing and excavation works cannot be fully quantified. The potential magnitude of harm is likely to be proportional to the scale of habitat loss and/or disturbance. Controls should be implemented during construction works to reduce the potential for harm.

The potential magnitude of core habitat loss for Threatened and Migratory species as a consequence of the proposed development is shown in Figure 19-5 below. The assumptions and data sources used for calculation of potential core habitat loss are provided in Appendix 5 (Flora and Fauna Technical Report).

Table 19-5: Threatened Fauna and Migratory-listed species known or predicted to occur on the project area, their status, potential core habitat and potential impact area.

Species	EPBC Act Status	Core Habitat [A]	Predicted Occurrence [B]	Potential Impact Area (ha) & Proportion (%)[C,D]
Kuranda Tree Frog	Endangered	MNVF (streams for breeding) (Figure 19-3)	Regular / resident	0
Bare-rumped Sheathtail Bat	Vulnerable	EOFW	Regular / resident	6 (4%)
Greater Large-eared Horseshoe Bat	Vulnerable	MNVF, NMVF and EOFW	Regular / resident	87 (15%)
Spectacled Flying-fox	Vulnerable	MNVF, NMVF and EOFW	Regular / resident	87 (15%)
Spectacled Monarch	Migratory	MNVF, NMVF and EOFW	Regular / resident	87 (15%)
Black-faced Monarch	Migratory	MNVF, NMVF and EOFW	Regular / resident	87 (15%)
Rufous Fantail	Migratory	MNVF, NMVF and EOFW	Regular / resident	87 (15%)
White-throated Needletail	Migratory	Above (airspace) all habitats	Regular / resident	Nil
Fork-tailed Swift	Migratory	Above (airspace) all habitats	Regular / resident	Nil
Northern Bettong	Endangered	EOFW	Uncertain	6 (4%)
Greater Glider	Vulnerable	EOFW	Uncertain	6 (4%)
Semon's Leaf-nosed Bat	Vulnerable	MNVF, NMVF and EOFW	Uncertain	87 (15%)
Masked Owl	Vulnerable	MNVF, NMVF and EOFW	Uncertain	87 (15%)
Southern Cassowary	Endangered	MNVF and NMVF	Intermittent	80 (19%)

Species	EPBC Act Status	Core Habitat [A]	Predicted Occurrence [B]	Potential Impact Area (ha) & Proportion (%)[C,D]
Australian Lacelid	Endangered	MNVF (streams for breeding)	Intermittent	0
Northern Quoll	Endangered	EOFW	Intermittent	6 (4%)
Red Goshawk	Vulnerable	EOFW	Intermittent	6 (4%)
Ghost Bat	Vulnerable	MNVF, NMVF and EOFW	Intermittent	87 (15%)
Oriental Cuckoo	Migratory	EOFW	Intermittent	6 (4%)
Glossy Ibis	Migratory	Open Pasture	Intermittent	84 (87%)
Eastern Osprey	Migratory	MNVF, NMVF and EOFW	Intermittent	87 (15%)
Barn Swallow	Migratory	Above (airspace) all habitats	Intermittent	Nil

A: Verified habitat for Kuranda Tree Frog and potential core habitat for other fauna species in the project area. Core habitat does not necessarily encompass the full range of habitats in which a species may occur; for most species on the project area, all forested habitat types will be of some potential value. Fauna Habitat: Mesophyll to Notophyll Vine Forest (MNVF), Notophyll to Microphyll Vine Forest (NMVF), Eucalypt Open Forest to Woodland (EOFW). See Appendix 5 (Flora and Fauna Technical Report, Section 4.3.2 for further detail).

B: Predicted occurrence based on published information on species distribution and ecology and observed conditions on-site. Categories comprise: 'Regular / resident', 'Intermittent' and 'Uncertain' (Refer Appendix 5 Section 4.3.2 for further detail).

C: Based on direct loss of predicted core habitat. They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. Area estimates are rounded to the nearest whole number. Proportions shown in parenthesis are the area of habitat lost relative to what currently exists on the project area.

D: Habitat mapping is where all forested areas are treated as potential habitat. Queensland Government pre-clearing Broad Vegetation Group (BVG) mapping was used to delineate distribution of habitats. Specific mapping and decisions rules were used for Kuranda Tree Frog (Figure 19-3).

Indirect threats - Fauna

Indirect threats refer to those secondary threats that may occur as a result of development projects. Their impacts may extend beyond the development's footprint and some may persist throughout the operational life of a project. Potential indirect threats to fauna values associated with developments may include the following.

- All indirect threats described for flora previously listed are applicable to fauna since that plant communities are a component of fauna habitat.
- Sedimentation and contamination of waterways resulting in reduced water quality and condition of in-stream habitats.
- Alteration of surface hydrology (that is changing drainage, the locations where surface water occurs and altered environmental flows).
- Direct and/or secondary poisoning of wildlife due to 'pest' control programmes (lethal or sub-lethal impacts).

- Altered fauna communities in response to artificial lighting and changes to the acoustic environment.
- Increased number of cats and dogs and subsequent incidence of attacks on native wildlife, and/or alteration of natural behaviours of native wildlife due to the presence of cats and dogs.
- Increased chance of wildlife colliding with vehicles.
- Increased number of human-wildlife interactions. These may have negative effects on some wildlife. (e.g. unhabituated wildlife may vacate an area).
- Increased levels of habitat fragmentation may change fauna behaviours in response to human presence and/or physical habitat loss.

It is not possible to quantify the potential magnitude of impact that may result from the above indirect threats. Some indirect threats are likely to be short-term and very localised in spatial extent (for example construction noise) whereas others, if not properly managed, may cause severe and/or irreversible impacts at the site, local and/or regional scales. The fauna species (and populations) that are potentially most vulnerable to the indirect threats (and resulting impacts) are those that:

- are permanent, frequent or regular inhabitants of the project site (see Table 19-5).
- are sensitive to the threats posed by the action[23]
- have core, limiting or critical habitat within the receiving environment of impact.

The listed fauna species predicted to have an intermittent occurrence on the project area, and whose core habitats or areas of activity are likely to be remote to the main area of potential indirect threats, comprise: White-throated Needletail, Fork-tailed Swift, Greater Glider, Northern Bettong, Northern Quoll, Red Goshawk, Ghost Bat, Oriental Cuckoo and Barn Swallow. These species are least vulnerable to the potential indirect threats of the project. The Kuranda Tree Frog is the most vulnerable in that they have critical habitat in the immediate receiving environment and is sensitive to most of the potential identified indirect threats. However, design alterations, vegetation buffers and the allocated conservation areas for frog species will mitigate potential impacts.

Table 19-6 below lists the potential indirect threats to fauna in the absence of mitigation measures.

[23] Due to biology (including life history), behaviour and/or population size.

Table 19-6: Potential indirect threats (in the absence of mitigation) to fauna.

Indirect Threat	Potential Spatial Scale of Impact [A]	Potential Temporal Scale of Impact [B]	Comments
Habitat loss due to uncontrolled clearing, excavation, or other physical disturbance.	Site-specific.	Medium (assuming some natural regeneration) to long-term.	Standard controls can reduce likelihood of impact. Some impacts are reversible.
Habitat degradation: edge effects.	Site-specific.	Short to long-term.	Most pronounced along disturbance edges and likely to vary spatially and temporally.
Habitat degradation: biosecurity ingress and proliferation.	Mostly site-specific; however, potential for local or regional scale impacts.	Long-term.	Standard controls can reduce likelihood of impact, and in most cases, reduce spatial and temporal scale of impact.
Habitat degradation: fugitive dust.	Site-specific.	Short-term.	Standard controls can reduce risk.
Sedimentation and contamination.	Mostly site-specific; however, potential for local scale impacts.	Short to long-term depending on severity.	Standard controls can reduce likelihood of impact.
Alteration of surface hydrology.	Mostly site-specific; however, potential for local scale impacts.	Short to long-term.	Standard controls can reduce risk.
'Pest' control programmes.	Mostly site-specific; however, potential for local or regional scale impacts.	Long-term.	Threats difficult to monitor and control during operational life of project.
Artificial lighting and anthropogenic noise.	Site-specific.	Long-term.	Standard controls can reduce likelihood of impact.
Domestic cats and dogs.	Site-specific.	Long-term.	Standard controls can reduce likelihood of impact. Some controls might be difficult to enforce.
Collision with vehicles.	Mostly site-specific; however, potential for local or regional scale impacts.	Long-term.	Standard controls can significantly reduce likelihood.
Human-wildlife interactions.	Site-specific.	Long-term.	Standard control measures can reduce likelihood of impact. Some measures might be difficult to enforce.
Habitat fragmentation.	Site-specific and local scale.	Long-term.	Sensitive planning can reduce impacts.

[A] Spatial scale categories comprise: site-specific (that is project area), local area (for example within 5 kilometres of project area) and regional (for example within 20 kilometres of project area).

[B] Temporal scale categories comprise: short-term (1 year to 5 years), medium-term (5 years to 30 years) and long-term (>30 years).

Detailed discussion of indirect threats and their potential influence on Threatened and Migratory can be found on Appendix 5 (Flora and Fauna Technical Report).

19.7.3.4 Mitigation measures for Listed Threatened species, Ecological Communities and Migratory species

The potential impacts to flora and fauna have been addressed in previous sections and include loss of habitat or diminished habitat quality. To avoid any potential impacts, a list of extensive recommendations has been developed, these recommendations include an additional modification to the project design to reduce the extent of fauna habitat loss in the north-east of the project area. This will be achieved through a combination of habitat retention and rehabilitation measures.

19.7.3.4.1 Flora

The below list presents the mitigation measures specific to flora, though many are applicable to other terrestrial ecological values.

- **Management Measure 1:** Destroy existing infestation of Cat's Claw Creeper (*Macfadyena unguis-cati*) and monitor the area for re-emergence or recovery of the species. Re-treat as required to achieve eradication.
- **Management Measure 2:** Prior to clearing woody vegetation (remnant or non-remnant) conduct surveys for threatened plants [note: some of this work is complete; see Astrebla (2015b)]. Subsequent management of any threatened plants that may be impacted by development should occur in accordance with relevant legislation.
- **Management Measure 3:** Minimise vegetation clearing extent via planning and implementation of systems/controls during construction (for example permit to clear system and clearly marking clearing extents prior to disturbance). This includes clearing for new roads and bridges.
- **Management Measure 4:** Implement systems to prevent unauthorised vegetation clearing throughout the operational life of the development.
- **Management Measure 5:** Develop and implement a rehabilitation plan. The plan should be prepared by a suitably qualified person and be appropriate for the setting (that is consider project and activity-related threats and all values of the receiving environment). All areas in the Environmental Area currently devoid of native vegetation should be rehabilitated to natural conditions. Areas disturbed during construction that are not needed for the operation phase should be rehabilitated as soon as they become available.
- **Management Measure 6:** Develop and implement a project-specific biosecurity management plan (construction and operation phases). The plan should include methods for prevention of introduction and/or spread of weeds, pests and pathogens, inspections/monitoring and control. The plan should be developed by a suitably qualified person and be appropriate for the setting (that is consider project-related threats, local/regional threats and all values of the receiving environment).
- **Management Measure 7:** Develop and implement an appropriate project-wide landscaping plan (construction and operation phases). The plan should provide guidance on plant species selection and describe limitations or precautions with regard to the receiving environment (example limitations or issues when landscaping in or near habitats for threatened stream-dwelling frogs). The plan should be developed by, or reviewed by, a suitably qualified person(s) to ensure it is appropriate for the setting (that is consider activity-related threats and all values of the receiving environment).
- **Management Measure 8:** Develop and implement a fire management plan (construction and operation). The plan should include methods for prevention of uncontrolled wildfire and emergency response.
- **Management Measure 9:** Develop and implement a stormwater management plan designed to achieve no adverse change in the environmental values of the aquatic receiving environment. The

management plan should include a monitoring programme capable of detecting change in key indicators (that is indicators that are specific to potential project-related contamination sources and specific to known values of the receiving environment). The sampling regime should be sufficient to detect changes in key indicators and allow/provide for a timely management response.

