

2017 Blacks Beach Local Coastal Plan

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BLACKS BEACH SUPPORTS PATCHES OF *CITICALLY ENDANGERED* BEACH SCRUB



BLACKS BEACH IS ONE OF THE

3 HIGHEST DENSITY MARINE TURTLE NESTING BEACHES IN THE MACKAY REGION



UP TO

584

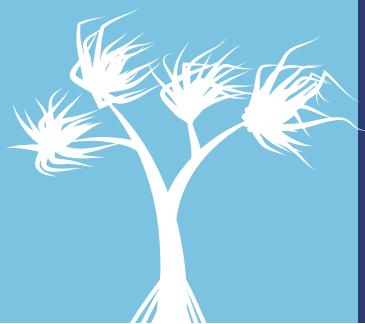


SHOREBIRDS AT ANY ONE TIME ARE RECORDED EACH YEAR USING THE FORESHORE TO REST AND FEED



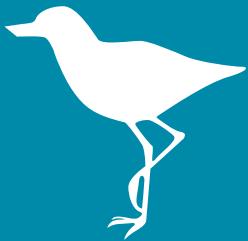
BLACKS BEACH IS **HIGHLY VALUED BY LOCALS AND VISITORS**, WHO LIKE TO ENJOY THE ENVIRONMENT AND ITS **NATURAL ASSETS**

COASTAL DUNE SYSTEMS PLAY A **CRUCIAL ROLE** IN THE ECOSYSTEM. VEGETATION IS CRITICAL TO DUNE FORMATION AND STABILISATION.

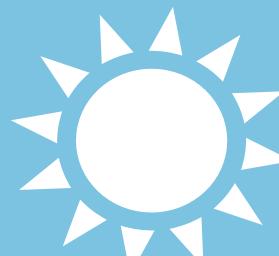
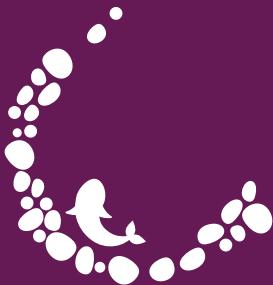


BLACKS BEACH AND BLACKS BEACH SPIT ARE BOTH **IMPORTANT INTERTIDAL ROOSTS**

FOR SHOREBIRDS IN THE MACKAY REGION



ENCOMPASSING LANDSCAPES AND PLACES OF GREAT IMPORTANCE TO ABORIGINAL COMMUNITIES IN THE MACKAY REGION AND MAY CONTAIN **MIDDENS, FISHTRAPS AND OTHER CULTURALLY SIGNIFICANT AREAS**



IT IS THE LONGEST CONTINUOUS STRETCH OF BEACH IN THE MACKAY AREA

14 ha
OF TARGETED WEED MANAGEMENT WORKS
FROM 2010 TO 2015



POPULAR
RECREATIONAL BEACH



>
REVEGETATION OF



4ha

OF FOREDUNES
(FROM 2010 –2015) TO SHIELD NESTING AND **HATCHING TURTLES** FROM LIGHT POLLUTION

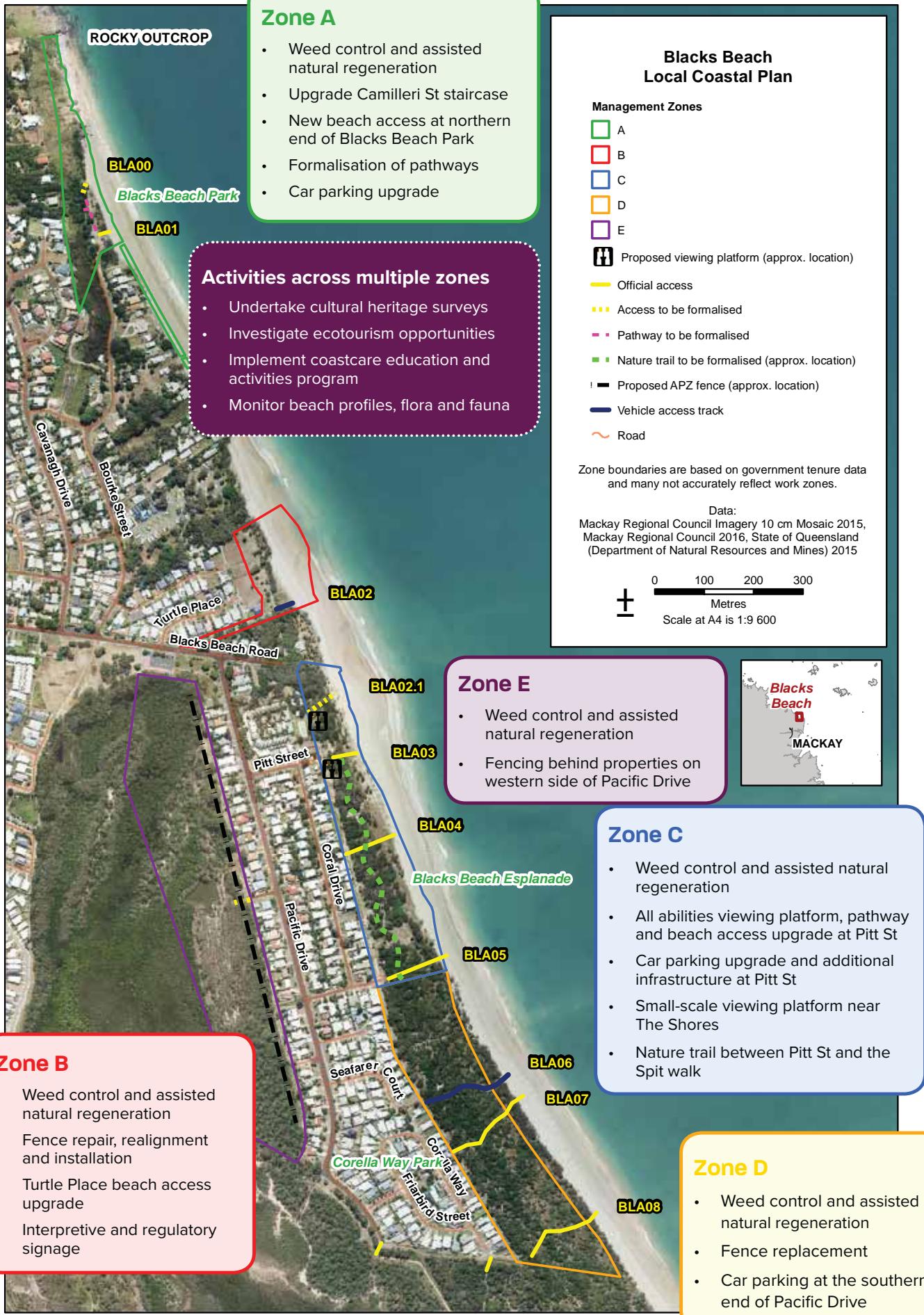


Figure 1: Visual summary of recommendations



Blacks Beach

1 Executive Summary

Blacks Beach is a popular recreational area for locals and visitors to our region. Council manages its coastal land at Blacks Beach through an integrated program of planning, on-ground works, monitoring and community engagement known as the Coasts and Communities Program. As part of this program, Coastal Management Guidelines have been developed to provide a framework for management decisions and activities for coastal land under Council's jurisdiction. Individual Local Coastal Plans, such as this plan for Blacks Beach, provide site-specific recommendations for individual beach units.

The *Blacks Beach Local Coastal Plan* describes the environmental and social values of the coastal unit, as well as the key threats and management issues. The Blacks Beach coastal unit supports rare and threatened species including migratory shorebirds, marine turtles and critically endangered beach scrub vegetation. Key pressures include the presence of non-native vegetation, the removal of native vegetation; waste dumping, erosion and climate change. Recommendations to manage these threats include weed control, revegetation, fencing and access management. Social values are also described and opportunities to improve recreational facilities and values have been identified, including additional beach accesses, linking pathways, interpretive signage and infrastructure such as bike racks and an all abilities access viewing platform.

Community engagement is recognised as a critical part of the success of on-ground works and opportunities for the community to learn about coastal ecosystems and get involved in management activities at Blacks Beach will be provided through the Coastcare program.

The activities recommended in this Local Coastal Plan will help protect and improve the condition of assets in the coastal unit, ensuring that best-practice management principles are implemented and on-ground activities are prioritised and undertaken in a coordinated and strategic way. This plan will

help attract additional funding to the region (including from State and Federal sources) to protect coastal resources and improve recreational opportunities for our community.

Key recommendations for this beach include:

- Construction of an all abilities beach access at the northern end of Blacks Beach Park.
- Upgrading the stairs leading from Blacks Beach Park to Camilleri Street as a recreational asset and to provide connection to Dolphin Heads.
- A pathway linking new beach access, the Camilleri Street stairs and the existing beach at the Bourke Street car park.
- Weed control across all zones, targeting major weeds including Guinea grass and lantana, and revegetation to assist establishment of native vegetation.
- Realigning fencing 15-20m landward from BLA02 access track and continuing fencing to the northern end of Zone B.
- A nature trail from Pitt Street linking to Blacks Beach Spit Walk.
- An all abilities access viewing platform adjacent to the Pitt Street beach access.
- Upgrades to the parkland at the end of Pitt Street including redesign of the car parking area and provision of additional park infrastructure.
- Realignment of the fencing location in Zone C between Pitt Street and Anglers Parade and provide privacy landscape treatment.
- Continuation of the Asset Protection Zone (APZ) behind properties on the western side of Pacific Drive, including the installation of fencing.
- Installation of regulatory and interpretive signage where appropriate.



2 Introduction

Council has a major role to play in the management of public coastal lands. Council is responsible for the public land along the coast including Esplanade, Reserves and Open Space areas. The *Coastal Protection and Management Act 1995* and associated *Queensland Coastal Plan* (DEHP 2013b) underpin coastal management in Queensland and along with multiple other pieces of State and Federal legislation and Council's own Local Laws and *Coastal Management Guidelines* (MRC 2012), direct the management of these public coastal areas.

The *Mackay Coastal Management Guidelines* (MRC 2012) recognise that the coast is characterised by a diverse range of natural features including: sandy beaches, rocky headlands, rainforest, woodland and grassland, extensive intertidal flats, and substantial areas of coastal wetland. The Mackay coastline is a dynamic and forever changing landscape, shaped and formed by a range of factors including: wave action, changing tides, predominant winds and human influences. Mackay also has a large tidal range that exceeds six metres (EPA 2004).

The Mackay region is prone to severe storm events and tropical cyclones that impact coastal areas causing localised erosion. After a storm some areas recover quickly. However, if there is not enough time for adequate recovery before another storm event, or if the coastline is a predominantly eroding coast, the erosion can accumulate altering the shape of the coastline over time.

Management options to improve the resilience of coastal areas to future storm events are available. Maintaining a sufficient buffer of vegetated dune or other coastal ecosystems, such as mangrove acts to bind and retain sediment in coastal areas. The *Mackay Coast Study* (EPA 2004 p.4) describes the need to protect coastal areas not only for their importance as assets to tourism and recreation, but also as the maintenance of wide sandy beaches and well vegetated dune systems as it provides a natural barrier to storm wave energy and protects inland areas against extreme water levels. Effective coastal management can therefore be viewed as a risk mitigation strategy.

Within the region, development has occurred in some areas that are prone to erosion (EPA 2004). Some areas are already seeing changes in their local coastlines. With future predicted increases in sea level rise and more extreme weather events including cyclones, there is an increasing need to forecast the impact on coastal areas and plan effective, achievable action for protection of coastal values, including:

- The safety and longevity of communities - this includes property, infrastructure and services required for healthy communities.
- Meeting of recreational needs - many locals and visitors utilise coastal areas for activities that add to their health and fitness, provide relaxation and offer opportunities to enjoy nature.
- Continuity of economic services - fisheries and tourism rely heavily on healthy and attractive coastal areas.
- Environmental values – the provision of ecosystem services relies upon healthy coastal vegetation communities and natural environmental processes. Marine turtles and shorebirds require sandy beaches and dune systems for nesting and feeding and many other native flora and fauna require coastal areas for habitat and food.

Adaptation options for coastal areas need to be well considered to ensure the region as a whole is best placed for the future. Maladaptation can occur when proper planning and best science are not incorporated into decision-making processes.

Council manages coastal areas through an integrated program of planning (i.e. Local Coastal Plans, formerly Beach Plans), on-ground works, monitoring and community engagement known as the *Coasts and Communities Program* (Figure 2). The *Coasts and Communities Program* is a joint initiative of Council and Reef Catchments, funded through Council's *Natural Environment Levy* and Australian Government *National Landcare Programme*. The aim of this program is to



protect coastal ecosystems in the Mackay region and, where opportunities exist, restore these areas to enhance their biodiversity values, whilst allowing for appropriate recreational access and use. Visit www.mackay.qld.gov.au/environment/coasts for more information on the program.

This Local Coastal Plan is an update of the *Blacks Beach Beach Plan*, which was adopted in 2010. The 2010 Beach Plan identified key pressures affecting the coastal unit. Since then, strong emphasis has been on the protection, conservation, rehabilitation and management of the coastal unit and its biological diversity. Actions from the 2010 Beach Plan implemented over the last five years include:

- Weed control and revegetation along the foredunes and surrounding reserve areas.
- Installation of post and rail fencing along the majority of the beach unit.
- Establishing and/or improving beach access points.

These works were undertaken to improve habitat connectivity and support dune systems to increase their resilience to natural processes including storm events. The post and rail fence protects fragile ecosystems and directs pedestrians to designate a beach access track.

The objectives of this updated Local Coastal Plan are to:

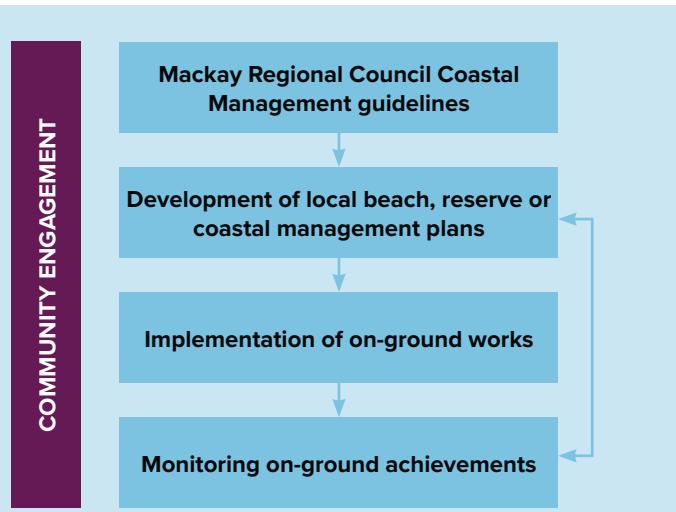
- Identify the values and pressures in the coastal unit.
- Develop strategies to guide the long-term protection of the natural coastal environment of Blacks Beach.
- Identify recreational opportunities within the coastal unit.

Council is committed to ensuring that communities are well informed throughout the process of review and implementation.