- **Management Measure 10:** The wastewater treatment system, inclusive of effluent irrigation (if this occurs), should be designed and managed so as to achieve no adverse change in the environmental values of the aquatic receiving environment.
- **Management Measure 11:** Manage run-off or wash-down water from animal enclosures/stables to avoid contamination of the aquatic receiving environment.
- **Management Measure 12:** Irrigation practices should be managed to reduce the run-off of irrigated water or the infiltration of potentially contaminated water (for example nutrients, pesticides, herbicides) to groundwater.
- **Management Measure 13:** Develop and implement a dust management plan (construction).
- **Management Measure 14:** Develop and implement Erosion and Sedimentation Control Plans (ESCPs) for each area of construction and for the operational phase, inclusive of certification of the plans by a Certified Professional in Erosion and Sediment Control (CPESC) or equivalent. ESCPs should be designed with the objective of achieving no adverse impact on the aquatic receiving environment.
- **Management Measure 15:** Develop and implement a management plan for the storage and handling of chemicals and hazardous substances (construction). The management plan should consider storage of minimum necessary volumes, emergency response training, procedures and controls in the event of an inadvertent release of chemicals or hazardous substances.
- **Management Measure 16:** Design plans for communal buildings and infrastructure facilities should consider the potential need for storage and handling of chemicals and hazardous substances.
- **Management Measure 17:** Training and site inductions to increase environmental awareness, identification of project-related threats and management requirements/obligations (construction and operation).
- **Management Measure 18:** Feral pigs should be managed to reduce numbers and limit access to creeks across the project area.
- **Management Measure 19:** Prevent cattle access to creeks via fencing and the provision of off-creek watering points.
- **Management Measure 20:** Implement and appropriately resource (capital, labour, time, equipment) a management system to ensure that recommendations presented in this report, and any subsequent flora and fauna assessments, are implemented. The system should identify lines of responsibility/accountability and encompass the life of project (construction and operation).

19.7.3.4.2 Fauna

The below list presents the mitigation measures specific to fauna, though many are applicable to other terrestrial ecological values. Most of the management measures relating to flora are applicable to fauna and are not repeated below.

- **Management Measure 21:** Reduce the extent of fauna habitat loss in the north-east of the project area. The primary objectives for habitat retention should be to: (a) reduce net habitat loss for fauna associated with mixed notophyll vine forest habitats (*eg* Southern Cassowary and Greater Large-eared Horseshoe Bat); and (b) retain a forest corridor along the Warril Creek tributary. The recommended minimum areas for habitat retention are shown on Figure 19-10. Similar results can be achieved with different configurations.
- **Management Measure 22:** Restore riparian vegetation along Haren Creek, Owen Creek, Cain Creek and the tributary of Warril Creek. The recommended areas for habitat restoration are shown on 9-18

(approximately 12 ha). Habitat restoration should aim to improve the condition of riparian habitats for fauna and be of a habitat type that reflects pre-clearing conditions.

- **Management Measure 23:** Where clearing within, or adjacent to, Kuranda Tree Frog habitat cannot be avoided, manage bank stability and stormwater discharge to ensure no adverse change in the environmental values of the aquatic receiving environment. The use of vegetative buffers and engineering solutions should be considered.
- **Management Measure 24:** Measures to protect water quality should be integrated into project Erosion and Sediment Control Plans (ESCPs), Storm Water Management Plans and Surface Water Monitoring Programmes (SWMPs).
- **Management Measure 25:** Inspect disturbance areas for roosting or nesting fauna prior to clearing. If nesting or roosting fauna are found, clearing at that location should cease until the appropriate management and approval requirements are ascertained and implemented. A fauna spotter/catcher is to be present during clearing activities.
- **Management Measure 26:** Woody vegetation clearing should occur progressively to give animals that survive the tree-felling activity a chance to move out of the area.
- **Management Measure 27:** During the construction phase, develop and implement controls relating to noise management (including: maintain vehicles and machinery according to manufacturer specifications; fit and maintain appropriate mufflers on machinery used on-site).
- **Management Measure 28:** Lighting in public spaces should be designed to minimise artificial light impacting natural habitats, in particular avoid artificial light impacts on riparian habitats. The use of lighting shields, directional lighting, timers and motion-sensors should be considered.
- **Management Measure 29:** Pathways through the development area should be designed to prevent pedestrian access to core Kuranda Tree Frog habitat (Figure 19-3), and areas immediately upstream of this habitat (nominally 1 kilometre from mapped habitat).
- **Management Measure 30:** Roads through forest areas, notably the proposed access roads, should be designed to minimise the barrier effects to fauna movements and to reduce the likelihood of fauna being hit by vehicles. A suitably qualified and experienced ecologist should be involved with the designs. All fauna groups should be considered, though specific attention should be given to threatened stream-dwelling frogs and Southern Cassowary. Clearing widths (construction and operation) should be kept as low as possible and strategies to reduce the impact of light and acoustic pollution, especially near streams, should be incorporated into designs. Bridges should be used over larger streams, and designed to permit fauna movements (including Southern Cassowary) and minimise ground disturbance. A maximum 50km/hour speed limit should apply to the access roads, though the need for further speed reductions, and speed reduction furniture, should be considered during the design phase (for example lower speeds due to poor line of sight along roadways).
- **Management Measure 31:** The Rainforest Education Centre and Adventure Park (inclusive of the Zip Line) should be designed so as to result in minimal clearing of woody vegetation.
- **Management Measure 32:** The project biosecurity management plan (Management Measure 6) should include specific focus on protecting riparian habitats, in particular core habitat for Kuranda Tree Frog (Figure 19-3).
- **Management Measure 33:** The use of toxic baits to control feral vertebrate pests is discouraged. Toxic baits should only be considered if the potential for non-target impacts on native fauna has been properly assessed (for example by a suitably qualified person) and if strategies to negate non-target impacts are available and implemented. For example, toxic baiting of wild dogs may pose a threat to Northern Quoll, and the use of rodenticides can result in secondary poisoning (that is kill or harm) higher order predators (for example Masked Owl).

- **Management Measure 34:** All management and monitoring plans relating to the aquatic environment should consider the requirements of Kuranda Tree Frog. Populations of Kuranda Tree Frog in the entire receiving environment (that is on and off-site) should be considered.
- **Management Measure 35:** Prohibit cat ownership and limit dog ownership to small breeds, or certified assistance dogs. The rules regarding pet ownership should include proper containment within place of residence. All rules should be enforceable and monitored.
- **Management Measure 36:** The development should include a community/public education programme so that all residents and visitors are aware of the sensitivity of the receiving environment, and aware of any relevant rules or regulations.
- **Management Measure 37:** The Zip Line should be designed and constructed with the knowledge that the area could be fire affected.
- **Management Measure 38:** Barrier netting should not be used along the golf course unless it poses a negligible threat to volant fauna as determined by a suitably qualified ecologist.
- **Management Measure 39:** The use of surface or ground-stored water should not adversely change the environmental values of the aquatic receiving environment. The parameters around which water is used should be based on specific assessment by suitably qualified persons and consider the specific values of the receiving environment.
- **Management Measure 40:** An Environmental Management Plan (Operational Phase) should be developed for each development precinct or activity. The plan should identify and address potential threats to the environment associated with the activity/land use, measures to address threats, responsibilities and performance measures. This is particularly important for the golf course which may require the use of chemicals in areas near to Threatened frog habitat.
- **Management Measure 41:** The Environmental Area should be retained as a reserve for native wildlife with the primary function of nature conservation. The management plan should be developed by a suitably qualified and experienced ecologist. The management plan should aim to protect the value of the area as habitat for native flora and fauna, and protect its value as a wildlife corridor. The management plan should identify the values of the area, existing and emerging threats, and actions to address and monitor existing and emerging threats. The management plan should be appropriately resourced (capital, labour, time, equipment) and have clear lines of responsibility/accountability that encompass the life of project.
- **Management Measure 42:** Conduct targeted surveys for Threatened fauna in forests and woodlands immediately west of the project area. The results should be used to inform the fire management plan for the south-western portion of the Environmental Area. The survey should include targeted searches for Northern Bettong and Northern Quoll.

19.7.4 Residual impacts

KUR-World has been designed to predominantly occur in cleared areas. This approach was taken during the preliminary design and planning phases of the project. The design intention is to reduce the potential project-related environmental impacts on flora and fauna.

Potential residual impacts are the impacts predicted to occur following implementation of the recommended management and mitigation measures. Following implementation of the management measures in Sections 19.7.3.4.1 and 19.7.3.4.2 (particularly Management Measures 21 and 22), residual clearing areas required for development are influenced by the following.

- Disturbance areas (derived from the master plan).
- Areas of vegetation to be retained and restored, in accordance with:

  - Habitat retention (Environmental Area on the master plan with minor additions as per Appendix 5).
  - Recommended additional habitat retention (Appendix 5
  - Recommended habitat restoration (Appendix 5).
- Zip Line:
  - Disturbance areas have been included for Zip Line option 1 only, as this is the preferred option of the three available options.

Residual areas of potential habitat disturbance and habitat retention for threatened flora and fauna within the project area are illustrated in Figure 19-10. Commonwealth Government policies and guidelines have been used to assist in determining whether a potential residual impact to MNES is 'significant' (hereafter, significant residual impact (SRI)). These include generic and value-specific guidelines, some of which overlap. The policies and guidelines relevant to the assessment for this project are as follows.

- Matters of National Environmental Significance. Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999 (DoE 2013).
- Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. Referral guideline for 14 birds listed as migratory species under the EPBC Act.
- Significant impact guidelines for the endangered southern cassowary (Casuarius casuarius johnsonii) Wet Tropics population. EPBC Act policy statement 3.15 (DEWHA 2010).

19.7.4.1.1 Potential residual impacts to flora

The residual loss of potential core habitat for threatened flora species known or predicted to occur on the project area is shown in Table 19-7 below. Myola Palm occurs within the proposed project area. However, this species occurs along streams, therefore is unlikely to be directly affected by clearing since vegetated buffers around creeks will be retained. Other threatened flora species have not been found in the project area after 14 days of survey effort. Whilst areas of potential core habitat have been identified, the proposed clearing extents are relatively minor.

On the available information, the potential for SRI on threatened flora is unlikely.

Table 19-7: Threatened flora known or predicted to occur on the project area, their status, potential habitat and residual impact area.

Species	Presence[A]	EPBC Act Status	Potential Core Habitat (Regional Ecosystem)[B]	Residual Impact Area (ha) & Proportion (%)[C]
Myola Palm (*Archontophoenix myolensis*)	Verified[E]	Endangered	RE 7.11.1, RE 7.11.7 (streams).	24 (8%)
Endlicher's Filmy Fern (*Polyphlebium endlicherianum*)	Probable	Endangered	RE 7.11.1.	15 (31%)
Smooth-bark Rose Apple (*Syzygium hodgkinsoniae*)	Probable	Vulnerable	RE 7.11.1, RE 7.11.7 (streams).	24 (8%)
Velvet Jewel Orchid (*Zeuxine polygonoides* Syn, *Rhomboda polygonoides*)	Probable	Vulnerable	RE 7.11.1, RE 7.11.7 (streams).	24 (8%)

Species	Presence[A]	EPBC Act Status	Potential Core Habitat (Regional Ecosystem)[B]	Residual Impact Area (ha) & Proportion (%)[C]
Rat's Tail Tassel-fern (*Phlegmariurus filiformis*)	Possible	Endangered	RE 7.11.1.	15 (31%)
Cajanus mareebensis	Possible	Endangered	RE 7.11.44.	3 (6%)

A: Either 'Verified' as present during the NRA (Appendix 5) study, or, predicted to have a 'Probable' or 'Possible' presence on project area.

B: Habitats, as represented by Regional Ecosystems (REs), the species is most likely to occur in. Based on the parent RE (vegetation community variations not stated). Species typically associated with streams are indicated.

C: Area estimates are rounded to the nearest whole number. They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. Values calculated based on habitat mapping undertaken by NRA (shown in Figures 19-2). Proportions shown in parenthesis are the area of potential core habitat lost relative to what currently exists on project area.

E: Assumed present. Taxonomy of plants on project area is unresolved.

19.7.4.1.2 Potential residual impacts to fauna

The potential core habitat loss for Threatened fauna based on the current master plan and adoption of recommendations presented in this chapter is discussed in Appendix 5 (Section 6.1.2). Estimates of residual potential habitat loss were calculated and presented for Threatened species, for Migratory-listed species, and for clearing extents of habitat types (Table 19-8). The Commonwealth (DoE 2013) criteria for assessing potential SRI on Threatened species are presented and discussed in Appendix 5 (refer to Table 21).

Table 19-8: Threatened Fauna and Migratory-listed species known or predicted to occur on the project area, their status, potential core habitat and residual impact area.

Species	EPBC Act Status	Core Habitat [A]	Predicted Occurrence [B]	Residual Impact Area (ha) & Proportion (%)[C,D]
Kuranda Tree Frog	Endangered	MNVF (streams for breeding) (Figure 19-3)	Regular / resident	0
Bare-rumped Sheathtail Bat	Vulnerable	EOFW	Regular / resident	6 (4%)
Greater Large-eared Horseshoe Bat	Vulnerable	MNVF, NMVF and EOFW	Regular / resident	77 (13%)
Spectacled Flying-fox	Vulnerable	MNVF, NMVF and EOFW	Regular / resident	77 (13%)
Spectacled Monarch	Migratory	MNVF, NMVF and EOFW	Regular / resident	77 (13%)
Black-faced Monarch	Migratory	MNVF, NMVF and EOFW	Regular / resident	77 (13%)
Rufous Fantail	Migratory	MNVF, NMVF and EOFW	Regular / resident	77 (13%)
White-throated Needletail	Migratory	Above (airspace) all habitats	Regular / resident	Nil
Fork-tailed Swift	Migratory	Above (airspace) all habitats	Regular / resident	Nil
Northern Bettong	Endangered	EOFW	Uncertain	6 (4%)

Species	EPBC Act Status	Core Habitat [A]	Predicted Occurrence [B]	Residual Impact Area (ha) & Proportion (%)[C,D]
Greater Glider	Vulnerable	EOFW	Uncertain	6 (4%)
Semon's Leaf-nosed Bat	Vulnerable	MNVF, NMVF and EOFW	Uncertain	77 (13%)
Masked Owl	Vulnerable	MNVF, NMVF and EOFW	Uncertain	77 (13%)
Southern Cassowary	Endangered	MNVF and NMVF	Intermittent	70 (17%)
Australian Lacelid	Endangered	MNVF (streams for breeding)	Intermittent	0
Northern Quoll	Endangered	EOFW	Intermittent	6 (4%)
Red Goshawk	Vulnerable	EOFW	Intermittent	6 (4%)
Ghost Bat	Vulnerable	MNVF, NMVF and EOFW	Intermittent	77 (13%)
Oriental Cuckoo	Migratory	EOFW	Intermittent	6 (4%)
Glossy Ibis	Migratory	Open Pasture	Intermittent	84 (87%)
Eastern Osprey	Migratory	MNVF, NMVF and EOFW	Intermittent	77 (13%)
Barn Swallow	Migratory	Above (airspace) all habitats	Intermittent	Nil

A: Verified habitat for Kuranda Tree Frog and potential core habitat for other fauna species in the project area. Core habitat does not necessarily encompass the full range of habitats in which a species may occur; for most species on the project area, all forested habitat types will be of some potential value. Fauna Habitat: Mesophyll to Notophyll Vine Forest (MNVF), Notophyll to Microphyll Vine Forest (NMVF), Eucalypt Open Forest to Woodland (EOFW). See Appendix 5 (Flora and Fauna Technical Report, Section 4.3.2 for further detail).

B: Predicted occurrence based on published information on species distribution and ecology and observed conditions on-site. Categories comprise: 'Regular / resident', 'Intermittent' and 'Uncertain' (Refer Appendix 5 Section 4.3.2 for further detail).

C: Based on direct loss of predicted core habitat. They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. Area estimates are rounded to the nearest whole number. Proportions shown in parenthesis are the area of habitat lost relative to what currently exists on the project area.

D: Habitat mapping is where all forested areas are treated as potential habitat. Queensland Government pre-clearing Broad Vegetation Group (BVG) mapping was used to delineate distribution of habitats. Specific mapping and decisions rules were used for Kuranda Tree Frog (Figure 19-3).

Assessment of the Threatened and migratory fauna under the Commonwealth criteria determined that SRIs were not anticipated for the following:

- The fauna species least vulnerable to the potential threats of the project are those predicted to have an intermittent occurrence on the project area, and whose core habitats or areas of activity are likely to be remote to the main area of potential impacts (considering direct and indirect threats). These species comprise: White-throated Needletail, Fork-tailed Swift, Greater Glider, Northern Bettong, Northern Quoll, Red Goshawk, Grey Falcon, Ghost Bat, Oriental Cuckoo and Barn Swallow.
- SRIs on Migratory fauna are not anticipated based on consideration of DoE (2013) SRI criteria. The project area may occasionally, and temporarily, support ecologically significant proportions of White-

throated Needletail, Fork-tailed Swift and Spectacled Monarch populations; however, their habitats are unlikely to be substantially modified by the proposed action. The management of biosecurity items (that is Tramp Ants) is of critical importance for avoiding the potential for SRI on the Spectacled Monarch.

For the remaining Threatened fauna (hereafter 'priority Threatened fauna'), the extents and relative proportion of potential core habitat loss are either minor (Table 19-8), or are mostly affecting habitats dominated by regrowth vegetation (that is not optimal or climax condition states).

Potential core habitat loss is minor or nil for Kuranda Tree Frog, Australian Lacelid and Bare-rumped Sheathtail Bat. Habitat loss predominantly relates to regrowth vegetation for Greater Large-eared Horseshoe Bat, Spectacled Flying Fox and Southern Cassowary. For these species this habitat loss is unlikely to have significant impacts on their populations at the site, local or regional scales. Further, the magnitude of impact on all of the above species will be reduced by Management Measure 22 (habitat restoration as shown in Figure 19-10). SRI on the above-described species as a consequence of habitat loss is unlikely.

The likelihood of SRIs on most priority Threatened fauna as a consequence of indirect threats is low if the recommendations for protection of flora and fauna are implemented; however, for a few species, the risk for SRI is less clear due to the following.

- While the recommended mitigation measures will reduce the potential magnitude of impact, a residual impact will likely remain. This is applicable to most species though certain fauna populations might be more sensitive (for example species with small populations).
- Given the size, complexity and duration of the project it is possible that certain aspects of management will fail at some time, or unforeseen eventualities may occur. This is applicable to most species though certain fauna populations might be more sensitive (for example species with small populations).

The issues described in the above points are relevant to assessing the potential for SRI and are discussed below.

- The performance outcomes recommended in Appendix 5 (Section 5.3.3), with respect to water quality, are for no adverse change in the aquatic receiving environment as a consequence of development (construction and operation). This performance outcome was set because significant receptors occur in the receiving environment (notably Threatened frogs). The listed species at risk is the Kuranda Tree Frog. Although this species is sensitive to pollution, species-specific thresholds for impacts do not exist. Maintaining the *status quo* with respect to water quality is therefore the only option for avoiding impacts. This advice has been factored into project designs for stormwater and wastewater treatment systems. The fact that Threatened stream-dwelling frogs occur along Jum Rum Creek (the receiving environment for the Kuranda township), indicates this species can exist near urban environments. In practice, it is not possible to achieve conformity with standards all the time; for example, unplanned events or extreme events may occur.
- Biosecurity incursions or proliferation can require substantial investment and commitment to prevent, and greater investment and commitment to contain or eradicate incursions. Even when best practice is operating, a residual threat is likely to persist. Yellow Crazy Ants are of particular concern because they are present in Kuranda, there are numerous potential pathways for incursions into the project area (construction and operation), and their impacts can be devastating. Serious incursions of Yellow Crazy Ants have the potential to impact Threatened fauna species, though particularly ground-dwelling species such as the Kuranda Tree Frog and Southern Cassowary. The magnitude of any potential impact will be commensurate with the spatial and temporal scale of the incursion, and the location of the incursion relative to core habitats for the Threatened species of interest.

- The proposed access roads via Myola Road and Mount Haren Road will traverse forested habitats known to support Threatened fauna and introduce the risk of vehicle strike to fauna populations in these areas. Careful planning and design can greatly reduce the risk of fauna being killed or harmed by vehicle strike; however, a residual threat is likely to remain. For most species, the potential residual impact at the population level is likely to be sustainable. The residual impact is of concern for the Southern Cassowary because the local population is apparently small, and therefore sensitive to additional threats. There is opportunity to offset this impact by implementing a wild dog control programme, though the degree to which this may offset project-related threats is uncertain.

The potential for SRI on the Kuranda Tree Frog, Australian Lacelid and Southern Cassowary is assessed as follows. All project-related threats are considered.

- **Kuranda Tree Frog**. There is some uncertainty about potential residual impacts in relation to the management of water quality and biosecurity. The scale, complexity and duration of the project contribute to uncertainty. Knowledge gaps in the ecology of the species contribute to uncertainty. The plausible worst-case scenario is that impacts that are serious at the project area, local area and regional scales may occur; under this scenario an SRI is likely (Appendix 5: refer to SRI Criteria (a), (b)[24], (e), (i) and (k) in Table 21). The plausible best-case scenario is that impacts that are serious at the project area, local area and regional scales do not occur; under this scenario an SRI is unlikely.
- **Australian Lacelid**. There is some uncertainty about potential residual impacts in relation to the management of water quality and biosecurity items (as per Kuranda Tree Frog); however, the species is remote from the area most likely to be impacted upon. An SRI is unlikely.
- **Southern Cassowary**. Residual impacts in the form of habitat loss, vehicle strike and biosecurity exist. These residual impacts may interfere with the recovery of the local population. Wild dog control will offset residual impacts; however, the degree to which wild dog control will reduce overall impacts is uncertain. It is uncertain because it is not possible to predict the residual project-related impacts at the population scale or predict the degree to which the population would benefit from wild dog control. The plausible worst-case scenario is that residual impacts remain after wild dog control; under this scenario an SRI is likely (Appendix 5: refer to SRI Criterion (g) in Table 21). The plausible best-case scenario is that wild dog control effectively mitigates project-related impacts and that the project does not inhibit the recovery of the Southern Cassowary population; under this scenario an SRI is unlikely.

The best-case scenario outcome (*i.e.* mitigation of residual impacts and the avoidance of an SRI) is achieved through the effective implementation of technical management plans and specifications. Technical management plans and specifications, including species specific management plans, can be reliably prepared based on existing knowledge and experience. The technical aspects include:

- overarching management plans, such as a Biosecurity Management Plan,
- environmental management procedures, for example a Permit to Clear procedure,
- general management actions, including for example waste reduction, and
- species specific management actions, such as speed limits.