Mackay Coasts and Communities Program implementation model

Figure 2: Mackay Coasts and Communities Program Implementation model



2.1 STATUTORY OBLIGATIONS



FEDERAL GOVERNMENT

➤ *Biosecurity Act 2015* provides management principles for diseases and pests that may cause harm to human, animal or plant health or the environment, and for other related purposes.

➤ *Environmental Protection and Biodiversity Conservation Act 1999* provides a high level of protection for Matters of National Environmental Significance (MNES). In particular it provides protection for important populations of migratory species.

➤ *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* provides for the preservation and protection of areas and objects in Australia and in Australian waters that are of particular significance to Aboriginals in accordance with Aboriginal tradition.



INTERNATIONAL AGREEMENTS

➤ *China and Australia Migratory Bird Agreement (CAMBA)*, the *Japan and Australia Migratory Bird Agreement (JAMBA)*, and the *Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)* provide for conservation of shorebirds (waders) across the migratory flyway for these species.



STATE GOVERNMENT

➤ *Land Act 1994* provides for the designation of the reserves and assignment of Trustees for the protection of environmentally and culturally valuable and sensitive areas and features.

➤ *Recreation Areas Management Act 2006* provides for the establishment, maintenance and use of recreation areas; and aims to coordinate, integrate and improve recreational planning, recreational facilities and recreational management for recreation areas.

➤ *Vegetation Management Act 1999* provides management principles for vegetation within Queensland.

➤ *Coastal Protection and Management Act 1995* (Coastal Act) provides a comprehensive framework for the coordinated management of the Queensland Coast, and establishes the Queensland Coastal Plan 2012 as the primary statutory instrument under the Coastal Act.

➤ *Nature Conservation Act 1992* provides management principles for wildlife within Queensland.

➤ *Native Title (Queensland) Act 1993* identifies the presence of Native Title over land.

➤ *Land Protection (Pest and Stock Route Management) Act 2002* provides the regulatory basis for control of pest species. In particular the Act classifies pest species and provides obligations for landholders.

➤ *Fisheries Act 1994* provides protection for marine plants including mangroves and saltmarshes, and provides the regulatory environment for control of recreational fishing activities.

➤ *Sustainable Planning Act 2009* provides the regulatory background for the development of planning schemes.

➤ *Environmental Protection Act 1994* regulates environmentally relevant activities, including release of emissions on land, air or water and noise.

➤ *Marine Parks Act 2004* regulates use of Marine Park to protect marine environment.

➤ *Waste Reduction and Recycling Act 2011* provides regulatory regime for management of litter and illegal dumping.

➤ *Queensland Coastal Plan 2012* provides policy guidance to coastal land managers including best practice coastal management principles which support the development of local management plans.



including ensuring that they are under effective control and requiring removal of faeces in a public place.

➤ *Coastal Management Guidelines 2012* provides a framework for management decisions and activities for land under Mackay Regional Council jurisdiction in the coastal zone.

➤ *Mackay Regional Council Planning Scheme Open Space Strategy No. 12* outlines Mackay Regional Council's commitment to provide a balanced

mix of public open space that in turn will provide for a range of active and passive recreational opportunities for the community.

➤ *Reef Guardian Council Program* Recognises Council's commitment to protect, conserve and enhance the values of the Great Barrier Reef for future generations through effective and responsible land-based management practices. The *Coasts and Communities Program* is a key initiative under this program.

Figure 3: Regulatory Framework

3 Coastal Unit Description

Blacks Beach is located approximately 11km north of Mackay. It is the longest continuous stretch of beach in the Mackay area (EPA 2004) and stretches four kilometres from Dolphin Heads in the north to McCreadys Creek in the south (Figure 4). The coastal unit extends 3.1 km and encompasses the rocky outcrop in the north to the end of Corella Way. The area north of the rocky outcrop falls under a separate management plan (*Eimeo Beach Plan*), as does the area south of Corella Way (*Blacks Beach Spit Management Plan*, herein referred to as the Spit).

The coastal unit is divided into five zones based on common management values and issues. Zone A begins at the rocky outcrop and ends at the southern extent of 40 Bourke Street and includes Blacks Beach Park. Zone B begins approximately 100m north of Turtle Place and ends at beach access BLA02. Zone C begins at Blacks Beach Road and continues to Anglers Parade and Zone D covers the remaining reserve area from Anglers Parade along the southern end of Corella Way. Zone E is to the west of Pacific Drive (Figure 1).

Blacks Beach is a residential suburb with large areas of Freehold tenure, Reserve tenure and Esplanade (Figure 5). Council managed land includes 32.9 ha of Reserve tenure and 2.8 ha of Esplanade. Areas are zoned for Urban and Higher Density Residential development, Special Activities, Open Space, Esplanade and Rural use (Figure 6). Limited area is zoned for Commercial use and Public purpose. Within the coastal unit, some Freehold properties directly border the coast without an Open Space or Esplanade buffer. Blacks Beach is an area of future growth, with a number of new residential subdivisions proposed and a towards high density development in some areas. Future management of the coastal unit, including preservation of the coastal strip, needs to be carefully considered to account for the impacts of population growth.

The northern end of the coastal unit is wave exposed, widening to intertidal sand flats towards McCreadys Creek mouth (Short 2000). A seawall has been built in front of beachfront properties along the central and northern sections of the beach and is located within Freehold tenure. The seawall also extends onto Reserve and Esplanade tenure in some locations.

The northern section of Blacks Beach generally consists of properties zoned as Special Activities, with Freehold tenure extending to the beachfront in some areas (Figures 5 and 6). Coastal frontage along the southern end of Blacks Beach is Reserve tenure correspondingly zoned as Open Space.

Despite the erosion in parts of Blacks Beach, sand is accreting and new parabolic dunes are forming adjacent to the Turtle Place beach access.

The southern end of the coastal unit flows into the Spit, and contains an extended area of tidal flats with rich benthic communities. The area is considered Essential Habitat (EH) for critically endangered species including the mangrove mouse (*Xeromys myoides*) and beach stone-curlew (*Esacus*

magnirostris), and is known to provide flatback turtle (*Natator depressus*) nesting area (Figure 18). The Spit is zoned as Open Space under the management of Council. It is a high value recreational and environmental area that contains significant remnant vegetation.

Common vegetation communities within the coastal unit, especially on parallel dunes along the beachfront, are *Melaleuca* spp. and *Corymbia tessellaris* open forest with beach scrub species. Its sandy shoreline is distinguished by tussock open grassland and the intertidal margins of McCreadys Creek support salt pans and mangroves ecosystems (Table 1). Weed incursion in the northern rocky headland has resulted in the degradation of native vegetation and invasive species like prickly pear (*Opuntia* sp.) and guava (*Psidium guajava*) have colonised (EPA 2004). Common weeds such as Guinea grass (*Megathyrsus maximus*) and lantana (*Lantana camara*) persist throughout the coastal unit.

The recreational value of the coastal unit is high where activities enjoyed include cycling, running, walking, swimming, kayaking and picnicking. Blacks Beach is a small, family-oriented community with a natural recreational focus. A number of local, district and linear parks as well as Open Space Reserves are located within the coastal unit. Two parks, Blacks Beach Park and Corella Way Park provide a range of facilities including shade, seating and play equipment.

Blacks Beach Bushfire Management Plan (Kleinfelder 2015) provides a concise determination of the potential bushfire risk to human life and assets. It identifies assets at risk of bushfire impact and provides land management and emergency response information to Council and the community to prioritise suitable treatment options. Council has provided an Asset Protection Zone (APZ) between Freehold tenure and the Reserve. This zone forms a significant fire mitigation measure and is also set aside for the use of emergency services and Council maintenance vehicles.

The Mackay region is inshore from the Great Barrier Reef and activities must comply with the regulatory zoning conditions introduced by the Great Barrier Reef Marine Park Association (GBRMPA) in 2004. Marine Park zoning is an important component of managing marine areas (GBRMPA, 2011). The area offshore from Blacks Beach is within a Conservation Park (yellow) Zone (See Figure 7). The Conservation Park (yellow) Zone allows for increased protection and conservation of the area, while providing opportunities for reasonable use and enjoyment, including limited extractive use. For additional details regarding restrictions in the Conservation Park (yellow) Zone, please visit the GBRMPA website: www.gbrmpa.gov.au



Figure 4: Extent of Blacks Beach coastal unit



Figure 5: Land tenure at Blacks Beach



Figure 6: Planning scheme zonation at Blacks Beach.

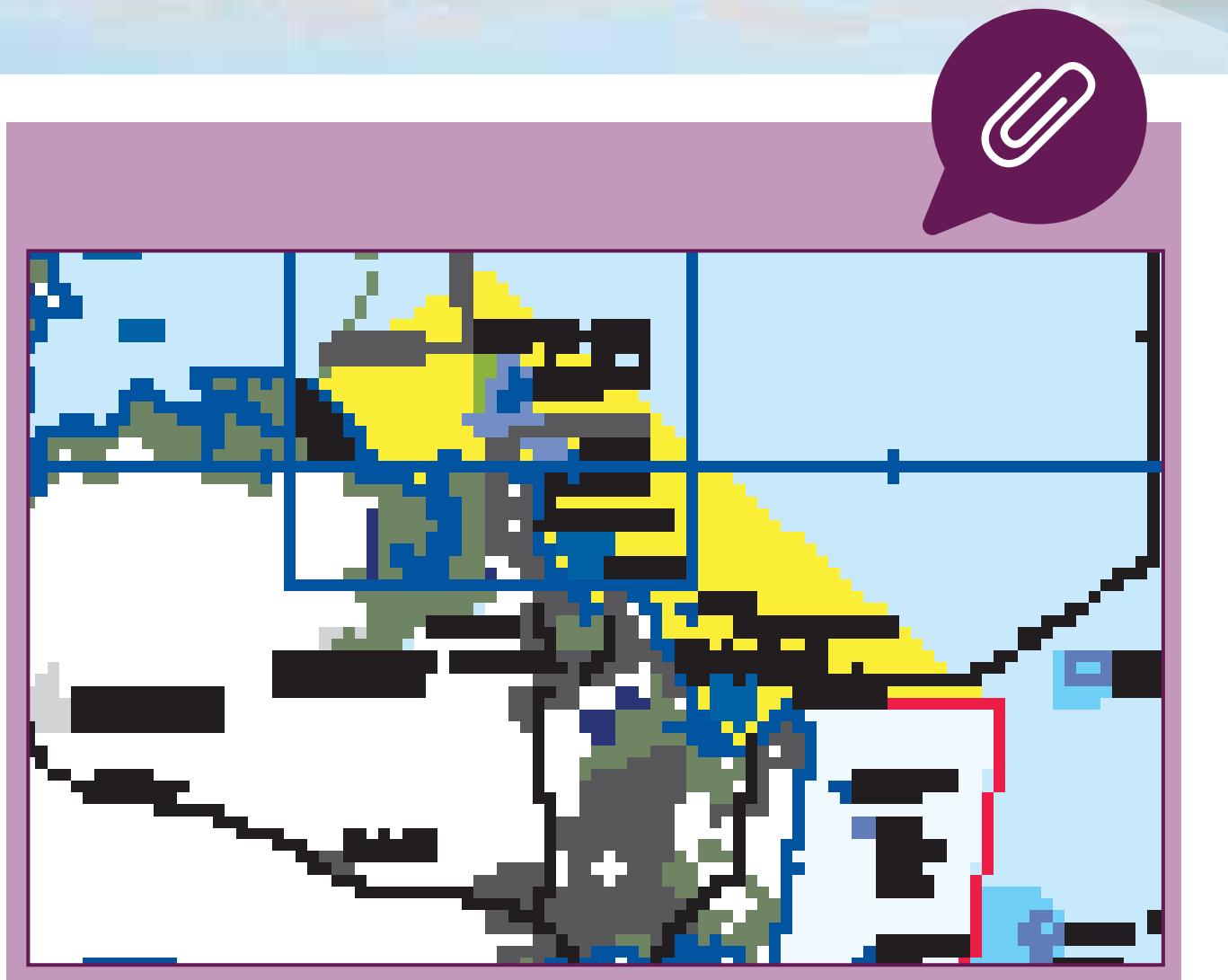
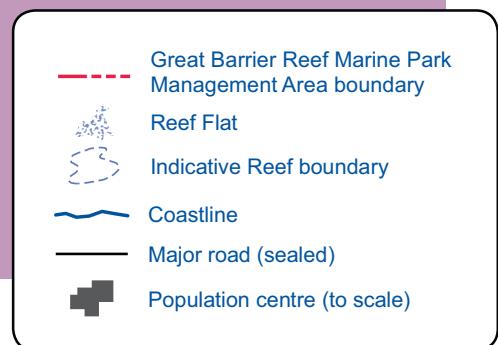


Figure 7: GBRMPA Zoning – Excerpt from the GBRMPA Zoning Map 12 (GBRMPA, 2011), indicating the extent of the Conservation Park (yellow) Zone offshore of Blacks Beach



Blacks Beach





4 Environmental Values and Management Issues

The coastal unit has been extensively modified with only 15.5 ha of coastal vegetation falling within the boundaries of Council managed land. Although small in size, these tracts of remnant vegetation contain significant Regional Ecosystems (REs) and provide important corridor linkages across the Mackay landscape. These ecosystems are valuable not only in their own right; but as habitat for native fauna. The area's natural environment sustains important marine and terrestrial life and support wildlife populations of Regional, State and National Significance. In addition, the ecosystems are important in maintaining natural processes and providing ecosystem services to the region. Carbon storage, water filtration, climate regulation, stabilisation of the shoreline, nutrient cycling and scenic and recreational values constitute just a few examples of the ecosystem services that these areas provide to the local community.

This section outlines the distribution and significance of coastal vegetation and wildlife in the Blacks Beach area and

its environmental values. The major threats and management issues relevant to the environmental values will also be discussed, including dune systems and erosion processes.

4.1 VEGETATION

The vegetation component of this plan considers three important facets that define the integrity and condition of vegetation in the coastal unit.

Remnant vegetation is the historical vegetative cover of an area and is captured within official Regional Ecosystem (RE) mapping. It includes both woody and non-woody vegetation and is dominated by species characteristic of the vegetation's undisturbed canopy. Remnant vegetation is distinguished by the dominant canopy having greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum (Queensland Government 2016).

Vegetation zonation is the sequence of different vegetation communities or zones that occur along a coastline. The zones reflect changes in the nutrient and moisture content of dune soils which increase in a landward direction, as well as changes in the degree of exposure to strong winds, salt spray and sandblast which decrease in a landward direction (DEHP 2015). When vegetation communities are heavily disturbed, for example by weed encroachment or mowing, vegetation zonation and succession is inhibited.

Non-native vegetation is discussed in terms of the weed species that are present and may require management.