The EMP (refer to Chapter 21) describes the management approach to avoid or mitigate negative impacts and to promote beneficial outcomes. The significance of this EMP to the achievement of a best-case outcome is the consideration of, and weight given to, the administrative aspects that influence outcomes. The principles of management have been distilled and described in the EMP. Instilling these principles in the organisations and workforces that will contribute to project delivery is required to achieve the best case outcome. This approach is simple in concept yet it is not routine. It is a necessary approach and has

[24] Specific to area of occupancy (DoE 2013). Reduction in area of occupancy is unlikely.

demonstrably worked for development projects in Far North Queensland. For example, in the construction sector the integration of ESCP principles and resultant specifications and practices in the construction sequence for property development and transport infrastructure has evolved from virtual nil consideration in the early 90's through to the sophisticated approach now common and informs the EMP for this project. The achievement of the best outcome is facilitated by implementing required EMP tasks in an appropriate time frame. Timely implementation minimises risk, avoids costly retrofits and achieves the desired outcome.

In consideration of the EMP, and that some uncertainty exists regarding potential residual impacts for the Kuranda Tree Frog, Australian Lacelid and Southern Cassowary, additional consideration is given to the species-specific mitigation measures necessary to achieve an SRI of unlikely. To this end, overarching and species-specific management measures, to mitigate project related impacts have been identified and aligned with each phase of project delivery (Table 19-9).

This approach presents the mode of project delivery necessary to achieve the best-case outcome and it is a commitment of the proponent to adopt this approach

Additional management measure:

- Management Measure 43: Prepare a Species Management Plan for Kuranda Tree Frog, Australian Lacelid, Bare-rumped Sheathtail Bat, Greater Large-eared Horseshoe Bat, Tube-nosed Insectivorous Bat, Spectacled Flying Fox, Macleay's Fig-parrot and Southern Cassowary.

Table 19-9: Overarching and species-specific management actions to mitigate project related impacts

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions			
Broad	**Specific**		**Administrative**	**Behavioural**	**Physical**	**Southern Cassowary**	**Frogs**	Macleay's Fig-Parrot	**Bats**
PRE-CONSTRUCTION									
Concept Design		Design requirements and/or design needs not aligned and/or deficient. Project risk and opportunities are not appropriately addressed. Resultant negative outcomes.	Undertake Master Plan development process. Undertake EIS. Develop a communication plan to facilitate knowledge transfer. Engage in value management (planning, workshop, follow-up).			Identify habitat and develop concept plan to avoid, minimise, mitigate impact to habitat by consolidation of project infrastructure to minimise footprint of development. Identify areas suitable for habitat conservation as well as restoration.	Identify habitat and develop concept plan to avoid, minimise, mitigate impact to habitat by consolidation of project infrastructure to minimise footprint of development. Identify areas suitable for habitat conservation as well as restoration.		
Approvals and permitting		Absent or deficient process resulting in controls not fit for the intended outcome.	Adopt and follow the statutory process.		Implement and appropriately resource (capital, labour, time, equipment) a management system to ensure that EMP plans, procedures and actions are implemented. Consistent with the EMP define and report the lines of responsibility/accountability and encompass the life of project (construction and operation).				
Detailed Design		Failure to identify and address design risks. Deficient specifications. Resultant negative outcomes.	Engage in value management (planning, workshop, follow-up). Preliminary consideration of project delivery options and evaluate implications to the Design process. Design specifications prepared in accordance with relevant Australian Standard, and prepared in accordance with licence/permitting requirements.	The development should include a community/public education programme so that all residents and visitors are aware of the sensitivity of the receiving environment, and aware of any relevant rules or regulations.	Lighting in public spaces should be designed to minimise artificial light impacting natural habitats, in particular avoid artificial light impacts on riparian habitats. The use of lighting shields, directional lighting, timers and motion-sensors should be considered. The Environmental Area should be retained as a reserve for native wildlife with the primary function of nature conservation. A management plan for the Environmental Area should be developed by a suitably qualified and experienced ecologist. The management plan should aim to protect the	Traffic calming measures incorporated in design. Measures include though not limited to maximum speed limit of 40 km/hr in areas of designated habitat that are under the control of the proponent. A maximum 50 km/hour speed limit should	In addition to measures described for Cassowary, roads through forest areas, notably the proposed access roads, are to be designed to minimise the barrier effects to fauna movements and to reduce the likelihood of fauna being hit by vehicles. A suitably qualified and experienced ecologist is be involved with the designs. All fauna groups to be considered, though specific attention is to be given to threatened stream-dwelling frogs and Southern Cassowary. Clearing widths (construction and operation)	Barrier netting will not be used along the golf course unless it poses a negligible threat to flying fauna as determined by a suitably qualified ecologist.	Barrier netting will not be used along the golf course unless it poses a negligible threat to flying fauna as determined by a suitably qualified ecologist.

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions			
Broad	Specific		Administrative	Behavioural	Physical	Southern Cassowary	Frogs	Macleay's Fig-Parrot	Bats
PRE-CONSTRUCTION									
					value of the area as habitat for native flora and fauna, and protect its value as a wildlife corridor. The management plan should identify the values of the area, existing and emerging threats, and actions to address and monitor existing and emerging threats. The requirements of the Australian Standard AS2436-2010 Guide to noise and vibration control on construction, demolition, and maintenance sites to be integrated in design.	apply to the access roads, though the need for further speed reductions, and speed reduction furniture, should be considered during the design phase. Roads through forest areas, notably the proposed access roads, are to be designed to minimise the barrier effects to fauna movements and to reduce the likelihood of fauna being hit by vehicles. A suitably qualified and experienced ecologist is be involved with the designs. All fauna groups to be considered, though specific attention is to be given to threatened stream-dwelling frogs and Southern Cassowary. Clearing widths (construction and operation) are to be kept as low as possible and strategies to reduce the	are to be kept as low as possible and strategies to reduce the impact of light and acoustic pollution, especially near streams, are to be incorporated into designs. Bridges are to be used over larger streams, and designed to permit fauna movements (including Southern Cassowary) and minimise ground disturbance. Design and operate a wastewater treatment system to meet Barron River Water Quality Objectives or site-specific targets appropriate for the Barron River, Wet Tropics Water Quality Improvement Plan 2015 – 2020 and the Reef Water Quality Protection Plan 2013. Stormwater should be directed to water treatment systems or appropriately designed retention dams considering worst case discharge scenarios to achieve water quality performance objectives for the Wet Tropics nominated in Arup (2017). Reduce the extent of fauna habitat loss in the north-east of the project area. The primary objectives for habitat retention should be to: (a) reduce net Endangered Vulnerable Near Threatened (EVNT) species habitat loss; (b) reduce net Mesophyll to Notophyll Vine Forest (MNVF) habitat loss; & (c) retain a forest corridor along the Warril Creek tributary. Any adjustment in the configuration of retained habitats should optimise protection of habitats where listed frog species occur at high densities, which in the		

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions			
Broad	Specific		Administrative	Behavioural	Physical	Southern Cassowary	Frogs	Macleay's Fig-Parrot	Bats
PRE-CONSTRUCTION									
						impact of light and acoustic pollution, especially near streams, are to be incorporated into designs. Bridges are to be used over larger streams, and designed to permit fauna movements (including Southern Cassowary) and minimise ground disturbance.	north-east of the project area corresponds with the downstream reach of the Warril Creek tributary. Pathways through the development area will be designed to prevent pedestrian access to core Kuranda Tree Frog habitat, and areas immediately upstream of this habitat.		
Project delivery		Project Delivery Model not considered or inappropriate. Resultant negative outcomes.	Evaluate Project Delivery Models and select the option (or combination of options) that is the optimum method of project delivery given the complexity of this project. The selection process to be bias towards that model which achieves greatest reduction in the risk of non-conformance with licence/permitting conditions.						
Procurement		Project procurement model not considered or inappropriate. Resultant negative outcomes.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audit to confirm procurement process conforms to Project Delivery Model.						
Contract documentation		Deficient incorporation of design requirements into contractual documentation.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audit to confirm contractual documentation accurately reflects design specifications (which have been prepared in						

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions			
Broad	Specific		Administrative	Behavioural	Physical	Southern Cassowary	Frogs	Macleay's Fig-Parrot	Bats
PRE-CONSTRUCTION									
			conformity with licence/permitting requirements).						
Tendering and award		Inappropriate tendering and award of contract process leading to negative outcomes.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audit to confirm tendering and award conforms to Project Delivery Model.						

Dark Green highlight indicates completed
Light Green highlight indicates in progress
No highlight indicates to be completed

[#] The actions have been presented into four groups (i.e. Southern Cassowary, Frogs, Macleay's Fig Parrot and Bats). Where for "Frogs", Species Management Plans are required for: Kuranda Tree Frog, Australian Lacelid and Tapping Green-eyed Tree Frog. Where for "Bats", Species Management Plans are required for: Bare-rumped Sheathtail Bat, Greater Large-eared Horseshoe Bat, Tube-nosed Insectivorous Bat and Spectacled Flying Fox.

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions [#]			
Broad	Specific		Administrative	Behavioural	Physical	Southern Cassowary	Frogs	Macleay's Fig-Parrot	Bats
CONSTRUCTION									
All activities	Contract administration	Deficient contractual administration leading to negative outcomes	Adopt a Quality Assurance System. Develop systems and procedures. Third party audits.		Implement and appropriately resource (capital, labour, time, equipment) a management system to ensure that EMP plans, procedures and actions are implemented. Consistent with the EMP define and report the lines of responsibility/accountability and encompass the life of project (construction and operation).				
	Equipment failure	Equipment failure e.g. leaks, spills. This could impact on soils, flora and fauna (death, loss of habitat) and adverse impacts on receiving waters values.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audits.	Training to raise awareness. The importance of compliance is covered in training programs, including for all contractors.	All mobile plant and equipment to be utilised onsite is to be certified in writing as appropriate for task and serviceable. Pre-start checks to completed prior to use of mobile plant and equipment on a per shift basis.				
	Maintenance and cleaning	Impact on land surface and receiving waters due to runoff from equipment or activities related to fuelling, servicing and	Adopt a Quality Assurance System. Develop systems and procedures. Third party audits.	Training to raise awareness. The importance of compliance is covered in training programs, including for all contractors.	All mobile plant and equipment to be refuelled, maintained and cleaned in designated areas that have been appropriately designed, constructed and maintained. Third party audits.				

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions #			
Broad	Specific		Administrative	Behavioural	Physical	Southern Cassowary	Frogs	Macleay's Fig-Parrot	Bats
		maintaining plant and equipment.							
	Air quality	Emissions adversely affect environmental values.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audits.		In the design phase, and adopt appropriate separation distances, incorporate relevant attenuation features.				
	Noise and Vibration	Emissions adversely affect environmental values.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audits.		In the design phase, and adopt appropriate separation distances, incorporate relevant attenuation features, including hours of operation.				
	Waste	Waste products adversely affect environmental values.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audits. Develop and implement a Waste Management Plan to align with waste handling and compliance requirements in accordance with legislation and industry best practice waste management strategies	Training to raise awareness. The importance of compliance is covered in training programs, including for all contractors.	Minimise waste generation by design (design out waste products where practicable; incorporate waste reduction requirements in procurement documentation). Provide appropriate waste disposal receptacles. Engage licenced entities to collect and remove waste (recycling) products from site. Irrigation practices should be managed to reduce run-off from irrigated water or the infiltration of potentially contaminated water (for example nutrients, pesticides, herbicides) to groundwater (prepare Irrigation Management Plan).				
	Monitoring	Failure to define required outcomes. Deficient specifications. Resultant negative outcomes.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audits.		Aquatic ecology surveys (fish) is be undertaken at a minimum of once annually, and aquatic ecology (aquatic macroinvertebrates) undertaken annually, along with sediment monitoring (prior to and during the construction stage). Groundwater monitoring is be undertaken quarterly (prior to during construction phase).		Surface water samples to be collected from reference (benchmark/background) and receiving sites on a monthly basis (prior to construction). All management and monitoring plans should consider the requirements of Kuranda Tree Frog and Tapping Green-eyed Frog.		
Site Establishment		Disturbance to land surface. This could impact on flora and fauna (death, loss of habitat), accelerate erosion and adverse impacts on	An appropriately qualified professional engaged to perform flora and fauna pre-clearance surveys. An appropriately qualified professional engaged to prepare an Erosion and Sediment Control Plan (ESCP) for the	Training to raise awareness (all site personnel to be introduced, through the site induction, to protected fauna that have potential to be encountered across the site). The	Utilise designated access to site (purpose built and operated). Restrict site access and movement within the site. Survey farm dams on the property or in the relevant sub catchments to determine if the Giant *Gudgeon Oxyeleotris selheimi* is established in these	Information describing the importance of not interacting with animals (including approaching, handling, feeding)	The project biosecurity management plan (Management Measure 6) will include specific focus on protecting riparian habitats, in particular core habitat for Kuranda Tree Frog (Figure 19-3). Develop and implement a Stormwater		

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions #			
Broad	**Specific**		**Administrative**	**Behavioural**	**Physical**	**Southern Cassowary**	**Frogs**	Macleay's Fig-Parrot	**Bats**
		receiving waters values.	construction and operational phases of the project. The ESCP to be certified by a Certified Professional in Erosion and Sediment Control (CPESC). The ESCP integrated into the planning, design, construction (including to the practical completion and defects period) and maintenance phases for each component of the project. Develop and implement a fire management plan (construction and operation). The plan should include methods for prevention of uncontrolled wildfire and emergency response. Develop and implement a project-specific Biosecurity and Pest Management Plan (construction and operation phases). The plan will include methods for prevention of introduction and/or spread of weeds, pests and pathogens, inspections/monitoring and control. The plan will be developed by a suitably qualified person.	importance of compliance is covered in training programs, including for all contractors. Procedures in place such that any animal requiring care or treatment will be immediately transported to a veterinarian or licenced wildlife carer.	habitats and eradicate it. On-site dams should not be stocked with species that are not endemic to the area.	prepared in different formats and distributed including signage, facts sheets, newsletters.	Management Plan designed to achieve no adverse change in environmental values of the aquatic receiving environment. The management plan should include a monitoring programme capable of detecting change in key indicators (that is indicators that are specific to potential project-related contamination sources and specific to known values of the receiving environment).		
		Introduction and/or dispersal of material that poses a biosecurity risk.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audits.	Training to raise awareness. The importance of compliance is covered in training programs, including for all contractors.	All equipment and materials intended to be brought to site is to be certified as free of biosecurity risk prior to site entry (and also free of harmful by products of any associated treatment to afford biosecurity free status). Restrict site access and movement within the site. Periodic surveys targeted to the early detection, and timely control, of biosecurity risks.				

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions #			
Broad	Specific		Administrative	Behavioural	Physical	Southern Cassowary	Frogs	Macleay's Fig-Parrot	Bats
Clearing & Grubbing		Disturbance to land surface. Impact on flora and fauna (death, loss of habitat), accelerated erosion and adverse impacts on receiving waters values. Loss of habitat impacts on conservation value of the area. Decrease in aesthetic appeal due to tree clearing. Impact on natural and cultural heritage due to loss of vegetation	Erosion and sediment control measures as described above. In areas which have not been surveyed, conduct surveys for threatened and near-threatened (T&NT) plants in accordance with the Queensland Protected Plant Survey Guidelines. Subsequent management of any T&NT plants threatened by development should occur in accordance with relevant legislation. Prepare and obtain approval of Species Management Program(s) as relevant.	Training to raise awareness. Make sure workers know what vegetation is approved for removal. The importance of compliance is covered in training programs, including for all contractors.	Restrict work areas (clearing is to be restricted to designated footprint (*i.e.* Permit to Clear procedure); identify stockpile locations for retaining soil and vegetation for rehabilitation purposes). Stage works i.e. do not open up the entire work area to achieve economies of scale, rather schedule works to limit amount of land disturbed and open to risk of accelerated erosion. Where practicable undertake works in the dry season. Where not practicable to limit works to the dry season, devote additional resources to erosion and sediment control.		In areas which have not been surveyed, conduct surveys for EVNT fauna species, in particular the Kuranda Tree Frog (*Litoria myola*) in accordance with Queensland Government Terrestrial Vertebrate Fauna Survey Guidelines. Woody vegetation clearing should occur progressively to give animals that survive the tree-felling activity a chance to move out of the area. This is especially important in areas of potential frog habitat. Where clearing within listed frog habitat cannot be avoided, manage bank stability and stormwater discharge to avoid no adverse change in the environmental values of the aquatic receiving environment.	Vegetation clearing to only occur in accordance with an approved Species Management Program (High risk and Low-risk species, as required). Plans should include requirement to inspect disturbance areas for roosting or nesting fauna prior to clearing. If nesting or roosting fauna are found, clearing at that location should cease until the appropriate management and approval requirements are ascertained and implemented. A fauna spotter/catcher is to be present during clearing activities.	Vegetation clearing to only occur in accordance with an approved Species Management Program (High risk and Low-risk species, as required). Plans should include requirement to inspect disturbance areas for roosting or nesting fauna prior to clearing. If nesting or roosting fauna are found, clearing at that location should cease until the appropriate management and approval requirements are ascertained and implemented. A fauna spotter/catcher is to be present during clearing activities.
Bulk earthworks	Excavation, handling and storage	Disturbance to land surface (soil excavation - handling, storage and transport). Accelerated erosion and adverse impacts on receiving waters values.	Erosion and sediment control measures as described above.		Restrict work areas. Stage works i.e. do not open up the entire work area to achieve economies of scale, rather schedule works to limit amount of land disturbed and open to risk of accelerated erosion. Where practicable undertake works in the dry season. Where not practicable to limit works to the dry season, devote additional resources to erosion and sediment control.				
Services, utilities and road infrastructure		Impacts on land and receiving water values if	Adopt a Quality Assurance System. Develop systems and procedures. Third		Restrict work areas. Stage works i.e. do not open up the entire work area to achieve economies				

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions #			
Broad	Specific		Administrative	Behavioural	Physical	Southern Cassowary	Frogs	Macleay's Fig-Parrot	Bats
		inappropriate practices and/or materials.	party audit to confirm procurement process conforms to Project Delivery Model. Design plans for communal building and infrastructure facilities should consider the potential need for storage and handling of chemicals and hazardous substances (in accordance with applicable Australian Standards).		of scale, rather schedule works to limit amount of land disturbed and open to risk of accelerated erosion. Where practicable undertake works in the dry season. Where not practicable to limit works to the dry season, devote additional resources to erosion and sediment control.				
Building and landscaping (including recreational areas and gardens)		Impacts on land and receiving water values if inappropriate practices and/or materials.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audit to confirm procurement process conforms to Project Delivery Model.		Restrict work areas. Stage works i.e. do not open up the entire work area to achieve economies of scale, rather schedule works to limit amount of land disturbed and open to risk of accelerated erosion. Where practicable undertake works in the dry season. Where not practicable to limit works to the dry season, devote additional resources to erosion and sediment control.		Develop and implement an appropriate project-wide landscaping plan (construction and operation phases). The plan should provide guidance on plant species selection and describe limitations or precautions with regard to the receiving environment (for example limitations or issues when landscaping in or near habitats for threatened stream-dwelling frogs). The plan should be developed by, or reviewed by, a suitably qualified person(s) to ensure it is appropriate for the setting (that is, consider activity-related threats and all values of the receiving environment).		
Rehabilitation	Plan	Failure to define required outcomes. Deficient specifications. Resultant negative outcomes.	Develop and implement a rehabilitation plan. The plan is to be prepared by a suitably qualified person and be appropriate for the setting (that is consider project and activity-related threats and all values of the receiving environment). All areas in the Environmental Area currently devoid of native vegetation should be rehabilitated to natural conditions. Areas disturbed during				Restore riparian vegetation along Haren Creek, Owen Creek, Cain Creek and the tributary of Warril Creek. The recommended areas for habitat restoration are shown on Figure 19-10 (approximately 12 hectares). Habitat restoration should aim to improve the condition of riparian habitats for fauna and be of a habitat type that reflects pre-clearing conditions		

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions #			
Broad	Specific		Administrative	Behavioural	Physical	Southern Cassowary	Frogs	Macleay's Fig-Parrot	Bats
			construction that are not needed for the operation phase should be rehabilitated as soon as they become available.						
	Surface preparation	Pest species ingress or contamination if any imported materials is not clean.	Adopt a Quality Assurance System. Develop systems and procedures. Third party audit to confirm procurement process conforms to Project Delivery Model.		Only use appropriately certified materials.				
	Fertiliser application	Impacts on land and receiving water values if inappropriate agrichemical applications (fertilisers, pesticides, herbicides).	Adopt a Quality Assurance System. Develop systems and procedures. Provide appropriate resources (time, capital, labour). Third party audits.		Only use specified agrichemical applications, specified amounts and in accordance with manufacture's specified application method.				
	Plant species	Land surface changes from the planting of species e.g. ensure correct species, no weeds.	Adopt a Quality Assurance System. Develop systems and procedures. Provide appropriate resources (time, capital, labour). Third party audits.						
	Revegetation Success	Death of species planted or pest species overtaking the revegetation site.	Adopt a Quality Assurance System. Develop systems and procedures. Provide appropriate resources (time, capital, labour). Third party audits.		Periodic surveys targeted to the early detection and timely intervention of corrective measures.				

No highlight indicates to be completed

The actions have been presented into four groups (i.e. cassowary, frogs, other birds and bats). Species Management Plans are required for Kuranda Tree Frog, Australian Lacelid, Tapping Green-eyed Tree Frog, Bare-rumped Sheathtail Bat, Greater Large-eared Horseshoe Bat, Tube-nosed Insectivorous Bat, Spectacled Flying Fox, Macleay's Fig-parrot and Southern Cassowary.

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions #			
Broad	Specific		Administrative	Behavioural	Physical	Cassowary	Frogs	Other Birds	Bats
OPERATIONS AND MAINTENANCE									

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions #			
Broad	Specific		Administrative	Behavioural	Physical	Cassowary	Frogs	Other Birds	Bats
Habitation	All activities	Anthropogenic activities negatively impact on environmental values	Augment existing regulatory requirements (embodied for example in the *Environmental Protection Act 1994*) with requirements that attach to land title. The requirements would include exclusions (*e.g.* the keeping of cats) and inclusions (*e.g.* annual contribution to environmental levy to fund ongoing monitoring for example of the biosecurity risk). Prohibit cat and dog ownership and visitation, with the exception of certified assistance dogs.	Education	Restrict access to known sensitive areas.	Information describing the importance of not interacting with animals (including approaching, handling, feeding) prepared in different formats and distributed including signage, facts sheets, newsletters.	Implement education opportunities about frogs found in the area and provide access to nature-based activities to residents by providing supervised and approved frogging activities.		
	Waste	Waste products adversely affect environmental values.	Adopt existing regulatory mechanisms and controls.	Education	Upon termination of the defects liability period, management devolved to the Local Government.				
	Management of environmental area	Impacts on land and receiving water values if inappropriate practices and/or materials.	Augment existing regulatory requirements (embodied for example in the *Environmental Protection Act 1994*) with requirements that attach to land title. Document a land management plan developed in consultation with regulatory authorities.	Education	Upon termination of the defects liability period, management devolved to the appropriate Government or as relevant NGO entity.				
	Services, utilities and road infrastructure	Impacts on land and receiving water values if inappropriate practices and/or materials.	Adopt existing regulatory mechanisms and controls.	Education	Upon termination of the defects liability period, management devolved to the Local Government.				
	Landscaping (recreational areas, gardens)	Impacts on land and receiving water values if inappropriate practices and/or materials.	Augment existing regulatory requirements (embodied for example in the *Environmental Protection Act 1994*) with requirements that attach to land title. Document a land management plan developed in consultation with regulatory authorities.	Education	Upon termination of the defects liability period, management devolved to the Local Government.				