4.1.1 Remnant vegetation

Remnant vegetation is mapped at a scale of 1:100,000 by the Queensland Government for legislative and management purposes (Queensland Government 2016). Regional Ecosystems (REs) are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. REs describe each vegetation community and list both the Biodiversity Status and the Vegetation Management Class of each (Table 1). The Biodiversity Status is determined based on an assessment of the amount of an RE remaining (as a percentage of its historic range) and its condition and is used to determine the Vegetation Management Class, under the *Vegetation Management Act 1999*. A RE is listed as Endangered, Of concern or No concern at Present/Least concern based on these factors. It is important to note that RE mapping provides no indication of the current condition of this vegetation at the local scale.

The importance of coastal vegetation includes, but is not limited to:

- Native dunal vegetation can provide a significant refuge and source of food for local and migratory fauna species.
- Existing native dunal vegetation provides a seed bank for future generations of vegetation, thus protecting the natural biodiversity of the area.
- Native dunal grasses and groundcovers, facilitate dune growth by colonising and trapping windblown sand and preventing its escape from the beach system.

In coastal areas, vegetation can be scorched by high temperatures and salt, as well as abraded by windblown sand. Species that can withstand these effects can actually benefit from onshore winds by intercepting wind-borne nutrients from the sea. These nutrients are deposited on the leaves of coastal plants and washed into the sand by the first showers of rain, thereby introducing nutrients to the system and allowing less hardy species to colonise the coastal area (Gold Coast City Council 2007).

In Queensland, approximately 80% of people live on the coast (DEHP 2013). As a result, remnant coastal vegetation is often fragmented and subject to high levels of disturbance (Caton and Harvey 2010). Coastal development characteristically results in a loss of coastal vegetation since it often facilitates disturbance throughout the coastal zone and/or mowing and clearing areas of vegetation for recreation. Coastal vegetation remnants, however, remain a critical part of the landscape providing important ecosystem services, habitat corridors, and recreational values (Figure 8).

General principles for the conservation of remnant vegetation include:

- Controlling weeds to allow native species to regenerate.
- Discouraging the dumping of garden and general waste.
- Replanting areas adjoining remnant vegetation patches with native species, to build a buffer between the core vegetation and adjacent land uses.
- Controlling activities such as four-wheel driving, foot and vehicle traffic (Nordstrom *et al.* 2000).

The largest stand of remnant vegetation remains at the southern end of Blacks Beach extending into the Spit. The vegetation is predominantly *Corymbia tessellaris* open forest with beach scrub on parallel dunes (RE 8.2.6a) (Table 1 and Figure 8). Approximately 2.5 ha of microphyll vine forest on coastal dunes (commonly known as beach scrub, RE 8.2.2) occurs in this area on Reserve tenure and is listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999*. Key threats to this community include inappropriate fire regimes, weed invasion, impacts of coastal development and recreational use. Appropriate fire regimes are required to maintain native vegetation communities. Fire management for the coastal unit should follow the recommendations of the *Clark Connors Range Fire Management Guidelines* (Appendix 1).

Although not mapped as remnant, natural vegetation occurs on the dune and estuarine system along the length of Blacks Beach. This vegetation plays a critical role in shoreline stabilisation, natural erosion and accretion processes, and buffering the terrestrial environment from winds and storm tides. Vegetation along the length of the beach is predominantly *Casuarina equisetifolia* open forest, with coastal grasses and vines as a ground layer, on foredunes (RE 8.2.1).

Other remnant vegetation communities within the coastal unit include tussock grassland (RE 8.12.13a) on the northern rocky outcrop on Esplanade and Reserve tenure and *Melaleuca spp.* woodland (wetlands) (RE 8.2.11) occurring along the length of coastal unit. Mangrove and saltpan communities (RE 8.1.1 and RE 8.1.2) occur on the western margin of the Spit on Reserve tenure.

RE 8.1.1, RE 8.1.2, RE 8.2.6, RE 8.2.13a and RE 8.12.13a also exist on freehold title within the coastal unit. As these vegetation communities play a vital role in maintaining ecological health and resilience it is hoped that this Local Coastal Plan encourages Freehold property owners to continue to protect and enhance these ecological communities for the benefit of Blacks Beach, its residents and its visitors. REs found on Council managed land within the Coastal unit are further described in Appendix 2.

Table 1: Remnant Vegetation (RE) communities of the Blacks Beach coastal unit.

Regional Ecosystem (RE)	Short description	Approximate area in hectares (ha) on Reserve and Esplanade tenure	Vegetation Management Act status	Biodiversity status	Environment Protection & Biodiversity Conservation Act status
8.1.1	Mangrove vegetation of marine clay plains and estuaries (estuarine wetland)	3.6 ha (shared with 8.1.2)	Least concern	Not of concern at present	n/a
8.1.2	Samphire open formland to isolated clumps of forbs on saltpans and plains adjacent to mangroves (estuarine wetland)	3.6 ha (shared with 8.1.1)	Least concern	Of concern	n/a
8.2.1	<i>Casuarina equisetifolia</i> woodland and/or sparse hermland to open scrub on foredunes and beaches	Disturbed	Of concern	Endangered	n/a
8.2.2	Microphyll vine forest on coastal dunes.	2.5 ha	Of concern	Endangered	Critically endangered
8.2.6a	<i>Corymbia tessellaris</i> +/- <i>Acacia leptocarpa</i> +/- <i>Banksia integrifolia</i> +/- <i>Melaleuca dealbata</i> +/- beach scrub species open forest on coastal parallel dunes	18.9 ha (shared with 8.2.11)	Of concern	Of concern	n/a
8.2.11	<i>Melaleuca</i> spp. woodland in parallel dune swales (wetlands).	18.9 ha (shared with 8.2.6a)	Of concern	Of concern	n/a
8.2.13a	<i>Melaleuca</i> spp. and/or <i>Corymbia</i> spp. and/or <i>Lophostemon suaveolens</i> and/or <i>Acacia</i> spp. open forest on dune sands mixed with alluvial material +/- marine sediments	0.8 ha	Endangered	Endangered	n/a
8.12.13a	Tussock grassland, or <i>Xanthorrhoea latifolia</i> shrubland, including areas recently colonised by <i>Timonius timon</i> var. <i>timon</i> shrubland, volcanics	0.8 ha	Of Concern	Of Concern	n/a



Opportunities exist to protect and enhance the native vegetation throughout the coastal unit, mostly via weed control and the landward offset of the post and rail fence to allow natural regeneration. Succession planning of old trees in parklands would ensure that the natural and recreational values (shade etc.) of these trees are sustained. Educating Freehold tenure property owners on tree succession planning would also be beneficial to ensure longevity of tree cover in the area as a whole.

Vegetation restoration will enhance the complexity of vegetation zonation, increase the environmental value of the area, reduce impacts of artificial lighting on turtle hatchlings and act as a buffer against wind, salt and extreme weather events. Additional native vegetation will also provide habitat for local fauna.

In areas where the native vegetation remains largely intact, the approach to be taken will be one of assisted natural regeneration. By controlling weeds and limiting disturbance,

natural recruitment of dunal species will occur and large-scale revegetation will generally not be required. Small-scale supplementary planting may be undertaken in these areas to enhance vegetation complexity and to replace removed weed species. In areas where natural recruitment is not occurring (for example, due to mowing), or where vegetation has been cleared, revegetation will be used as a technique to restore and enhance native vegetation.

All revegetation activities should follow the coastal revegetation principles as documented in Appendix 3 and include species from the recommended species list provided in Appendix 4. The species selected for revegetation at any particular location will ultimately depend on current and pre-clearing RE mapping and site specific conditions such as aspect, topography, existing vegetation, soil condition and the availability of appropriate plants.





Figure 8: Remnant Vegetation at Blacks Beach



Figure 9: Remnant beach scrub vegetation

4.1.2 Vegetation zonation

A key feature of dune vegetation is the sequence of different vegetation communities that occur with increasing distance landward. Typically, this involves a gradual transition from bare sand, to ground cover, to open forests or woodlands (DEHP 2015a). Zonation processes are those which facilitate this progression, and are discussed in this Local Coastal Plan as recruitment and colonisation. Natural zonation refers to what is effectively a normally behaving ecosystem, where recruitment and colonisation can occur unhindered over natural gradients (Figure 11). Along Blacks Beach however, these processes are in some areas hindered by weed incursion, mowing and seawalls (Figure 10).

The southern end of the Blacks Beach unit (south of Anglers Parade) maintains the full complex of dune zonation with linear stands of *Casuarina equisetifolia* open forest to woodland (RE 8.2.1) and tussock grassland (RE 8.12.13a), transitioning to *Melaleuca spp.* woodland (RE 8.2.11) and *Corymbia tessellaris* open forest with patches of beach scrub on parallel dunes (8.2.2) (Figures 8 and 11). The condition of parts of this remnant vegetation is reduced owing to inappropriate

access, disturbance, erosion and dense stands of non-native vegetation.

Native vegetation has been removed in some areas where residential areas border Reserve and Esplanade tenures, and dunal areas have become an extension of adjacent lawns and gardens (Figure 12). This detrimentally effects zonation processes as it inhibits establishment of young seedlings and prevents native vegetation recruitment. This, as well as the introduction of non-native vegetation, has resulted in a sparse scattering of mature trees, with no younger recruits. Clearly defined boundaries will reduce the extent of maintained lawns, private gardens and belongings in Esplanade and Reserve tenure and will allow vegetation zonation to be reinstated.

The establishment of turf and the mowing of vegetation suppresses the growth of the sand dunes (height and width), and inhibits their capacity to act as long-term sand reserves. The absence of sand-trapping vegetation causes sand to be lost from the system and the natural, dynamic system of sand movement is therefore disrupted (Gold Coast City Council 2007).



Figure 10: Where rock walls are present along Blacks Beach the capacity for natural dune zonation has been removed



Figure 11: Natural dune zonation colonised by beach (*Spinifex sericeus*) and coastal she oak (*Casuarina equisetifolia*)



Figure 12: Adjacent residential properties extending their gardens into Reserve tenure

Tertiary vegetation

Taller shrubs and trees further elevate the wind and provide protection for inland plants, animals and property.

Secondary vegetation

Shrubs and small trees help to stabilise the foredune and deflect the wind up and over the foredune.

Primary vegetation

Grasses and creepers colonise lower parts of the beach and trap sand particles with their roots.

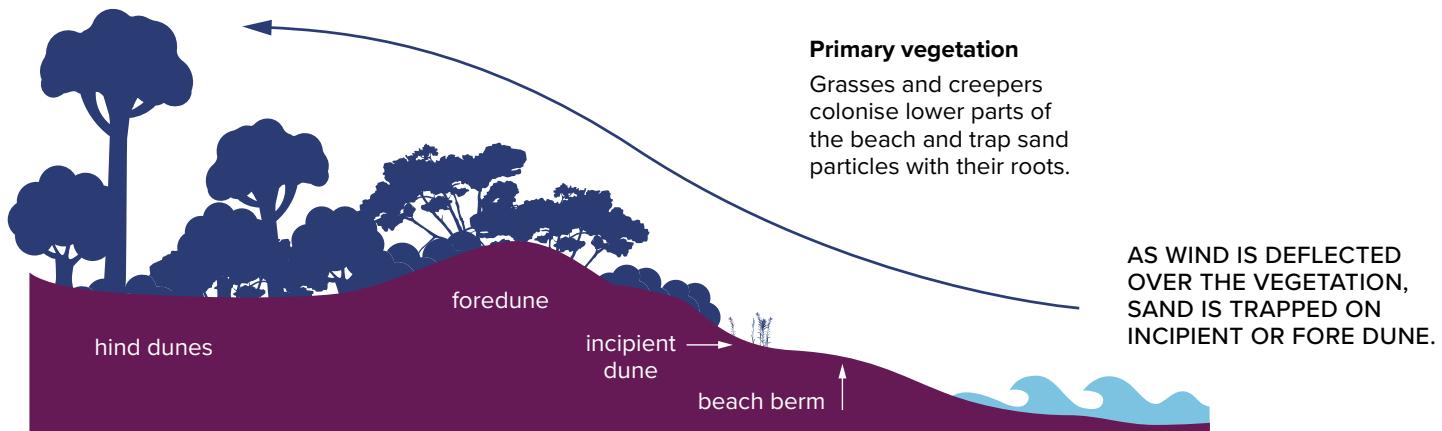


Figure 13: Role of dune vegetation

4.1.3 Non-native vegetation

The presence of non-native vegetation can be detrimental to the function of the dunal environment. Non-native vegetation can displace native dune vegetation due to its ability to grow aggressively, smother native species, and compete for available nutrients. Transformative weeds such as Guinea grass and lantana can also increase fuel loading and fire intensity.

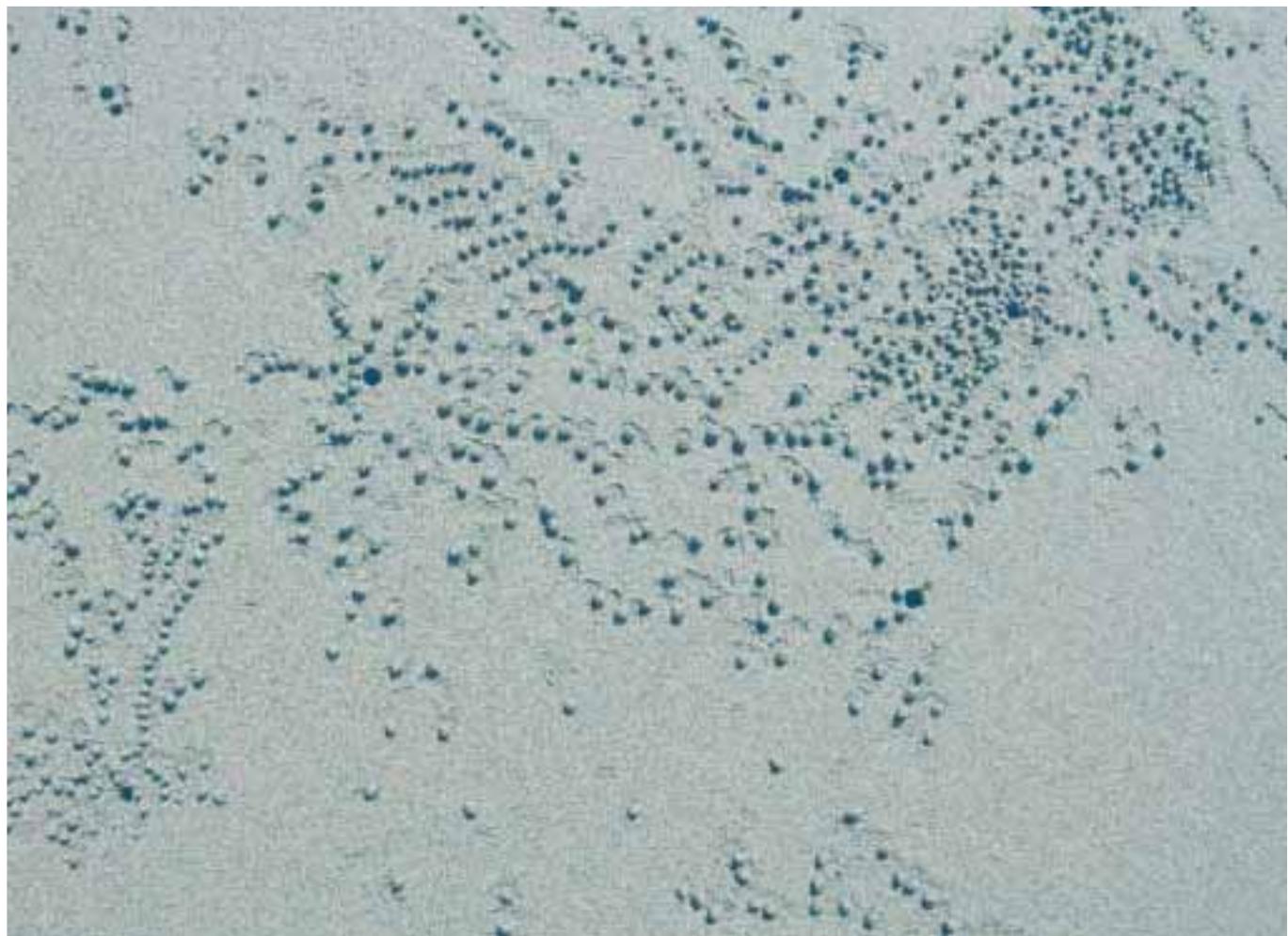
It is important to note that while not all weeds require immediate removal due to low impacts on native species, under the *Biosecurity Act 2014*, the Council and local community have a general biosecurity obligation to take reasonable and practicable steps to minimise the risks associated with invasive plants and animals under their control. This legislation was put into force on 1st July 2016, and changes the classifications of weed species from what has been discussed in earlier beach plans. Subsequently, weeds will now be discussed in terms of:

- **Declared weeds** are described as species that have, or could have, serious economic, environmental or social impacts (DAFF 2013a). Declared weeds recorded at Blacks Beach include lantana (*Lantana camara*) (Figure 14), mother-of-millions (*Bryophyllum spp.*) (Figure 15), Singapore daisy (*Sphagneticola trilobata*) and prickly pear (*Opuntia stricta*) require action for removal under the *Land Protection (Pest and Stock Route Management) Act 2002*.
- **Environmental weeds** are described as those that can cause major modifications to natural ecosystem function. These species are capable of outcompeting native vegetation and in some cases, have the potential to increase fuel loads in coastal ecosystems largely sensitive

to fire (DAFF 2013b). Environmental weeds for removal at Blacks Beach include, but are not limited to Guinea grass (*Megathyrsus maximus*), leucaena (*Leucaena leucocephala*) and molasses grass (*Melinis minutiflora*). Leucaena and Guinea grass are thriving and threaten remnant vegetation in disturbed areas at the northern end of the beach (Figure 14 and 16).

- **Locally significant weeds** are those that impact natural processes at a local scale. Locally significant weeds within the Blacks Beach coastal unit include beach evening primrose (*Oenothera drummodii*) and Century plant (*Agave spp.*). Beach evening primrose is a new emergent herbaceous species at Blacks Beach.
- **Non transformative/nuisance weeds** are problematic on a local scale and should be managed on a case-by-case basis. A multitude of herbaceous weeds and garden escapees result from the close proximity of coastal Reserve areas to residential zones and include snake weed (*Equisetum spp.*), mother-in-law's tongue (*Sansevieria trifasciata*) (Figure 17), sensitive weed (*Mimosa pudica*), painted spurge (*Euphorbia cyathophora*), cobblers peg (*Bidens pilosa*), Seaforth burr (*Cenchrus echinatus*), corky passionflower (*Passiflora suberosa*) and pink periwinkle (*Catharanthus roseus*).

Council recognises that some community members may value coconuts (*Cocos nucifera*) for their aesthetic appeal. The removal of coconuts from recreational and parkland areas is beyond the scope of this plan. However, adult and juvenile coconuts that occur within areas managed for environmental purposes will be removed in accordance with



the coastal weed control principles (Appendix 5). Removal will be undertaken in a staged manner. Coconuts can be a significant risk to pedestrians, increase fire risk and intensity through the accumulation of vegetative waste and smother native vegetation preventing regeneration. It is a common misconception that coconut trees assist foredune stability, however their root system is very shallow and is easily undermined by high waves.

It is recommended that weed management continues throughout the coastal unit and this, together with revegetation activities to replace removed weed species will prevent future weed reoccurrence and assist the reestablishment of native vegetation. Opportunities for local community members to get involved in coastal management activities will be provided through the Coastcare program. All activities should follow the principles documented in Appendix 3. A list of weed species can be found in Appendix 6.

The removal of non-native species from the coastal unit will improve the condition of native vegetation, enhancing habitat quality and its resilience to natural disturbance whilst also reducing the risk of fire. Using appropriate weed control techniques in a progressive manner as time and resources permit, as per Appendix 5 will assist the rehabilitation of coastal vegetation communities.

High value areas being encroached upon by residential gardens are key areas to focus weed control and community education programs. Weed control priorities include declared species and those capable of altering habitats or ecosystem function. However, some weeds play a role in dune stabilisation (in absence of native vegetation) and should be managed in an appropriately staged manner. Removal of large tracts of non-native species at the same time should be avoided as it may displace native fauna.

Dense stands of Guinea grass (*Megathyrsus maximus*) and lantana (*Lantana camara*) threaten to outcompete native vegetation, pose a fire threat to fire sensitive remnant vegetation communities throughout the coastal unit (Figures 14 and 16) and are key targets for weed control.

Any fire management activities should occur in line with the *Blacks Beach Bushfire Management Plan 2015* (Kleinfelder 2015), and the *Clarke Connors Range Fire Management Guidelines* (Reef Catchments 2009), Appendix 1.



Figure 14: Declared weeds *lantana* (*Lantana camara*) at Turtle Place increase the fuel load



Figure 15: Mother-of-millions (*Bryophyllum* sp.) near the Turtle Place access competes with native vegetation



Figure 16: Guinea grass (*Megathyrsus maximus*) increase the fuel load near Blacks Beach Park



Figure 17: Weeds such as mother-in-law's tongue (*Sansevieria trifasciata*) found at Blacks Beach displace native vegetation

Blacks Beach





4.2 WILDLIFE

Blacks Beach has the highest annual mean number of marine turtle nestings in the Mackay region. An average of 24 flatback turtle (*Natator depressus*) nests per year were recorded at Blacks Beach between 1993 and 2003 with a maximum of 47 occurring in one year (Mackay and District Turtle Watch Association 2016, pers. comm.). Green turtles (*Chelonia mydas*) have also been recorded in very small numbers. Both species are listed as vulnerable in State (*Nature Conservation Act 1992*) and Federal (*Environment Protection and Biodiversity Conservation Act 1999*) legislation. Given their status, a Recovery Plan for Marine Turtles in Australia has been in place since 2003 and provides an overview of threats and recovery actions required for these species.

While there are many pressures on marine turtles throughout their life cycles, the threats to turtles and their reproductive success are identified as:

- Light and noise pollution from nearby houses disorientates hatchlings during their movement to the ocean.
- The presence of dogs and other domestic pets in the area, particularly those not on leashes, poses a number of threats including mortality of hatchlings from predation, exposing of clutches from digging and injury to turtles while laying eggs.
- Distribution and type of vegetation (i.e. root system), including excessive shading or lack thereof plays an influential role determining the sex of the hatchling.

- Unofficial tracks through the dune system, where tracks appear brighter than surrounding areas due to light reflection and can disorientate both hatchlings and adults.
- Beach vehicle access, as turtles are not able to penetrate the compacted sand or navigate wheel ruts.

Interpretive signs highlighting the value of Blacks Beach as turtle nesting habitat have previously been installed at two beach access points (i.e. Pitt Street and Blacks Beach Park). Enforcement of domestic animal restrictions should continue to be undertaken across the coastal unit. Seasonal beach closures should be considered south of Anglers Parade in Zone D. Opportunities exist along the southern end of the beach to improve dune vegetation and promote marine turtle nesting in this area.

The Spit and Blacks Beach (sandy shoreline) are both identified as intertidal roosts for shorebirds in the Mackay region (Figure 18). The Spit intertidal roost is considered locally significant with up to 584 shorebirds recorded at one time (Harding and Milton 2003). Disturbance to shorebird roosting at this site occurs from boating, domestic animals, pedestrian and vehicular traffic. This disturbance reduces the amount of resting time the birds have at high tide, forcing them to use excessive energy at a time when they need to maximise their reserves for migration. The result may be a failure to migrate back to their breeding grounds, or a reduced ability to breed (Harding and Milton 2003). An interpretive sign highlighting the





Figure 18: Wildlife values at Blacks Beach



value of Blacks Beach as a shorebird roost has been installed at the seaward end of the Anglers Parade access point. Seasonal beach closures have been successfully implemented at Sandfly Creek Environmental Reserve and should be considered for the area south of Anglers Parade. A pair of the vulnerable beach stone-curlew (*Esacus magnirostris*) have inhabited the Blacks Beach area for some time and have been sighted as recently as January 2013 (Mackay District Turtle Watch Association pers. comm 2016).

Regional Ecosystem 8.2.2 (beach scrub) is known to provide suitable habitat for the rare northern quoll (*Dasyurus hallucatus*). The northern quoll is known to occupy a diverse range habitats such as woodlands dunes and creek lines. However their distribution is restricted as a result of an increase in usage and development of adjacent lands. The loss of foraging habitat as a consequence of coastal development, combined with predation (cats and foxes) and potential ingestion of cane toad toxin may pose threat to this species in this coastal unit (Oakwood 2003). Interpretive sign for beach scrub communities and associated species is provided at the end of Anglers Parade.

Regional Ecosystem 8.2.6a occurs along the extent of the coastal unit. An array of reptiles are known to inhabit this ecosystem including: geckos, dragons, monitors, skinks and snakes, as are mammals such as possums, flying foxes and melomys. During the wet season RE 8.2.6a is known to support a diversity of frogs.

Essential Habitat (EH) mapping identifies sites and locations considered to contain important habitat for flora and fauna species of conservation significance. It is only mapped over either remnant or regrowth vegetation, and is based on either confirmed sightings, records of breeding, known suitable

habitat or resources occurring at a location, or habitat that forms part of a potentially important corridor (EPA 2002).

Essential Habitat mapping for the mangrove mouse (*Xeromys myoides*) covers the mangroves adjacent to McCreadys Creek at the southern end of Blacks Beach. Mature animals appear to utilise taller communities dominated by yellow mangrove (*Ceriops tagal*) and orange mangrove (*Bruguiera spp.*), however juveniles are sometimes located in low forests of yellow mangrove. The quantity and quality of storm water entering the catchment will be of relevance to the health of the mangrove mouse population.

The coastal unit also contains essential habitat for the coastal sheath-tail bat (*Taphozous australis*) (Queensland Government, 2011). These bats are known to live in highly specialised habitats such as beach scrub, mangroves, melaleuca swamps and coastal heathlands. Any threats to these vegetation communities constitutes a threat to the vulnerable coastal bat which is classed as vulnerable under the *Nature Conservation Act 1992*. Coastal sheath-tail bats are suspected to be easily disturbed when at roost, and could be negatively impacted by noise. There is currently no widespread decline documented for the species, however disturbance due to high rates of human visitation at roost sites can have negative impacts on the species and may cause low breeding success or roosts to be abandoned. The loss of foraging habitat as consequence of coastal development, combined with roost disturbance (with increasing human access to the coast) may pose threat to this species.

Currently, the major threats to wildlife along the coastal unit include loss of habitat through development, erosion and weed incursion, infrastructure and artificial lighting. A targeted community education campaign around restraining domestic animals both in home (cats) or on the beach (dogs), and increased enforcement would benefit shorebird and marine turtle populations. Restricting domestic animals on the foreshore at critical times of the year (i.e. nesting) would help to protect the ecological values of Blacks Beach, specifically shorebird and marine turtle populations using the area. There are opportunities to install interpretive signage featuring key faunal species and ecosystems (such as beach scrub and mangroves) at high profile locations within the coastal unit.

4.3 EROSION

4.3.1 Coastal processes and erosion

Blacks Beach and a large portion of the broader Mackay region's beaches maintain sand dunes in the coastal unit. Coastal dune systems play a crucial role in facilitating coastal ecosystem processes and in the protection of property in the coastal unit (DERM 2011). As part of the broader sand movement process, healthy dune systems act to dissipate the kinetic energy of waves, which may otherwise propel into adjacent infrastructure and property. The sand and dunes create friction when waves pass over them, slowing the waves

down and dissipating their energy. Healthy coastal dunes help protect coastal infrastructure during intense wind, storm and cyclone events. The dunes also act to replenish the foreshore with sand after major sand-loss events.

However, human induced changes have altered coastal areas and therefore dune formation. For example, the loss of coastal vegetation for open space and coastal development reduces the capacity of beaches to catch and trap wind-borne (Aeolian) sand grains. Once the protective capacity of the dune system is weakened in this way, coastal erosion can take place, leading to significant damage to landforms and infrastructure via coastal recession (figure 19).

Planners and coastal residents may have a negative association with erosion and coastal recession, though in many cases it is a natural phenomenon. There are constant interactions between coastal landforms and the ocean, and this creates a dynamic and ever-changing environment. Sandy coastlines migrate landward and seaward in response to natural phases of sand erosion (loss) and accretion (gain). Sand movements can form dunes onshore, sand bars offshore, or instigate beach erosion. All of these movements are governed by wind, waves and tidal activity over varying time scales.