No highlight indicates to be completed

[#] The actions have been presented into four groups (i.e. cassowary, frogs, other birds and bats). Species Management Plans are required for Kuranda Tree Frog, Australian Lacelid, Tapping Green-eyed Tree Frog, Bare-rumped Sheathtail Bat, Greater Large-eared Horseshoe Bat, Tube-nosed Insectivorous Bat, Spectacled Flying Fox, Macleay's Fig-parrot and Southern Cassowary.

Activity		Issue and Impact	Overarching Management Actions			Species Specific Management Actions [#]			
Broad	**Specific**		**Administrative**	**Behavioural**	**Physical**	**Cassowary**	**Frogs**	**Other Birds**	**Bats**
ALL ACTIVITIES									
Emergency Response		Deficient response to emergency event resulting in negative outcomes.	Develop Emergency Response Plan collaboratively with contractors and regulators. Update and review Emergency Response Plan in accordance with Quality Assurance System. Third party audits.	Undertake training of workforce, including contactors. Undertake training for mock emergency events.					

No highlight indicates to be completed

[#] The actions have been presented into four groups (i.e. Southern Cassowary, Frogs, Macleay's Fig Parrot and Bats). Where for "Frogs", Species Management Plans are required for: Kuranda Tree Frog, Australian Lacelid and Tapping Green-eyed Tree Frog. Where for "Bats", Species Management Plans are required for: Bare-rumped Sheathtail Bat, Greater Large-eared Horseshoe Bat, Tube-nosed Insectivorous Bat and Spectacled Flying Fox.

19.8 Project Alternatives

The terms of reference for the EIS require the inclusion of a project alternatives section:

> *13.15. Project alternatives must be discussed in accordance with Schedule 4, section 2.01(g) of the EPBC Regulations, including:*
>
> *(a) if relevant, the alternative of taking no action;*
>
> *(b) a comparative description of the impacts of each alternative on the triggered MNES protected by controlling provisions of Part 3 of the EPBC Act for the action; and*
>
> *(c) sufficient detail to make clear why any alternative or option is preferred to another.*
>
> *13.16. Short, medium and long-term advantages and disadvantages of the alternatives or options must be discussed.*

Schedule 4 (Matters to be addressed by draft public environment report and environmental impact statement), section 2.01(g) of the EPBC Regulations clarifies the requirement concerning alternates as follows:

To the extent reasonably practicable, any feasible alternatives to the action, including:

- if relevant, the alternative of taking no action;
- a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action;
- sufficient detail to make clear why any alternative is preferred to another;

The discussion below addresses this requirement.

The following site characteristics were identified by the Proponent in its site selection as being supportive of its proposed KUR-World project:

- Previously cleared land: The site provides large areas of cleared land within which development can be located.
- Environmental features: The site contains various natural features such as remnant vegetation, and riparian environments that support the development of KUR-World as an eco-resort.
- Rural land: The site is located within the Rural Zone and has historically been used for rural purposes, allowing tourist activities associated with rural activities to be established.
- Large land holding: The site comprises a large land holding, allowing sufficient area to develop a low scale eco-resort that is in keeping with the character of the local area.
- Proximate to Kuranda township: The site is proximate to the Kuranda township, allowing for the utilisation of existing tourist facilities in the local area and access to the established tourism market centred on the township. The site is accessible from Kuranda by road.
- Proximate to Cairns: Kuranda is accessible by road, scenic tourism railway and cable car from Cairns, which provides a range of higher order facilities including an international airport.
- Ownership: The site, when acquired by the Proponent, was held in a single ownership.

The Proponent has been engaged in the evaluation of project alternatives since purchasing the freehold properties in early 2014. A plethora of project alternatives can be suggested, some of which include: do nothing, rural-residential, rural-grazing, rural-intensive livestock, rural-cropping (sugar cane), conservation, forestry, aged care housing, recreational vehicle (RV) park, youth programs offering outdoor opportunities, migrant workers' accommodation, high-end eco-tourism

accommodation, and low cost housing. Inherent in the assessment of each alternative is its practicability.

The production of the Initial Advice Statement (IAS) presented the culmination of evaluations undertaken to May 2016 (IAS 2016). The IAS described the project plan and presented the masterplan. Since May 2016, the Proponent has progressively undertaken investigations and assessments to inform master planning described in the original concept presented in the IAS.

For the purposes of the EIS, five alternative options in relation to the use of the site have been identified.

1. Existing Situation
2. Tourist Attraction
3. Rural Housing
4. Non-urban Residential Subdivision
5. Intensive Rural Use

Table 19-10 below, provides a summary of these alternatives and their social, economic and environmental consequences.

Table 19-10 Project alternatives

Project Alternative	Social	Economic	Environmental	Implications in relation to MNES
1. Existing Situation: The site is retained in its current state, being used for grazing, cropping and animal keeping uses. A temporary Nature-Based Tourism use is also operated on the site. These uses would all operate pursuant to existing land use approvals/existing use rights.	• Limited community benefit (land retained in private ownership), particularly in relation to community access to natural environment. • Limited connectivity to local community. • Limited potential for educational opportunities, particularly with respect to cultural and environmental matters. • Land remains in its current state, which is familiar	• Continued local economic benefits from current operations. • Inefficient use of well-located land. • Low level of tourist activity on-site.	• Potential for environmental degradation where management controls are not implemented. • Continued crossing of local creeks on unsealed tracks. • Existing use rights mean best environmental practice may not be employed. • Maintained extent of clearing. • Limited opportunity for environmental appreciation of the site and protection of identified values. • Limited opportunity for site rehabilitation for habitat linkages to be strengthened and supported.	• Potential for ongoing degradation of habitat of EPBC-listed species. • Potential for ongoing decline in water quality affecting downstream WTWHA and GBRWHA values.

Project Alternative	Social	Economic	Environmental	Implications in relation to MNES
	to the community. • Existing visual environment retained.			
2. Tourist Attraction (small-scale): A small scale tourist use is established on the site, providing a range of activities.	• Limited community benefit (land retained in private ownership). • Potential attraction for local residents as well as tourists/visitors. • Potential improvements to local infrastructure (such as roads) • Potential for educational opportunities to be incorporated within tourist attraction. • Potential for the incorporation of activities that promote awareness regarding cultural matters relevant to the site and locality.	• Contribution to natural/farm tourism experiences available within the local area, thereby potentially increasing tourism attraction and spend within the Shire. • Increase offering for tourists in local area. • Likely to directly compete with established tourist offerings by being of a similar scale and nature. • Increased and ongoing local employment opportunities. • Additional employment opportunities at construction stage.	• Increase in range of people using site creates greater potential for environmental impact. • Increased crossing of local creeks using existing unsealed tracks. • Maintained extent of clearing. • Potential for activities promoting appreciation/conservation of environmental values. • Opportunity for habitat rehabilitation and habitat linkages to be strengthened and supported as part of the tourist attraction operation. • Potential for impacts to threatened species, if not avoided in design.	• Potential for some degradation of habitat of EPBC-listed species unless planning controls can be implemented cost-effectively in relation to the scale of the development. • Potential for decline in water quality affecting downstream WTWHA and GBRWHA values; unless planning controls can be implemented cost-effectively in relation to the scale of the development.
3. Rural Housing: Dwelling Houses are established	• Increased residential catchment for	• Reduced economic potential due to	• Increased opportunities for the clearing of regulated vegetation,	• Potential for degradation of habitat of

Project Alternative	Social	Economic	Environmental	Implications in relation to MNES
on each existing lot forming the site. This situation could result in the separation of the existing land holding into a number of smaller holdings, through the sale of existing lots to individual owners.	Kuranda township. • Diversification of housing supply in local area. • Increased demand on Kuranda township for services. • Limited community benefit (land retained in private ownership). • No potential for educational opportunities, particularly with respect to cultural and environmental matters. • No potential for community/tourist enjoyment of the site and its natural features. • Potential increases to social infrastructure within the locality as a result of increased residential development within the shire. • Limited opportunity for environmental appreciation of the site and protection of identified values.	fragmentation of substantial land holding. • High costs associated with servicing new houses. • Increased demand on the Kuranda township for the provision of services. • Addition of new housing stock to the local housing market. • Local employment during construction phase of the project.	particularly in south of site. • Reduced management controls due to smaller land parcels and diversification of ownership. • Limited potential to achieve preservation of sensitive areas. • Potential for fragmentation of habitat and linkages. • Potential for increased human impact to the natural environment on and near to the site, particularly in the form of construction impacts and noise/light/emissions impacts associated within residential development (including fringe effects). • Potential for impacts to Threatened species.	EPBC-listed species. • Potential for decline in water quality affecting downstream WTWHA and GBRWHA values.
4. Non-Urban Residential subdivision: The	• Reduced integration amongst local	• Cost to provide services and	• Increased population proximate to sensitive areas.	• Potential for degradation

Project Alternative	Social	Economic	Environmental	Implications in relation to MNES
site is subdivided to provide an extensive residential subdivision, with new infrastructure.	population due to distance between Kuranda and site. • Need to provide social services for increased population. • Potential for environmental areas to be provided as public parkland. • Potential improvements to local infrastructure (such as roads). • Potential increases to social infrastructure within the locality as a result of increased residential development within the shire. • Change effected to use of the land, which could give rise to social concern (particularly considering the nature and scale of development). • Increased demand on the Kuranda township for the provision of services.	infrastructure for expanded population. • Increased demand on Kuranda to supply services. • Construction will provide short-term local economic benefits (employment). • Limited ongoing economic benefits, apart from small amount of local services growth. • Addition of new housing stock to the local housing market.	• Reduced potential for environmental appreciation due to preservation of sensitive areas within reserves. • Potential for rehabilitation of sensitive areas as part of subdivision. • Potential for fragmentation of habitat and linkages. • Potential for increased human impact to the natural environment on and near to the site, particularly in the form of construction impacts and noise/light/emissions impacts associated within residential development (including fringe effects). • Potential for impacts to Threatened species.	of habitat of EPBC-listed species unless planning controls can be implemented cost-effectively in relation to the scale of the development. • Potential for decline in water quality affecting downstream WTWHA and GBRWHA values; unless planning controls can be implemented cost-effectively in relation to the scale of the development.
5. Intensive Rural Use: The existing rural uses are intensified,	• Potential compatibility issues with surrounding land uses (in	• Increased economic activity on the site.	• Substantial impact on environment due to increased clearing (including to natural habitat and habitat linkages).	• Potential for accelerated degradation of habitat of EPBC-listed

Project Alternative	Social	Economic	Environmental	Implications in relation to MNES
through greater stocking density for grazing and/or the intensive cropping of vast areas of the site. Further clearing of the site would be undertaken, to re-establish the extent of rural use occurring on the site previously (refer to Appendix 5, Flora and Fauna technical report, pages 212 – 218, which provide aerial photography showing the historic clearing of the site as part of prior rural uses).	particular odour). • Limited community benefit (land retained in private ownership). • Strengthening of the local agricultural industry. • Change effected to use of the land, which could give rise to social concern (particularly considering the nature and scale of development). • No potential for educational opportunities, particularly with respect to cultural and environmental matters. • Increase in visual impact of development on the site, as viewed from various locations. • No potential for community and tourist enjoyment of the site and its natural features.	• Growth in local jobs. • Growth in regional industries supporting agriculture. • Potential for economic increases to the export industry (local and international).	• Intensity of land use likely to lead to further environmental impacts if not mitigated (erosion, sedimentation, creek crossings, cattle grazing). • Opportunity for limited site rehabilitation for habitat linkages to be strengthened and supported. • Potential for impacts to Threatened species.	species and significantly increased pressure on Threatened taxa. • Potential for significant decline in water quality affecting downstream WTWHA and GBRWHA values.

Of the alternatives to the project, that which is most reasonable and practical is the modification of the master planning described in the original concept presented in the IAS. This modification facilitates impact avoidance and maximises the potential benefits of the proposed KUR-World Integrated Eco-Resort. Following a series of studies the proposed KUR-World Integrated Eco-Resort development and master plan was optimised and finally assessed through the EIS process.

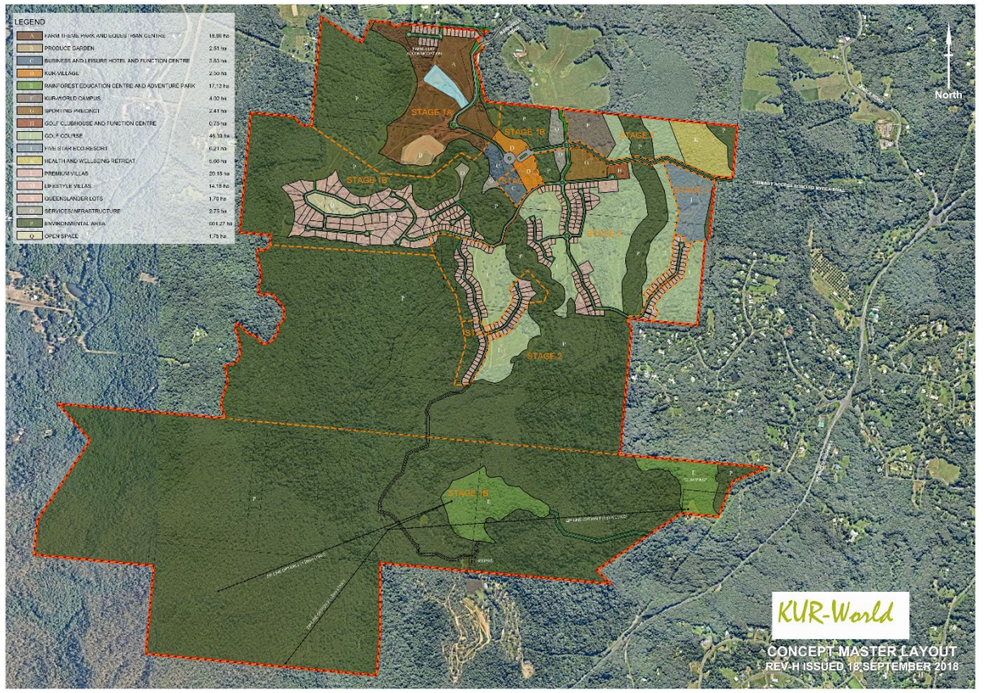
Significant alteration in the masterplan from the IAS to the EIS occurred with the intention to reduce the potential project-related environmental impacts. These alterations are evident through visual comparison between the masterplans from these documents with a description of the modifications presented in Table 19-11.

The alternate master plan presented in the EIS reduces the potential for unacceptable impacts spatially (that is extent) and temporarily (that is duration), on matters protected under state and commonwealth legislation as described in detail Chapter 8 and again discussed earlier in Chapter 19, as a function primarily of a significant reduction in the disturbance areas in comparison to the IAS.

The detailed investigations and assessments undertaken in the course of preparing the EIS have identified further alternates to the master plan. The alternates to the master plan involve reducing the area of disturbance together with rehabilitation of degraded areas (as described in Chapter 8 Section 8.7.3.3).

The adoption of these alternates will prove beneficial to matters protected under State and Commonwealth legislation, in comparison to the current plan, through a combination of a reduction of disturbance areas and the rehabilitation of degraded areas. The reduction in disturbance areas has an immediate as well as long term benefit; whereas the benefit of rehabilitation accrues as the rehabilitation tasks are completed.

Table 19-11: Project Design Refinements in Response to Environmental Impact Investigations

IAS Masterplan	2018 masterplan	
		The total developable area of KUR-World has reduced from 220 hectares in the IAS to about 157.33 hectares in the EIS, primarily in response to design changes implemented to avoid or mitigate potential impacts. Relocation of the KUR-World Campus and Sporting Facilities from the north-west of the site to the north-north east is one of the most significant refinements to the Project. This was undertaken to consolidate the more intensive urban elements of the Project to a location farther removed from verified habitat of *Litoria myola* (Kuranda Tree Frog) as well as improved access to reticulated service network infrastructure and primary road infrastructure. This Project refinement also serves to improve the walkability and functionality of the development by co-locating the campus with the service and retail functions of KUR-Village. The proposed golf course is another significant change, which has been refined from 18 holes and 65 hectares in the IAS down to a 12 hole golf course and 47.14 hectares (including Golf Club House and Function Centre Precinct) in the EIS, primarily in recognition of the environmental constraints of the site.

Aspect of Development	Defining Features	Aspect of Development	Defining Features	Comments
KUR-World Campus	7.5 hectares	**KUR-World Campus**	4.02 hectares	The KUR-World Campus Precinct has reduced in area by 3.48 hectares; predominantly due to the limited availability of land area adjacent the core urban centre of KUR-World i.e. a consequential refinement of the re-location of the KUR-World Campus.

IAS Masterplan		2018 masterplan		
	300 1-2 bedroom apartments		300 beds (comprising 300 student beds and 30 supervisor beds)	The accommodation capacity of the KUR-World Campus has decreased from up to 500 students in the IAS, to the accommodation of up to 300 students and 30 supervisors in the EIS. This refinement has been undertaken in response to market expectation for resident student population requirements and the traffic impacts of KUR-World Campus.
	2-3 storeys		Up to 5 storeys	The more constrained site area of the KUR-World Campus necessitated a more vertical built-form, which is considered in Chapter 6.2 – Visual Impacts.
	20 apartments per block		14 buildings	The number of anticipated KUR-World Campus buildings has reduced, primarily in response to the limited area of the KUR-World Campus Precinct in its new location and an increase in maximum building height. However, the draft Plan of Development (refer Appendix 2B) does not restrict the number of buildings.
Sporting Facilities	3.6 hectares	**Sporting Precinct**	2.41 hectares	The Sporting Facilities Precinct has reduced in area by 1.19 hectares; predominantly due to the limited availability of land area adjacent the core urban centre of KUR-World i.e. a consequential refinement of the re-location of the KUR-World Campus.
	Sports fields, outdoor court, covered training hall		Indoor and outdoor sport and recreation	The function of the Sporting Facilities Precinct remains unchanged.
Health and Wellbeing Medical Retreat	5.26 hectares	**Health and Wellbeing Retreat**	5.66 hectares	The area of the Health and Wellbeing Retreat Precinct has, through more detailed analysis of the environmental constraints, been identified as 5.66 hectares, which is an additional 0.4 hectares to that identified in the IAS.
	70 suites		60 suites	The area of the Health and Wellbeing Retreat Precinct has increased (through a more comprehensive understanding of environmental constraints) the accommodation capacity of the Health and Wellbeing Retreat has also reduced by 10 suites.

IAS Masterplan		2018 masterplan		
	Health herbal laboratory – bioresearch facility, clinic, facial/cosmetic treatments, body and health checks, herb garden		Clinical treatment facility, wellness treatment facility, meditation/yoga locations, reflection lagoon, Chinese herbal medicine treatments	The function of the Health and Wellbeing Retreat Precinct has remained largely unchanged, with the exception that the facility will involve, predominantly, holistic wellness practices. This refinement was driven by market expectation, that is to focus on "wellness" and limit the more traditional medical practices proposed under the IAS
Equestrian Centre and Farm Theme Park	2 hectares	**Farm Theme Park and Equestrian Centre**	18.96 hectares	The KUR-World Farm Theme Park and Equestrian Centre was proposed under the IAS as, predominantly, a residential estate for the horse enthusiast with an equestrian centre as the keystone attraction. Under the EIS the Farm Theme Park, in response to market expectation, has evolved as the primary experiential element of KUR-World and is proposed as a rural theme park attraction in its own right. The Precinct area is 18.96 hectares under the EIS, whereas in the IAS, the equestrian centre was located within an area of 2 hectares. The 16.96 hectare increase in area is predominantly offset by a 14 hectare reduction in area for Premium Villas.
	Covered equestrian area Stables, training and riding yards		Barnwell homestead, cattle yard, promenade, multi-media interactive spaces, historical displays, children's play area and petting zoo	In response to market expectation, the KUR-World Farm Theme Park and Equestrian Centre includes a range of additional facilities to that proposed in the IAS, including displays, activities and accommodation consistent with a rural theme park experience.
			Vehicle parking	
			Stables, arena and small scale food outlets.	
			Chapel and function centre	
			Classroom and farm stay accommodation, consisting of 110 beds	
			15 glamping tents	
	-	**Organic Produce Garden**	2.51 hectares	The Organic Produce Garden is a further Project refinement that is an extension of the KUR-World Farm Theme Park and Equestrian Centre experience and is intended to function as an organic showcase for Atherton Tablelands fresh produce.
			Café and restaurant	
			Interpretive displays and tours	

IAS Masterplan		2018 masterplan		
	-	**Queenslander Lots**	1.7 hectares	The Queenslander Lots Precinct is, essentially, the residual element of the Lifestyle Villas as originally proposed in the IAS as part of the Equestrian Centre and Farm Theme Park. The Queenslander Lots also provide transition from rural residential development to the north of the KUR-World site through to the more central urbanised elements of KUR-World.
			21 lots	-
			800m^2	
			Timber and tin "Queenslander" houses	
Lifestyle Villas	13 hectares	**Lifestyle Villas**	14.18 hectares	The location of Lifestyle Villa development is different in the EIS to that of the IAS, located to the south-west of that originally proposed and in a lower density form. The minimum lot size in the Lifestyle Villa Precinct in the EIS has increased from 600m^2 to 2,000m^2 i.e. lower density residential development is proposed. Both the locational and density refinements in respect to the Lifestyle Villas Precinct were made in consideration of the environmental constraints of the site.
	50 residential lots		56 residential lots	
	600m^2-2,000m^2		2,000m^2-4,000m^2	
		Open Space	Public parkland associated with lifestyle villas	
Premium Villas	34 hectares	**Premium Villas**	20.18 hectares	The Premium Villas Precinct is reduced in area by 13.82 hectares from that proposed in the IAS, including the removal of Premium Villas located to the immediate south of the Equestrian Centre and Theme Park.
	323 Premium Villa lots		288 Premium Villa lots 2 multiple dwelling lots	
	Approximately 600m^2 lots		Approximately 600m^2 lots (where not multiple dwellings)	
Golf Course	65 hectares	**Golf Course**	46.39 hectares	The Golf Course Precinct together with the Golf Course Club House and Function Centre Precinct has undergone the most significant refinement as part of the EIS process, with the golf course being reduced from an 18 hole course as proposed under the IAS, to a 12 hole course as proposed under the EIS. The total area of the Golf Course Precinct combined with the Golf Club House and Function Centre Precinct is reduced in area by 17.86 hectares.
	18 holes		12 holes	
	Club house with restaurant, spa and tennis court	**Golf Club House and Function Centre**	0.75 hectares	
			Clubhouse, function centre, restaurant, bar and tennis courts	
Central Village	0.8 hectares	**KUR-Village**	2.5 hectares	