Over short time scales there are natural beach fluctuations in response to intense weather activity. For example, during a storm, strong waves carve away sand from the beach and

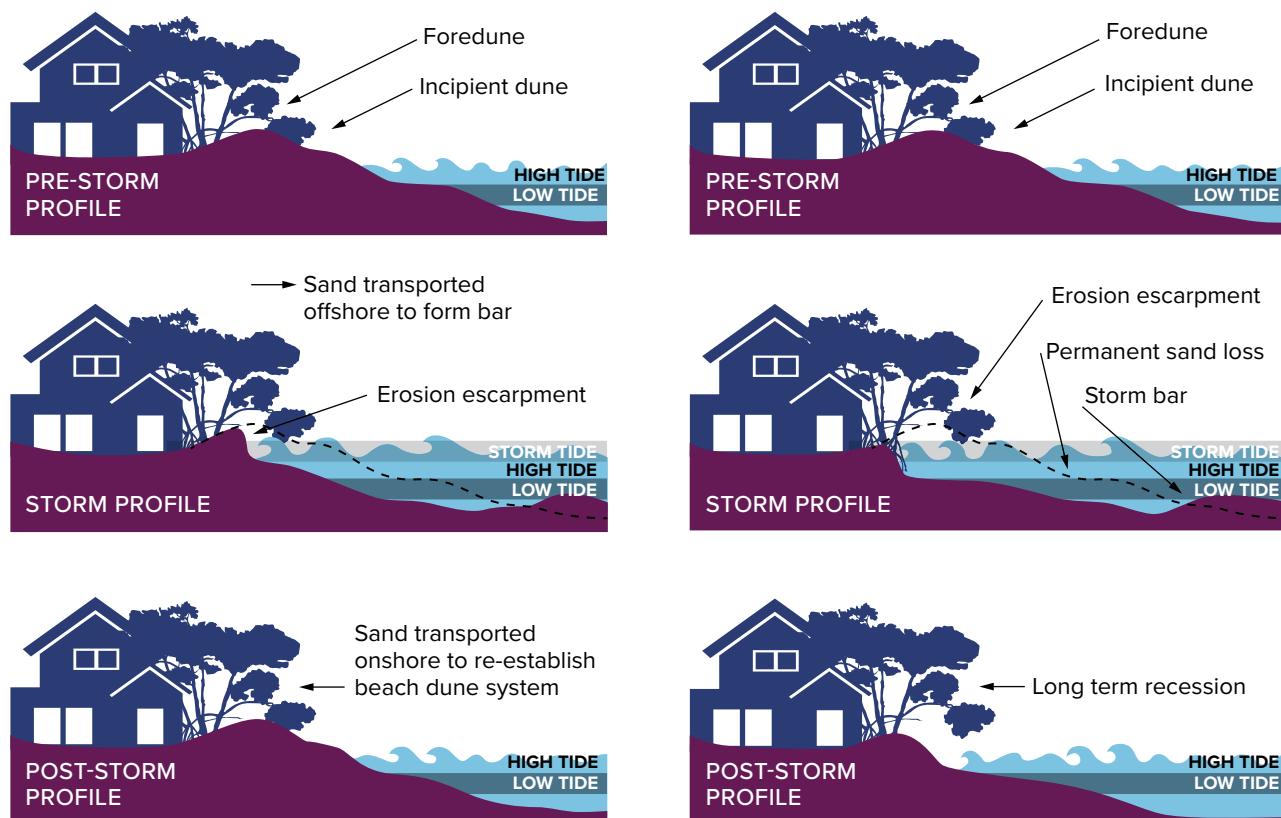


Figure 19: Beach erosion



dunes, resulting in escarpments onshore and sand bars offshore. Gradually, sometimes over many years, the sand that was lost offshore is pushed back onshore by gentler high tides. This process is natural and in many cases, cannot be stopped.

However, long-term erosion or accretion is driven by fundamental changes in the dynamics of sand deposition and removal from a beach system. This is an on-going problem, and preventing beach recession would often require continual nourishing. This is illustrated in Figure 19, where too much sand from coastal dunes is lost seaward to allow the dune to be restored to its original state.

Challenges to dune heath are often unavoidable in developed areas such as Blacks Beach. However, intervention and management can help to protect the coastal landforms.

Dunes should be protected where possible by maintaining and enhancing native vegetation. Ground cover, shrub and tree species stabilise dunes with their root systems, and catch wind-borne sand sediments to replenish the dunes and foreshore. The loss of this vegetation can lead to accelerated rates of erosion of the dunes. The natural build-up of sand in frontal dunes needs to be encouraged as a reservoir for sand during periods of wind and wave erosion. Plant communities provide vegetative cover, which stabilises the dune and thus make the system resilient to pressures such as sea level rise, storms, and floods. Supporting vegetation as a surface cover increases dune stability but also biodiversity and ecological function of the dune system (DEHP 2013). Coastal vegetation is also important in protecting infrastructure and houses, as it slows wind speeds and reduces the amount of salt and sand transported inland.

Damage to dunal vegetation in the Mackay region often occurs through pedestrian and vehicle traffic, and acts of vandalism.

Intentional removal of coastal dune vegetation, as well as inappropriate pedestrian and vehicle access, displaces sand, and where it continuously occurs, can lead to localised eroded areas. Clearly established pathways to the foreshore can help to mitigate the threat of people and vehicles destroying dunal vegetation by funneling activity to a small number of well-maintained pathways. To prevent the degradation of dune systems and for public safety, it is important for users to stay on designated tracks. A range of consultation and education opportunities should be provided to the local community to mitigate damage to dunal vegetation.

Another major threat to the natural function of dunes is hard infrastructure (e.g. seawalls). Often these structures are built in the attempt to protect property from shoreline recession. Seawalls and other hard structures, rather than gradually dissipate wave energy like dunes, reflect it onto other areas. This leads to scouring around the edges and in front of seawalls, and accelerates the loss of sand on the surrounding beach.

Ensuring that erosion prone areas (Figure 25) remain free of constructed infrastructure and well covered by native vegetation allows natural processes to occur unhindered. This provides the best opportunity for managing shoreline erosion and retaining environmental values (EPA 2004). Where infrastructure is installed, such as seawalls, the amount of sand that is lost seaward is much greater than the natural amount, thereby accelerating erosion and beach recession. However, Council recognises that in some exceptional circumstances, site specific design solutions may need to be considered.

4.3.2 Landscape context

The surface geology of Blacks Beach consists primarily of dunes, beach ridges and rocky headlands. The rocky headlands of Blacks Beach are primarily Paleozoic volcanic (200 million years of age) and sedimentary bedrock outcrops of the Devonian Campwyn Beds (EPA 2004).

Blacks Beach has developed as a barrier system across the McCreadys Creek estuary. Over landscape evolution timeframes (several thousand years), longshore sediment transport to the south in the lee of the Slade Point headland has resulted in the development of the sandy beach, and the spit barrier across the entrance of McCreadys Creek (Alluvium 2016).

4.3.3 Sediment transport pathways

Dominant longshore sediment transport direction is to the north, and turns to the south in the lee of the Slade Point headland. Key features of sediment supply and distribution include;

- The main sediment transport pathway across Slade Bay is along the margin of the outer tidal flats.
- Approximately halfway along Blacks Beach the sediment transport pathway reaches the shoreline, being the point where the majority of sand supply is delivered to the beach. A convex bulge in the shoreline is observed at this point (Figure 20 and 21). This represents a ‘null point’ in longshore sediment transport along Blacks Beach. From this point sediment transport heads both north and south.
- Sediment transport to the south and around Slade Bay is via a complex network of sandy shoals. Further details on Slade Bay sediment transport dynamics is provided in the *Mackay Coast Study* (EPA 2004).

4.3.4 Sediment supply and trajectory

The main source of historical sediment supply to Blacks Beach was from the Pioneer River and to its south and was transported north via longshore sediment transport (EPA 2004, Alluvium 2016). Another major historical sand source was likely supplied from the extensive parabolic dune field situated south of Slade Point (Figure 21). Sand would have been transported by wind (aeolian supply) across the Slade Point headland and into Slade Bay (Alluvium 2016).

Sediment supply from the Pioneer River has substantially reduced since European settlement, due to river regulation, urban development (including the marina) and sand extraction activity. Sediment supply from the Pioneer River to the coast is estimated to be less than a 25% of pre-regulation loads (Gourlay and Hacker 1986, Alluvium 2015), and is expected to continue to reduce over time (Zavadil and Rosengren 2016).

Development of the Slade Point headland has resulted in a cessation of aeolian sand supply to Slade Bay from the parabolic dune fields. While this supply has been lost, the dune fields are expected to be subject to recession over the coming decades (EPA 2004, Alluvium 2016) (due to a reduced sand supply formerly generated from a process of longshore drift from the south), and some eroded sand may subsequently be transported around Slade Bay and onto Blacks Beach. Overall the net long term trajectory of sediment supply to Blacks Beach is likely to be one of reduced supply. Further investigation would be required to quantify the trajectory of the sediment budget, and could be complimented by a regional study on long term sediment supply for the Mackay coastline.





Figure 20: Blacks Beach indicative sediment supply and distribution pathways (after EPA 2004) (2015 aerial imagery courtesy of Mackay Regional Council)

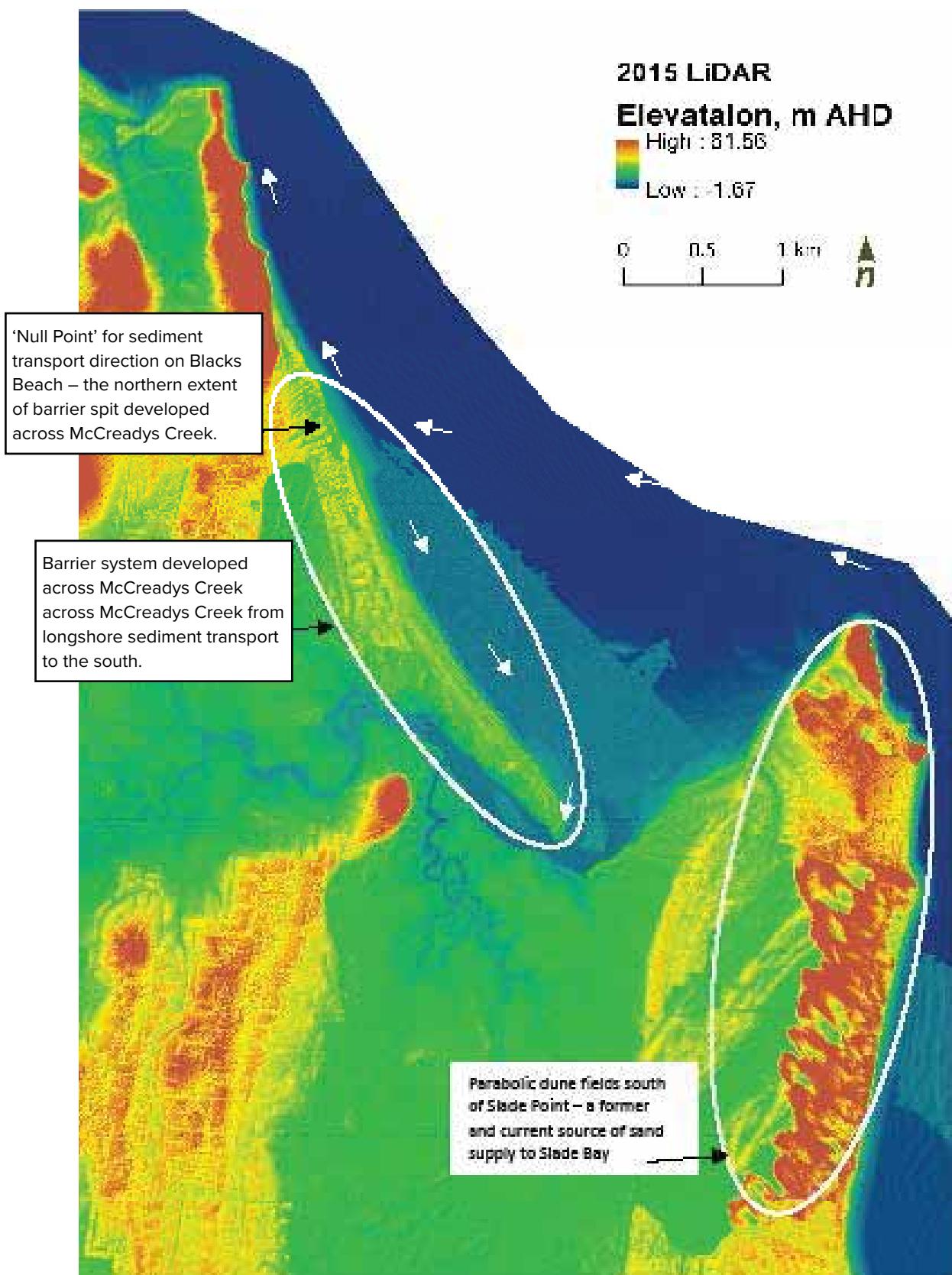


Figure 21: Blacks Beach elevation (2015) (High elevation: Red, Low elevation: Green) highlighting sites of sediment accretion and depletion, including the extensive parabolic dune field south of Slade Point

4.3.5 Shoreline changes

Since establishment of residential properties in the 1950s, areas of Blacks Beach north (north of the sediment transport ‘null point’) have experienced erosion. Multiple seawalls have been established on private land to provide protection to residential property (Figure 23). The exact timeline for establishment of these seawalls is uncertain, however the majority seem to have been established by 1962, as the shoreline position at these locations has not appreciably changed since (Figure 24). The majority of seawall extent is of an informal nature in poor structural condition.

Just north of the ‘null point’, substantial shoreline retrograde has occurred since 1962 in a limited area where there are two more recent seawalls, and a section with no seawall (refer change between the 1962 and current shoreline positions in Figure 24 and additional profiles in the EPA 2004 report showing progressive retrograde in this area). This past recession is likely a result of terminal scour (scour downdrift of a seawall) after the construction of the most southerly seawall. Within this area, in the limited locations where seawalls are not present, the upper beach is naturally rebuilding with prograding dune systems (Figure 23). Rebuilding of the upper beach dune systems is absent elsewhere along Blacks Beach north, due to the presence of the seawalls.

The presence of the seawalls has significant implications for management of the beach including:

- Seawalls do not readily dissipate energy (like dunes and vegetation do), and therefore excess wave energy along seawalls will result in scour of sand and over time the loss of the sandy beach at the toe of the structures. This has implications for the ecological importance of maintaining a sandy beach, as well as the amenity value.

- Seawalls will cause scour in locations downdrift of the walls (terminal scour), in areas where a seawall is absent or in disrepair (as excess energy is deflected in the downdrift direction).
- Existing walls are a potential risk to public safety and users of the beach who can readily access / climb on the seawalls that are in poor structural condition in many locations. This is particularly significant for the northern most seawall which is situated along public reserve / picnic area and was established by Council after terminal scour was experienced due to establishment of an adjacent private seawall immediately to the south. This particular seawall has been damaged after storm activity and is in poor structural condition with significant shifting of rock on the wall and at the toe of the structure. Council has commissioned a Coastal and Inland Flooding Hazard Adaptation Strategy Critical Coastal Infrastructure Risk Assessment which is currently reviewing the condition of existing seawalls within the region.
- Seawalls prevent natural rebuilding of the upper beach system during times of episodic high rates of sediment transport delivery. Rebuilding of the upper beach provides an important buffer for future storm activity. The presence of seawalls can therefore ultimately increase the risk of erosion during storm events, where overtopping of walls or scour and undermining of structures can occur. The nature of sediment delivery to northern Blacks Beach over time is likely to be episodic, and may occur as a series of ‘sand slugs’ (EPA 2004, Alluvium 2016a) as sediment moves around Slade Point and into the complex dynamics of Slade Bay. Behaviour of the Southern Blacks Beach shoreline indicates substantial periods of both retrograde and prograde, with limited net change in shoreline position over the last 50+ years. It is likely that this pattern of sediment



delivery as ‘pulses’ applied to Blacks Beach north as well, however the presence of extensive sections of seawalls is inhibiting the retention of this sand, and will be increasing the rate at which sand is transported around to beaches further north.

Regarding the seawalls at Blacks Beach, the *Mackay Coast Study* (2004) concluded, *considerable erosion would be expected to occur on the beaches immediately adjacent to, and seaward of the walls. Significant investment into the upgrading of the seawalls in their present position should be avoided. Instead, funding should be directed towards a planned retreat and the eventual removal of the seawalls* (EPA 2004). Revegetation and increased coastal buffer could increase the stability of the current dune structure on Reserve tenure behind the current seawall, particularly near the Turtle Place and Blacks Beach Park access points.