IAS Masterplan		2018 masterplan		
	Plaza, restaurant, wine bar, day spa, amphitheatre, convention centre, Tropical food and produce gardens, weekly markets, viewing tower		Plaza, shops, restaurants, offices, amphitheatre, village style goods sales, viewing tower, vehicle parking	KUR-Village, the main activity centre of KUR-World has increased in area from 0.8 hectares in the IAS to 2.5 hectares in the EIS, in response to market expectation regarding the functionality of KUR-Village, including community feedback. The function of KUR-Village has changed in-so-much as it is located more central to the development and forms the eastern gateway to the KUR-World Farm Theme Park and Equestrian Centre.
Leisure and Business Resort	3 or 4 star	**Business and Leisure Hotel and Function Centre**	4 star	The area of the Business and Leisure Hotel and Function Centre has increased from 1 hectare in the IAS to 3.83 hectares in the EIS. This refinement has occurred in response to market expectation, led by a need for a function centre for conferences held at the hotel.
	1 hectare		3.83 hectares	
	270 rooms		270 apartment rooms	
	Restaurant, bar, swimming pool, resort amenities, child friendly adventure facilities		Function centre, swimming pool, bar and restaurant	
5 Star Eco Resort	13.1 hectares	**Five Star Eco-Resort**	6.21 hectares	The Five Star Eco-Resort Precinct has reduced in area by 6.89 hectares in the EIS as compared to the IAS. As a consequence of the reduction in area, the built form of the Five Star Eco-Resort comprises more dense development, with the introduction of apartment style accommodation as well as independent villas.
	200 villas		200 rooms/villas	
	2 storey		Up to 5 storeys	
	Day spa, restaurant, pools, chapel/function centre		Central lobby, function area, restaurants and a spa	

IAS Masterplan		2018 masterplan		
Rainforest Education Centre	1.8 hectares	**Rainforest Education Centre and Adventure Park**	17.13 hectares Note – Excludes area allocation for zip line.	The combined area of the Rainforest Education Centre and Adventure Park Precinct has reduced by 3.67 hectares through refinements as a consequence of the EIS process, with development primarily restricted to areas of non-remnant vegetation. This reduced area excludes consideration of the area required to accommodate the zip line that would have a maximum clearing area of approximately 1.5 hectares in the Environmental Area Precinct. The accommodation potential of the southern area of the project has also increased, in response to market expectation, and an additional 50 persons are proposed to be accommodated in the Rainforest and Education Centre and Adventure Park Precinct at any one time. Research laboratories associated with the Rainforest Education Centre in the IAS masterplan have been removed in response to market expectation.
	300 beds		350 persons (315 students and 35 supervisors)	-
	14 boarding cabins		Dormitory style cabins	
	Communal kitchens, function spaces, combined dining and multi-use lecture spaces		Communal buildings, education centre and function centre	
	Research laboratories		10 glamping tents	
Adventure Park	19 hectares		Walking, mountain biking, horse riding, quad bike tours and ziplining	
	High ropes, suspended bridges, zip lines, flying foxes, rope lappers			
Nature Based Activities	Horse riding, bush walking and hiking (area undefined)			

IAS Masterplan		2018 masterplan		
-	-	**Services and Infrastructure**	2.75 hectares	In addition to the allocation of 2.75 hectares of the site for reticulated services infrastructure a number of refinements were undertaken in response to the technical findings of the EIS, including: • Realignment of the proposed internal roadways to better navigate the natural terrain • Removal of swimming pools from the proposed KUR-World Campus and Student Accommodation to improve total water cycle management • Reduction in the footprint of the Five-star Eco-Resort, including the reduction in hard surface pavement and swimming pools
-	-	**Environmental Area**	501.27 hectares	The proportion of the site included in the Environmental Area Precinct has increased in the EIS version of the masterplan. The undeveloped part of the KUR-World site in the IAS masterplan is understood to have been in the order of 406 hectares in area.

Note – the areas in Table 19-11 do not exclude the areas of road reserve located on the KUR-World site and therefore the total area of all precincts exceeds the KUR-World site area of 648.3 hectares.
Note – in between the IAS and the EIS 20.8548 hectares of road reserve were closed on the KUR-World site, which included corrections to historically incorrect survey that, in addition to the absorption of the area of closed roads, changed the area of the lots adjoining the closed road reserves.

19.9 Socioeconomic Impacts

19.9.1 Economic Impacts

Chapter 11, Social & Economic Impacts, sets out comprehensively how the KUR-World project would contribute to economic development at local, regional, State and national levels and in particular in relation to the provision of local employment for both the Indigenous and non-Indigenous regional workforce. Although the development of the Kuranda Markets and the addition of Skyrail in the 1990s, have made Kuranda an important destination in its own right; notwithstanding this, the lack of overnight accommodation has left Kuranda with a higher proportion of part time work and unemployed people than the regional average (9.1%), with Indigenous people forming around 11.5% of the population and having a 38.2% unemployment rate. According to the Census data of 2016, most Kuranda residents (59%) work outside Kuranda, mostly in Cairns City and the northern beaches, while about 25% of the jobs in Kuranda are filled by Cairns' residents.

The project is expected to progressively add a number of new dimensions to Kuranda over the nine-year project development period:

1) A major increase in day trippers to the area at an average of about 1,400 a day representing about a 50% increase by 2027-28.
2) A major increase in overnight stay visitors over the nine-year period to about an average of 2,000 in 2027-28 compared with about 300 recorded in the 2016 Census; with many coming from Asian and other international countries.
3) Over the nine-year period, a substantial increase in employment located in the Kuranda area – more than doubling.
4) When account is taken of workers switching to local employment from commuting outside the Kuranda area to work, reduction in unemployment and under employment, a modest increase in population over the nine-year project development period by about 13% is predicted.

KUR-World therefore has the potential to substantially change the local economy, offering employment opportunities for both Indigenous and non-Indigenous residents, curtailing travel-to-work in Cairns and providing opportunities for local businesses. Impacts on the Cairns regional economy's Gross Regional Product, including Type 1 flow-on effects, over the projects 9 lead-in years are estimated to total about $2.4 Billion and be contributing, once fully operational in 2027-28, in the order of $350 Million a year. Regional employment generated during the build-up is estimated to total of the order of 24,000 job years and when fully operational in 2027-28 in the order of 3,700 jobs in the region.

Queensland-wide impacts would be substantially higher than this because of flow-on effects to regions down the coast and to Brisbane and the south-east corner. Addition to Queensland State Product (currently at about $320 billion a year), could be expected to be up around an order of magnitude figure of $400 million a year and employment generated including 'flow-on' could be expected to be around an order of magnitude figure in the State of about 4000 a year.

The location of a major accommodation establishment on the Tablelands, with regionally significant international visitor use, has long been a key ambition of the regional tourism sector and the wider community in Tropical Queensland. This is because it can be expected to have a significant positive impact on existing Tablelands tourism initiatives and businesses and to greatly stimulate the development of new product and attractions; adding a unique Tropical Australian Highland landscape to the Reef, Rainforest and Outback, as underpinning sub-regional destinations.

19.9.2 Social Impacts

As can be seen form the forgoing economic impact narrative, the KUR-World development will result in an increase in local jobs. However, it is likely that the resulting increase in local residential population will be

modest. This is because over half of local workers currently commute outside Kuranda and the increase in jobs created by the proposed development is smaller when compared with the current workforce residing in the area.

It is expected that a substantial part of the employment requirements can be met from the large pool of Kuranda residents who commute to Cairns and elsewhere switching to local employment which will not result in an increase in residential population. The opportunity to draw on currently unemployed, especially local Indigenous people will also be a focus of the proposed development. It will also require substantial part-time employment that can potentially be met by those currently under-employed in the existing population.

The population of Kuranda already exhibits a steady underlying growth rate and the development of KUR-World means that it can be expected that Kuranda will experience an increased residential population growth rate of about 2.5% per annum over the next 10 years, from about 4,800 to 6,200 (about 29%). One of the benefits from this expansion would be that most of the increase could be expected to be in younger and family age groups, leading to a more balanced community; as the Kuranda area currently has a high aging population (45 – 64 years) and a very low young population (15 – 29 years).

In relation to the key social issue of housing, median rents in the Kuranda area are relatively low, with the proportion with rents over 30% of income low (at 8%) compared with the Queensland proportion of 11.5%. The indications of rental stress are also low compared with the regional and State averages. Thus, the numbers who would be exposed to difficulties if there was a substantial rise in rentals is not large but more likely to be from the Indigenous community. A detailed accommodation/housing strategy prior to construction has been proposed prior to construction to ensure that the most current data is used in the analysis and mitigation strategy.

Although the additional workforce and population might have some Asian/Chinese component for language reasons, it is likely that the great bulk of the additional residents would have fairly typical Australian origins and pose few difficulties of adjustment into the existing community. Notwithstanding this, there would however, be some need for expansion of social infrastructure over the nine-year project development period including health facilities (KUR-World itself would help with this), law and order, education and child care.

In relation to education, the current pattern of many parents commuting to work outside Kuranda leads to placement of children in schools outside the Kuranda area, weakening the strength of local education delivery. Reduction of commuting and additional residential population was raised in the public consultation process as a positive for the strengthening of the standard of local education development.

In relation to transport services, the size of the community will still be such that most will use their own transport, and public services may not be viable. However, there is likely to be a need for transport services for overnight visitors from the resort to Kuranda township including increased taxi availability. There is also likely to be a small residential population located in the resort area but of a type that would not interact greatly with the general community.

Comments, feedback, suggestions and issues raised by the community were assessed by the stakeholder engagement team. The most significant concerns expressed in the stakeholder survey were:

- Protection of endangered species.
- Pesticides and fertilisers from golf course reaching the reef.
- Jobs offered to locals.
- Sediment and erosion measures.
- Water supply.

The only negative socioeconomic impact of KUR-World identified by some residents of the Kuranda district was the potential loss of its currently perceived character as a low-key residential community, with an

associated predominantly day-visitor destination that does not impact on this residential character due to lack of overnight accommodation.

19.9.3 Broader Impacts

In broad terms, the development of KUR-World would help to consolidate Queensland's position in the international tourism industry and facilitate Queensland in becoming the leading State in Australia for holiday visitors from China. At the national level, KUR-World has the potential to play a significant role in diversifying Australia's growing economic engagement with China; developing significant people to people contact in the tourism sector, as well as across a wide range of goods and services; and helping to foster bilateral social and cultural relations. The regional location of KUR-World will also help to consolidate the role of Far North Queensland in spreading the positive impacts of international tourism beyond major metropolitan centres, with benefits to the Red Centre and Top End tourism, linked by strong air services through the Cairns hub; as well as throughout regional Queensland.

19.10 Summary

There is some uncertainty in the potential for residual impacts (SRI) to the Kuranda Tree Frog, Australian Lacelid and Southern Cassowary. Notwithstanding this, the location of the impact renders an SRI to the Australian Lacelid unlikely. The mitigation of residual impacts and the avoidance of an SRI for the Kuranda Tree Frog and the Southern Cassowary can be achieved through the effective implementation of technical management plans and specifications. The necessary technical management plans and specifications, including species specific management plans, can be prepared based on existing knowledge and experience. In relation to the EMP (refer to Chapter 21), as some uncertainty exists regarding potential residual impacts for the Kuranda Tree Frog and the Southern Cassowary, additional consideration is given to the species-specific mitigation measures necessary to render an SRI unlikely. To this end, overarching and species-specific management measures to mitigate project related impacts have been identified and aligned with each phase of project delivery. This approach presents the most appropriate mode of project delivery to achieve the best-case outcome. The proponent is committed to adopting this approach.

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