The southern section of Blacks Beach extends from the ‘null point’ (the end of Blacks Beach Road) where the barrier system starts, to the extent of the Spit at the mouth of McCreadys Creek.

There is an area immediately south of the ‘null point’ where residential housing is set back 50+ m from the beach, and no seawalls are present. Prograding dune systems are present in this area, with relatively well-established coastal vegetation (remnant and sections of revegetation works completed by Council) assisting with building and storing of sand in the upper beach. No major net change in shoreline position along this area has occurred from 1962 to present.

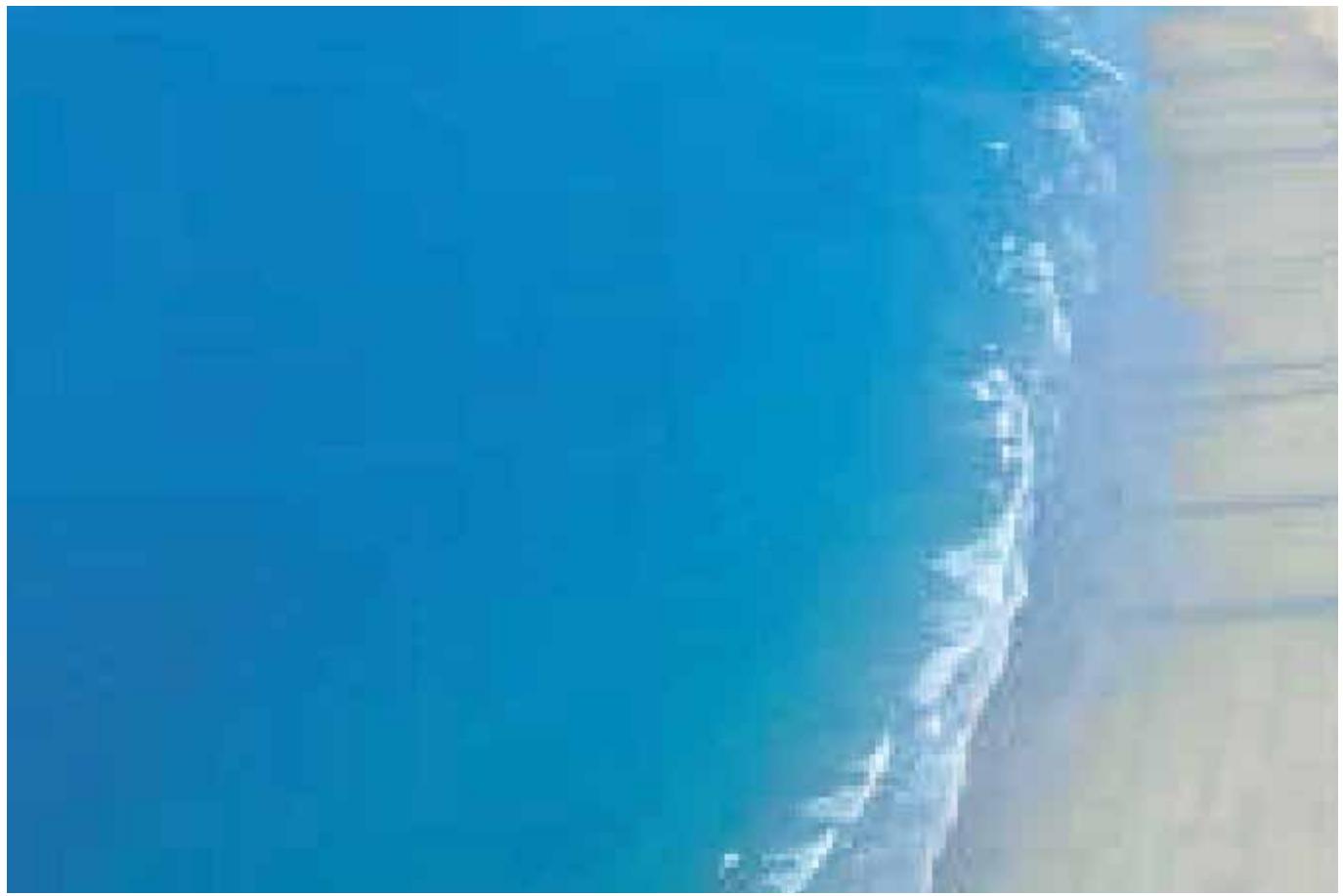
Being immediately south of the ‘null point’ where sediment is transported to the shore and then southward, this area will likely have a good ongoing sediment supply. However, given the episodic nature of sediment transfer across Slade Bay to Blacks Beach, there may be periods of substantially

reduced sediment supply. The presence of a well vegetated dune system in this area will be critical as a buffer during major storm events that coincide with period of low longshore sediment supply, to protect private property and as a source of sand to the beach.

Some areas of foreshore public land in this area remain denuded of protective coastal vegetation communities. Strategies to manage competing objectives for use of this land within the community should be implemented.

Appropriate vegetation communities include those that were historically present at the site and elsewhere in the region where similar vegetated dune systems are present. These vegetation communities are most appropriate, as they have evolved specific geomorphic function in the development of dune systems and support the relevant ecological communities for the region. Ground cover, shrub and tree species stabilise dunes with their root systems, and catch wind-borne sand sediments that replenish the dunes and foreshore.

Further south along the Spit, the episodic nature of sediment transport and periodic storm activity has resulted in considerable fluctuation in shoreline position, including substantial net prograde of the shoreline position from 1962 to 2009, followed by more recent recession in the order of 10 – 20 m from 2009 to 2015 (Figure 24). It will continue to be the nature of this shoreline to fluctuate over time, and maintenance of the vegetation community and dune systems is recommended. Beach Profile monitoring is a means to record and access change over time and is recommended to guide future coastal planning and works.



the most southerly seawall on Blacks Beach

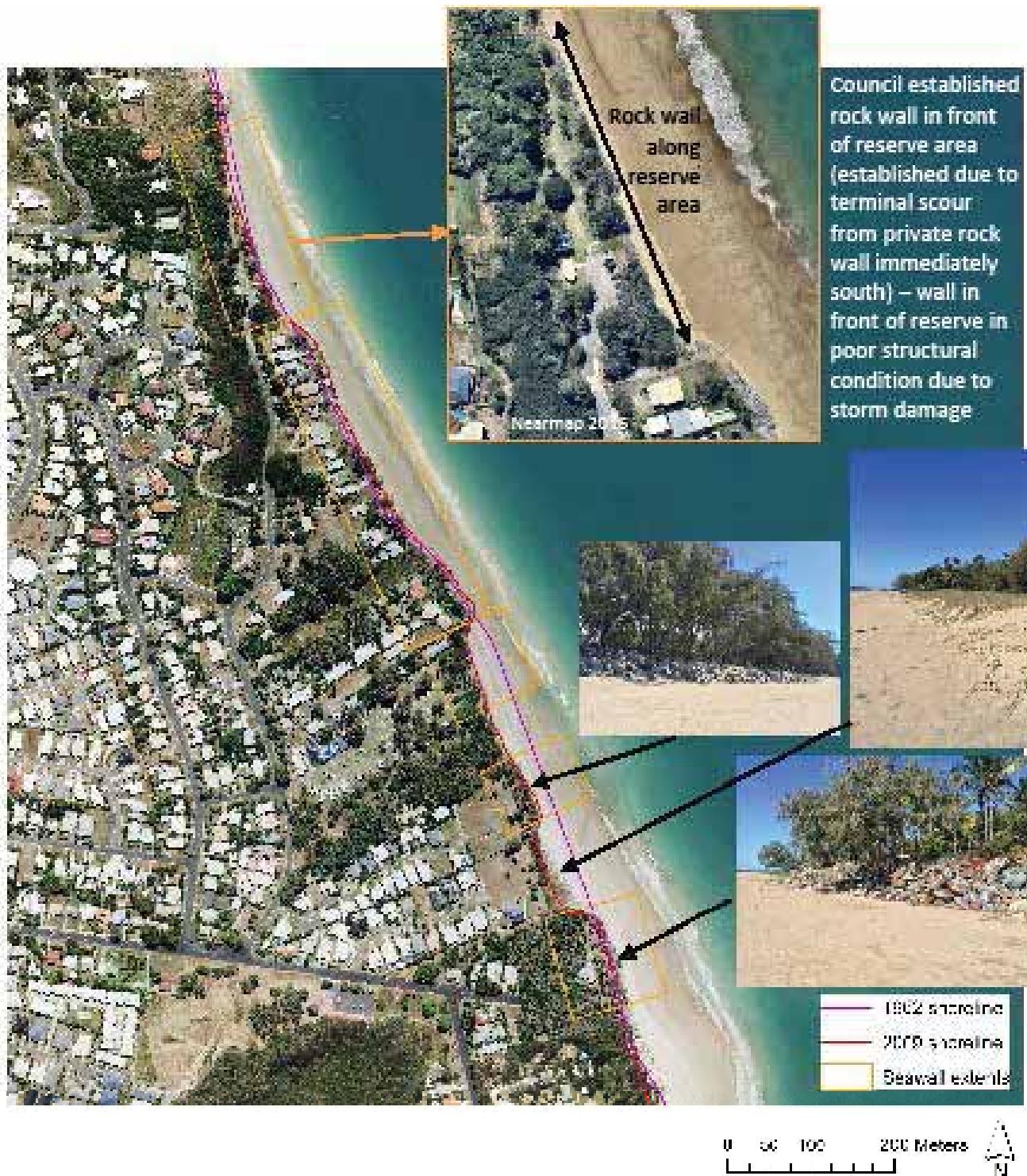


Figure 24: Comparative shorelines (1962, 2009 and aerial photo 2015) including extent of current seawalls (orange boxes)



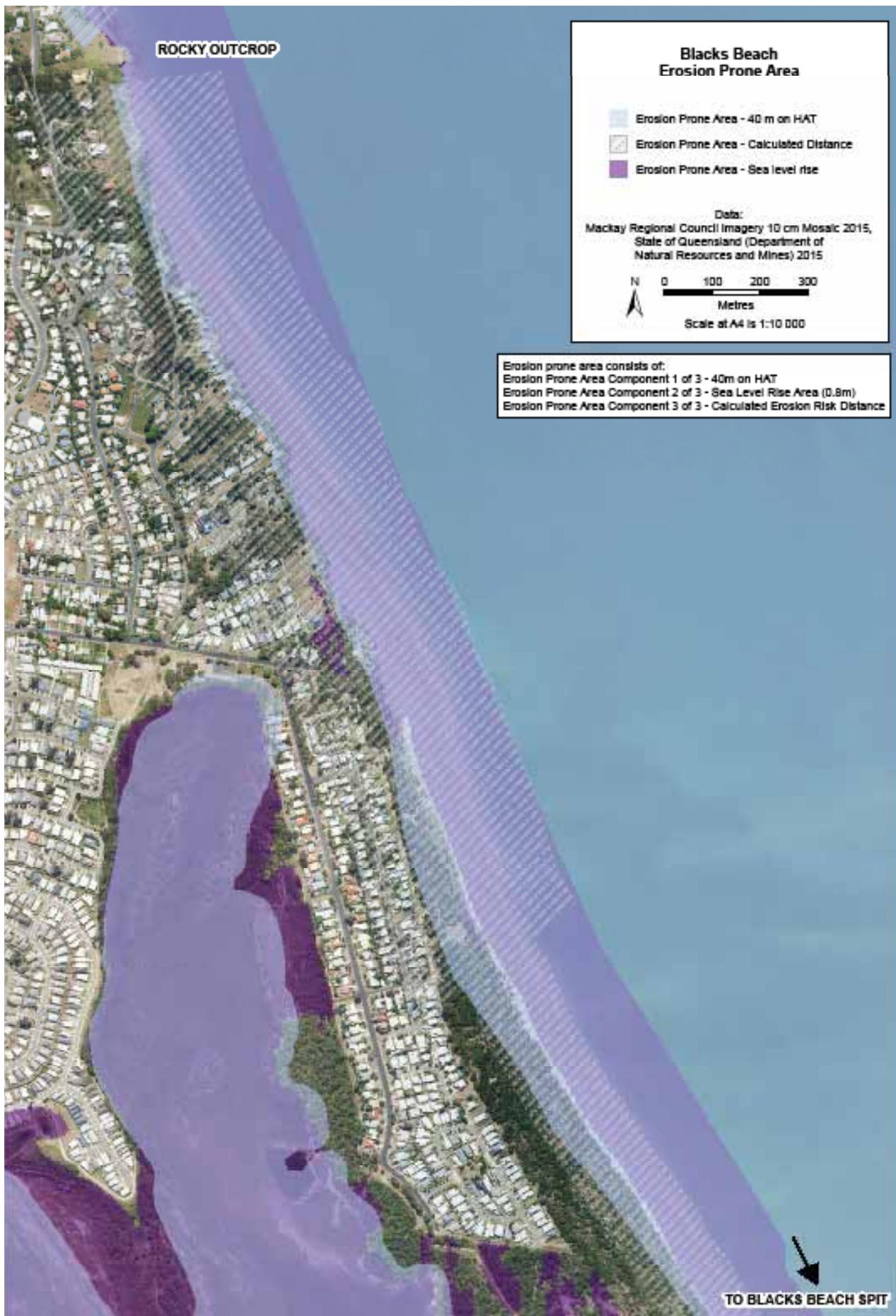


Figure 25: Erosion Prone Area Blacks Beach.



5 Social Values and Management Issues

This section provides an assessment of the social values such as cultural values, recreational opportunities and facilities present in the area. The focus lies on a sustainable approach to explore recreational opportunities while conserving the natural cultural and environmental values of the area. Provision of adequate facilities that cater for a range of interests and abilities is also an important consideration of this plan.

Blacks Beach is located within an open east to northeast facing bay known as Slade Bay. It is Mackay's longest continuous beach and a popular holiday location. It provides a variety of accommodation options, ranging from camping and caravan parks to self-contained, resort and motel style apartments. With high visitation, a young demographic and high population density spread along the coast, recreational options in the coastal unit are in high demand.

5.1 CULTURAL HERITAGE

The Traditional Owners of the Mackay region are the Yuwi-barra people. Many indigenous people previously inhabited the area, feeding off the plentiful resources provided by the marine and

terrestrial environments (Mooney 2013, pers. Comm). Given past occupation of the area, Blacks Beach and McCreadys Creek are likely to contain artefacts, shell middens, fish traps or other items of cultural significance (Mooney pers. comm 2013).

Council is committed to managing culturally significant places sensitively in partnership with the Yuwibara people. Additional surveys of the area by Traditional Owners may reveal further sites or items of cultural significance. In order to do so, it is suggested that Traditional Owners be employed to document finds and outline clear management objectives for the preservation of the cultural heritage in the area.

5.2 RECREATIONAL OPPORTUNITIES

Recreational sites are important as they provide a range of social benefits including opportunities for active and passive recreation, tourism, education and social interaction. They also support community wellbeing and provide opportunities for improving general health through outdoor recreation. Additionally, through signage and interpretation, there is an opportunity to raise awareness of local wildlife, and educate people about the natural coastal processes and vegetation, that supports these species. Council's *Planning Scheme* (MRC 2006) outlines Council's vision to provide a balanced mix of *public open space that in turn will provide for a range of active and passive recreational opportunities for the community*. Open space is provided for recreational and non-recreational activities. Active and passive recreational opportunities are provided to meet the needs of the community, whereas non-recreational open space areas are provided for the



protection of natural areas (including environmentally significant vegetation, wildlife habitat areas, waterways, and wetlands), and for the use of land for utilities and stormwater management through dedicated environmental, conservation, drainage and road reserves (MRC 2016). In order to develop an integrated and comprehensive Local Coastal Plan, it is important to consider public use and future opportunities that balance the environmental conservation and recreational needs of this coastal unit.

The *Planning Scheme* (MRC 2006) was considered when assessing the coastal unit for possible recreational and conservation based recommendations, including the risks recreation may pose to local wildlife and native vegetation. Environmental sustainability is prioritised in line with the *Coastal Management Guidelines* (MRC 2012), with consideration for providing a range of recreational opportunities in order to meet needs of the broader Blacks Beach and Mackay community and visitors. Council's *Draft Open Space Strategy* (MRC 2016) seeks to achieve recreational diversity and effective distribution of recreational areas, to create an interactive interface between the environment and the community, and establish a network of open space areas accessible to everyone. This Local Coastal Plan seeks to align this policy, community needs and environmental conservation.

Blacks Beach Park is the largest park area with facilities within the coastal unit (Figure 26) and provides a range of recreational opportunities, with infrastructure including: a playground, picnic tables, undercover seating areas, barbecues, toilets, signage (both regulatory and informative)

and a drinking fountain. A recreational park exists at Corella Way and can be accessed through a linkage corridor between the Corella Way beach access and Pacific Drive (Figure 27). An existing concrete pathway leads from the Corella Way beach access (landward) across the recreational park to Pacific Drive on the western side of the residential subdivision. Corella Way Park provides a playground, including a slide and swing, a shaded area and plenty of space to kick a ball. Car parking opportunities and the landscaped gardens enhance the recreational value of this park. Opportunity exists for the establishment of a local park at Pitt Street and will be investigated in line with the requirements outlined *Council's Draft Open Space Strategy* (MRC 2016).

An opportunity exists to connect both parks and thus neighbourhoods between Blacks Beach Park and Corella Way Park.

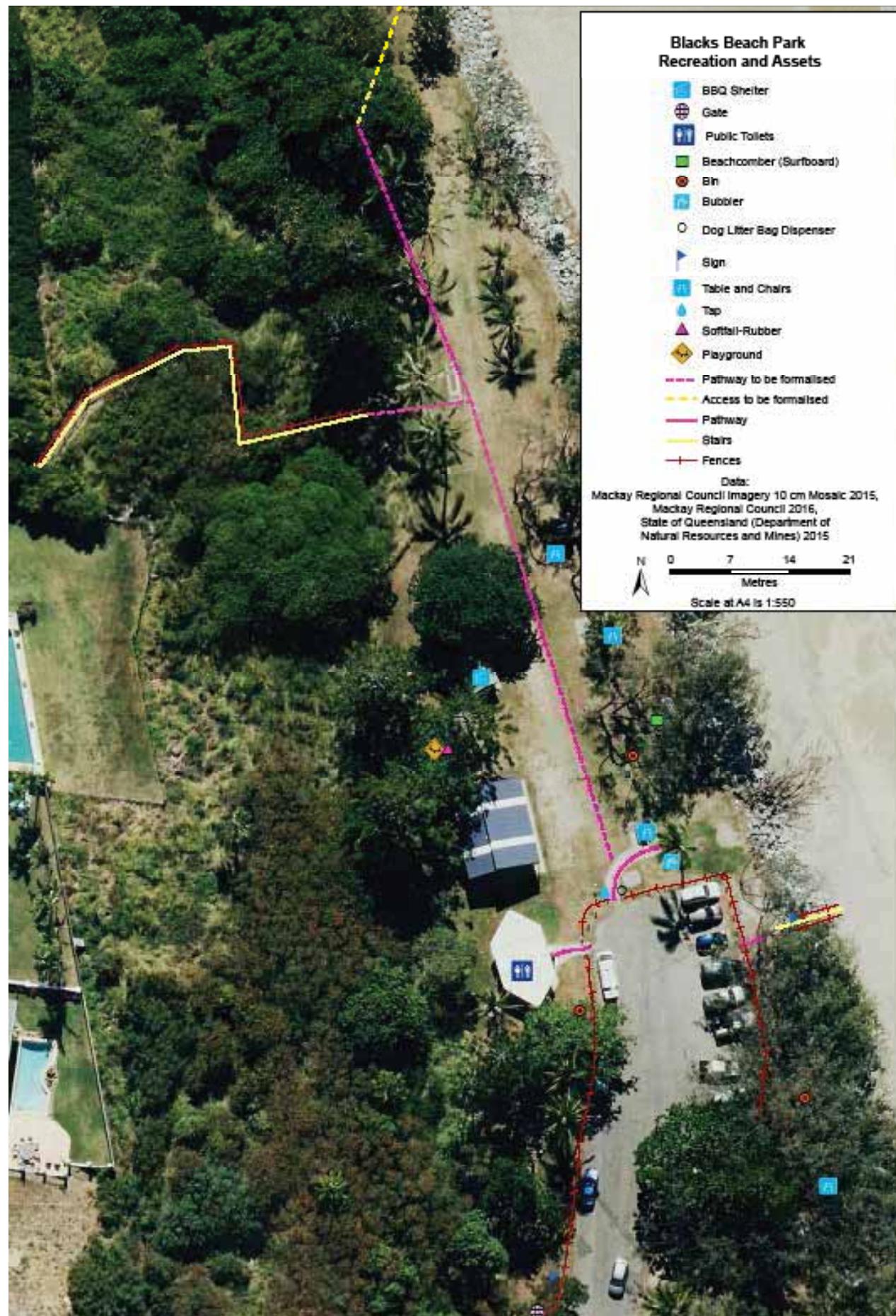


Figure 26: Blacks Beach Park is a recreational hotspot at Blacks Beach



Figure 27: Current recreational assets at Corella Way Park



5.3 PUBLIC ACCESS

To prevent the degradation of dune systems and for public safety, it is important for users to stay on designated access tracks. Pedestrian and vehicle traffic displaces sand, and where it continuously occurs, can lead to localised erosion. Recreational activities/facilities (i.e. walking tracks, bike pathways, picnic facilities etc.) where possible, should only be located outside of the erosion prone area and inside the landward dunal areas (DERM 2011).

Public access to the foreshore is solely pedestrian, via official public pathways and tracks. Activity is funnelled to official access points by post and rail fencing. The fence protects foredune vegetation by creating a barrier between residential areas, the dunes and the beach. It is recommended that this fence is maintained to continue to protect dunes and assist vegetation regeneration. Post and rail fence has been installed between Bourke Street and Turtle Place and Pitt Street to the end of Corella Way. There are currently eight official beach access points (Figure 28). A number of unofficial access points exist including some that were closed as result of the 2010 Beach Plan. Consequently, vegetation continues to be disturbed along the coastal unit.

Blacks Beach Park at the northern end of Bourke Street is a popular recreational area. The park is well catered with picnic and barbecue facilities. Showers, toilets and rubbish disposal points are also provided. Due to its high use, upgrading Blacks Beach Park with an additional access point, pathways and interpretative signage is recommended. Specifically, the staircase leading up to Camilleri Street shows signs of deterioration and drainage issues and should be upgraded. Blacks Beach Park would benefit from an all abilities beach access track at the northern end of the park. Formalised access would prevent park users from climbing across the seawall to reach the beach. A pathway would link pedestrians from the car park at Blacks Beach Park to the Camilleri Street staircase and the proposed all-abilities beach access at the northern end of the park.

Fencing along the Reserve in Zone B north of the Turtle Place beach access has been modified to gain access to the beach. This track is located within a vulnerable dune system adjacent to an existing seawall and should be closed. Pedestrians are currently entering the Reserve from the road parallel to Turtle Place. A connective link to the existing beach access track at Turtle Place could prevent further encroachment in the area. The movement of sand in some sections of Zone B has completely buried the post and rail fence (Figure 30). A new post and rail fence with mesh should be constructed 15 to 20 m further landward, where it will not be threatened in the near future by coastal recession and erosion, and meets Council specifications (Appendix 7). This will provide an area for the dune to continue to accrete whilst continuing to funnel pedestrian access to official beach access points.

A small-scale viewing platform adjacent to the beach access track in front of the Shores Holiday Apartments (Zone C), would improve the recreational value at this location.

Pitt Street currently offers parking and a beach shower. Improved car park design, toilet facilities and the installation of additional park features such as an all-abilities viewing platform with seating would improve visitor use.

Establishment of a nature trail from Pitt Street to Anglers Parade, connecting to the existing access way to the Spit, would provide a scenic and varied outdoor experience for locals and visitors alike. Additional car parking opportunities exist on Pacific Drive.

A post and rail fence exists between Pitt Street and Anglers Parade, however as encroachment and mowing are still occurring (Figure 31 and 33), it is recommended that the location of the fence be reviewed and once a distance from the property boundaries is confirmed, that the mesh be reinstated to protect the Reserve and its associated vegetation. Signage should be installed to inform the community about the significance of this vegetation and highlight the purpose of the protective measures employed.

Beach access points are well marked and located. Installation of distance bollards or similar is recommended across the length of the coastal unit to discourage the creation of unofficial access tracks. Signage about recreational walks, including linkages to playgrounds and beach accesses would be beneficial.

A post and rail fence exists south of Anglers Parade (Figure 32) and is lined with mesh to prevent encroachment. Gates have been installed at Anglers Parade, the end of Corella Way and at Pacific Drive to allow emergency vehicles access to the Spit (Figure 34). Fencing will be installed in Zone E to prevent illegal motorbike access and to delineate the APZ.



Figure 28: Blacks Beach coastal unit access points





Figure 29: Designated beach accesses at Blacks Beach



Figure 30: Unofficial access through rebuilding dune system at Turtle Place



Figure 31: Personal property blocks the Asset Protection Zone (APZ), restricting access to emergency vehicles





Figure 32: Post and rail fencing, including mesh installed to define the Reserve boundary



Figure 33: Reinstallation of mesh is required to prevent encroachment into the Reserve in Zone C



Figure 34: Gates installed at the southern end of the Blacks Beach coastal unit to prevent vehicle access and dumping of waste in the Spit



5.4 SIGNAGE

Signage provides education and interpretive opportunities for visitors and increases the value that locals place on the natural environment. Signs can highlight areas of high value, provide information about current projects and advise of site-specific restrictions and hazards. Beach access signage is present at the landward and seaward end of each formal and official beach access throughout the coastal unit. It is recommended that signage be regularly audited and updated where required to ensure consistency and accuracy (Figures 29 and 35).

There is scope for the installation of new signage detailing the importance of coastal vegetation in reducing erosion. This would be suited near revegetation sites to further dissuade the removal or destruction of vegetation via education and awareness training. Additional interpretive signs should be provided to educate visitors about dune health and function, important or unique native species and communities including marine turtles, and critically endangered beach scrub. Similarly, signage reflecting the cultural history of the area would enhance visitor experience and ensure that the importance of cultural heritage is reflected and appreciated by locals and visitors.

Signage should accompany all access tracks and be used as an information, education and regulation tool.



Figure 35: Signs to be updated at Blacks Beach where they are starting to fade and/or have been vandalised

5.5 ECONOMIC VALUES

Beaches are important economic assets as well as natural resources, as they provide services to people and property that have an economic value, including reduced storm damage, together with recreational and tourism opportunities (Stronge 2005).

The tourism industry is important for the Australian economy, comprising approximately three per cent of gross domestic product in 2014-15 (Productivity Commission 2015).

Australia's tourism industry is dominated by the natural environment, with national parks and protected areas forming the basis of nature-based tourism experiences (Weaver et al., 1999). Beaches are the most popular coastal attractions for visitors, providing opportunities for a range of activities including bushwalking, whale watching and fishing (Clarke and Johnston 2017).

Beach visitors generate income for the local economy through their expenditure. Spending by tourists is a component of the economic activity across a variety of sectors including accommodation, cafes and restaurants, transport and storage, retail trade, cultural and recreational services and education (Pambudi et al., 2009). Income generated by the coastal tourism sector is highly dependent on the quality and extent of beach systems (Jones and Phillips 2007).

Ecotourism is a significant and growing sector of the tourism industry, and provides a way to reconcile tourism and conservation (Weaver 2001). By marketing natural values, ecotourism can maintain the aesthetic appeal of coastal tourist areas while deriving economic value, and simultaneously produce environmental benefits (Clarke and Johnson, 2017).

Beach and dune environments are among the most valuable natural habitats on the coast, providing environmental services, landscape values and habitat for marine and terrestrial plants and animals which can serve to attract tourists as well as provide amenity for local residents (James, 2000). The costs associated with recreational and tourist usage of beaches includes the cost of infrastructure provision and maintenance.

Beaches provide goods and services to many stakeholders, with a range of market and non-market values which can be worth millions of dollars per year. The way people value the natural environment however can vary. Value can be associated with direct uses, such as fisheries or tourism, as well as indirect uses, such as mangroves providing nursery habitat for juvenile fish species. Indirect uses are usually found outside the market place and are effectively unpriced. Determining the full value of a natural asset is challenging and often overlooked, however if no monetary value is placed on environmental goods and services there is a risk that they will be perceived as having no value (zero worth) and may be vulnerable to exploitation (Kirkpatrick 2011).

Coastal resources in the Mackay region are highly sought after for competing uses including residential, commercial, tourism and recreation. Effective management is required to ensure that the natural values and attributes of the coast are preserved while economic development and population growth are accommodated (EPA 2004).

Climate change is likely to have a range of direct and indirect economic impacts on recreation and tourism in coastal areas. Local and state governments will need to invest in natural assets to ensure the continuation of a strong tourism culture and investigate opportunities to diversify the tourism image for beach-focused destinations while balancing the value of natural coastal assets against trade-offs for other uses such as industry and development (Kirkpatrick 2011).

5.6 WASTE DUMPING AND LITTER

Green and general waste has aesthetic, social and conservation repercussions. Litter and green waste reduce the visual appeal of beaches, present health threats to visitors (e.g. toxic waste, glass and sharps etc.) and compromise vegetation condition. Green waste such as palms fronds crushes and shades ground cover vegetation, reducing dune stability and increasing weed invasion and fire risk. Plastics and other general waste often wash out to sea, presenting dangers for marine wildlife including birds, fish, sharks, turtles and marine mammals. Marine debris may lead to drowning, or cause injury or death through entanglement and internal injuries, or from starvation following ingestion.

Green waste, general waste and marine debris were found throughout the coastal unit. Vegetative waste is present on dunes at Blacks Beach, particularly where there are adjacent residential areas (Figure 36). Dumping of general waste was an issue in previous years as identified in the *Blacks Beach Beach Plan* (Reef Catchments 2010) throughout the remnant vegetation on Freehold tenure and Reserve land on the Spit. Since then, fencing has been installed and successfully prevented unregulated vehicle access in the area and further waste dumping.

Appropriate regulatory signage and a public education and awareness program on the values of coastal unit and impacts of waste dumping should complement other management actions.



Figure 36: Waste dumping and accumulation of vegetative waste at Blacks Beach



6 Climate Change and Management Issues

Climate change is the term used to describe long-term changes in global weather patterns, and the gradual increase in mean global temperature. There is strong evidence that suggests that the gradual warming trend over the last fifty years has been driven largely by human activity, for example, the burning of fossil fuels, deforestation and intensification of agriculture (The Royal Society 2010). Climate change is having, and will continue to have, significant impacts on lives and ecosystems on which we depend.

Coastal areas are highly exposed to climate change with sea level rise being one of the greatest threats. The best known model relating shoreline retreat due to an increase in local sea level is that proposed by Per Bruun (1962) (Figure 37).

Projected sea level rise (0.8 m by 2100) is expected to increase erosion and damage property and infrastructure (DERM 2011) (Figure 25). The response of Australian coastal ecosystems and landforms to climate change will vary, but most are expected to involve shoreline recession, vertical accretion of sand, increased saline inundation of wetlands, and the modification and southward shift of habitat (Australian Government 2013). Additionally, many intertidal ecosystems such as mangroves, seagrass and tidal flat communities will decline.

Key climate change messages for the wet tropics NRM cluster, that encompasses the Mackay region, are displayed in Figure 38. Current predictions suggest that much of the dune system will be inundated by 2100 (Queensland Government 2011b). Maintaining and improving the condition of a buffer area of coastal vegetation, where possible, will provide the best opportunity to build resilience into these ecosystems to cope with changes into the future. The *Mackay, Whitsunday and Isaac Climate Sustainability Plan 2016-2020* contains forecasts local to the Mackay region. Figure 38 also highlights other key changes associated with climate change, such as increased temperatures and more severe tropical storms.

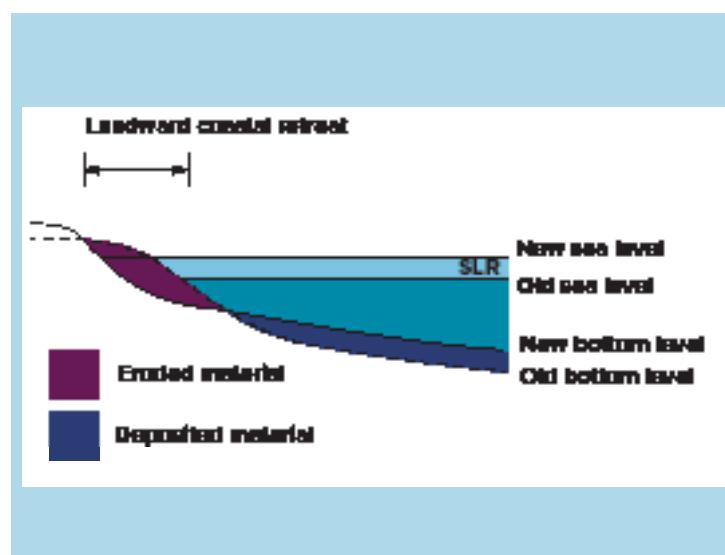


Figure 37: The Bruun Rule showing erosion of the upper beach and offshore deposition under sea level rise (SLR).
Source: Bruun 1962



The coastal areas of Blacks Beach are already affected by a changing climate with sea levels rising, intensifying the impacts of storm surges and king tides causing erosion in parts of the beach. The northern coastal strip of the Blacks Beach coastal unit and margins of McCreadys Creek will be, in particular, prone to future sea level rise (Figure 25). The dune system at the southern end of Blacks Beach is well vegetated to protect against the effects of climate change, however, there are some opportunities to improve structure and condition through weed control and rehabilitation activities. The capacity of the dunes in the central and northern sections of Blacks Beach to protect against the effects of climate change is currently limited due to clearing of native vegetation, by partial extensions of residential back yards and the presence of seawalls.

Retreat is likely to be required in the longer term in some places. Rising sea levels will also see the loss of habitats such as sand dunes that are not provided space to retreat landward. This will be the case for most of the sand dunes along Blacks Beach. The loss of this important habitat may have impacts on local turtles, birds and other flora and fauna.

The challenge for future planning will be to identify suitable ecological retreat areas for our developed sections of coastlines, informed by geomorphic setting and processes, to accommodate for climate change processes and preserve unique habitat in specific geographic regions. For example, it may be important to limit development around estuary areas and coastal wetlands and waterways, in order to preserve an area to accommodate ecological retreat. Adaptation planning is recommended to ensure that this is comprehensively considered to mitigate risk to social and environmental values in the area.

Residents of the coast are already familiar with the risks of living close to the ocean, such as storm surges, cyclones and erosion. However, the intensity of these threats is expected to increase with a warming global climate, so it is important to understand and prepare for this. Reducing environmental pressures will increase the resilience of coastal ecosystems, thereby increasing the likelihood of their persistence into the future.

KEY MESSAGES FOR THE WET TROPICS



Average temperature will continue to increase in all seasons.



More hot days and warm spells.



Changes to rainfall possible but unclear.



Increased intensity of extreme daily rainfall events.



Mean sea level will continue to rise. Height of extreme sea-level events will also increase.



Fewer but more intense tropical cyclones.



On annual and decadal basis, natural variability in the climate system can act to either mask or enhance any long-term human induced trend, particularly in the next 20 years and for rainfall.

Figure 38: Key climate change messages for the Wet Tropics Natural Resource Management (NRM) cluster (Source: Abbs, D. et al., 2015)

7 Recommended Activities

Table 2: Recommended Activities for the Blacks Beach Local Coastal Plan

RECOMMENDED ACTIVITIES	
ZONE A Rocky outcrop to southern extent of 40 Bourke Street (3.3 ha)	
1	Vegetation management
1.1	Control major target weed species including lantana, leuceana, Guinea grass, coconut and prickly pear.
1.2	Monitor spread of beach dune primrose and control as required.
1.3	Control weeds on and around beach access tracks including highly dispersive weeds such as cobbler's peg and Seaforth burr.
1.4	Undertake assisted natural regeneration.
1.5	Monitor and where suitable, manage other problematic weed species including, but not limited to: annual stylo, Brazilian nightshade, corky passionflower, common guava, Chinese burr, centro, grader grass, mile a minute, pink periwinkle, red natal grass, snakeweed, tridax daisy and siratro.
2	Access management
2.1	Upgrade Camilleri Street staircase and investigate drainage improvements.
2.2	Provide beach access point at the northern end of Blacks Beach Park, over the seawall (BLA00).
2.3	Connect the Camilleri Street beach access stairs with the proposed beach access track via a concrete pathway.
2.4	Install additional concrete pathways within Blacks Beach Park to connect existing and proposed beach access points.
2.5	Upgrade car parking area to provide additional car parks.
ZONE B North of Turtle Place to BLA02 (3.1 ha)	
3	Vegetation management
3.1	Control major target weed species including lantana, coconut, leuceana, mother-of-millions and Guinea grass.
3.2	Monitor spread of beach dune primrose and control as required.
3.3	Control weeds on and around beach access tracks including highly dispersive weeds such as cobbler's peg and Seaforth burr.
3.4	Undertake assisted natural regeneration.
3.5	Remove green waste and personal property encroaching into Reserve and Esplanade tenure.
3.6	Monitor and where suitable, manage other problematic weed species including, but not limited to: annual stylo, Brazilian nightshade, corky passionflower, common guava, Chinese burr, centro, grader grass, mile a minute, pink periwinkle, red natal grass, snakeweed, tridax daisy and siratro.
4	Access management
4.1	Repair modified post and rail fencing north of Turtle Place.
4.2	Upgrade Turtle Place beach access (BLA02).
4.3	Realign Reserve boundary fence landward by 15-20m.
4.4	Continue Reserve boundary fence throughout Zone B. Install mesh along the base of the fence.
4.5	Replace faded or vandalised interpretive signage.
4.6	Install regulatory and interpretive signage, where appropriate.

ZONE C | BLA02 to Anglers Parade (7.5 ha).

5 Vegetation management

- 5.1 Control major target weed species including lantana, coconut, mother-of-millions and Guinea grass.
- 5.2 Monitor spread of beach dune primrose and control as required.
- 5.3 Control weeds on and around walking beach access tracks including highly dispersive weeds such as cobbler's peg and Seaforth burr.
- 5.4 Undertake assisted natural regeneration.
- 5.5 Remove green waste and personal property encroaching into Reserve tenure and the APZ.
- 5.6 Monitor and where suitable, manage other problematic weed species including, but not limited to: annual stylo, Brazilian nightshade, corky passionflower, common guava, Chinese burr, centro, grader grass, mile a minute, pink periwinkle, red natal grass, snakeweed, tridax daisy and siratro.
- 5.7 Provide privacy landscape treatments where desired by residents between Pitt Street and Anglers Parade.

6 Recreational opportunities

- 6.1 Install an all abilities access viewing platform with seating at the Pitt Street beach access.
- 6.2 Upgrade car parking at the end of Pitt Street and install additional infrastructure in the park such as toilet facilities.
- 6.3 Install a small-scale viewing platform with seating in front of the Shores Holiday Apartments.

7 Access management

- 7.1 Connect viewing platform via linkage path to beach access and car park at Pitt Street.
- 7.2 Install a nature trail between Pitt Street and Blacks Beach Spit walk.
- 7.3 Review the location of the fencing between Anglers Parade and Pitt Street, given historical discussions with residents.
- 7.4 Formalise beach access in front of the Shores Holiday Apartments (BLA2.1).

ZONE D | Anglers Parade to BLA08 (9.8 ha).

8 Vegetation management

- 8.1 Control major target weed species including lantana, guava, agave, coconut and Guinea grass.
- 8.2 Monitor spread of beach dune primrose and control as required.
- 8.3 Control weeds on and around beach access tracks including highly dispersive weeds such as cobbler's peg and Seaforth burr.
- 8.4 Undertake assisted natural regeneration.
- 8.5 Remove green waste and personal property encroaching into Reserve tenure and the APZ.
- 8.6 Monitor and where suitable, manage other problematic weed species including, but not limited to: annual stylo, Brazilian nightshade, corky passionflower, common guava, Chinese burr, centro, grader grass, mile a minute, pink periwinkle, red natal grass, snakeweed, tridax daisy and siratro.

9 Access management

- 9.1 Replace BLA06 to BLA08 beach access track fence.
- 9.2 Investigate car parking opportunities at the southern end of Pacific Drive.
- 9.3 Investigate beach closures for domestic animals during turtle nesting and shorebird migration seasons.

ZONE E I (15.1 ha)**10 Vegetation management**

- 10.1 Control major target weed species including lantana, agave, coconut, Guinea grass, mother-of-millions, castor oil plant, African tulip and red leaved alternanthera.
- 10.2 Control weeds on and around access tracks including highly dispersive weeds such as cobbler's peg and Seaford burr.
- 10.3 Undertake assisted natural regeneration.
- 10.4 Remove green waste and personal property encroaching into Reserve tenure and the APZ.
- 10.5 Monitor and where suitable, manage other problematic weed species including, but not limited to: annual stylo, Brazilian nightshade, corky passionflower, common guava, Chinese burr, centro, grader grass, mile a minute.
- 10.6 Liaise with adjoining owner of land which is zoned Urban under the Planning Scheme, to discuss mutually beneficial vegetation management activities.

11 Access management

- 11.1 Continuation of the APZ behind properties on the western side of Pacific Drive, including the installation of fencing, including mesh, no more than 10m from the property boundary.
- 11.2 Provide pedestrian access to the Reserve at the end of Cowrie Street.
- 11.3 Maintain emergency and maintenance vehicle gates at the end of Cowrie Street.
- 11.4 Liaise with adjoining owners of land which is zoned Urban under the Planning Scheme, to discuss mutually beneficial access management activities.

Other activities across multiple zones**12 Cultural heritage**

- 12.1 Engage Traditional Owners to undertake cultural heritage surveys of the area to outline clear management objectives for the preservation cultural heritage within the coastal unit.

13 Signage

- 13.1 Audit all beach access signs across the unit and update or install:
 - Signage at the landward end of each beach access point that clearly identifies the beach access number, restricted activities, hazards present and provides information on the appropriate first aid treatment for marine stingers.
 - Beach access numbering signage at the seaward end of each beach access point.
- 13.2 Install pathway linkage signage that describes pathway routes and beach access tracks and include measured walking distances.

14 Access management

- 14.1 Install regulatory signage to protect shorebird and marine turtle populations.
- 14.2 Consider pathway linkages in neighbouring areas to improve connectivity between parks and reserves including Bourke Street, Pacific Drive, Coral Drive and Pitt Street.
- 14.3 Adhere to the recommendations outlined in Council's *Blacks Beach Mackay Bushfire Management Plan*.

15 Recreation

- 15.1 Provide bicycle racks at all recreational hot spots.

16 Tourism

- 16.1 Investigate ecotourism opportunities in collaboration with relevant stakeholders such as Mackay and District Turtle Watch Association.

17 Vegetation maintenance

- 17.1 Continue to protect and enhance well-vegetated dune systems.

18 Community involvement

- 18.1 Provide opportunities for community members to be involved in coastal management activities at formal Coastcare events.

19	Monitoring
19.1	Undertake beach profile monitoring to record and assess change over time and monitor the impacts of sea level rise and the changing dynamics of coastlines to guide future coastal planning and works.
19.2	Consider a regional study on the long-term sediment (sand) supply for the Mackay coastline.
19.3	Monitor, or in partnership with others, assist with the monitoring of shorebirds and turtles.
20	Climate change
20.1	Consider how to manage future predicted reduction in coastal land to retain buffer above the high tide mark (e.g. rolling boundaries).
20.2	Review existing revegetation list to ensure that species reflect diversity of all Regional Ecosystems present in coastal unit and in preparation for future predicted climates.
21	Stormwater outlets
21.1	Assess stormwater outlets and consider opportunities for Gross Pollutant Traps within the coastal unit.
22	Legislation and local laws
22.1	Use available legislation to protect existing native vegetation on Esplanade and Reserve tenure as required.
22.2	Using existing laws, undertake enforcements and compliance activities across the area, particularly relating to unrestrained dogs and motor vehicles in park and beach areas.
22.3	Review and update this document in line with changing legislation.
23	Enhancement of surrounding areas
23.1	Implement a tree succession plan across the length of the coastal unit.
23.2	Implement a roadside vegetation program to increase the amount of street trees along roads.
24	Waste management
24.1	Inform residents of appropriate waste disposal methods. Follow up with education, regulation and enforcement activities.
24.2	Educate the community on the impacts of waste on native vegetation, dune health, and wildlife.
25	Seawall assessment
25.1	Review structural integrity of seawall structures under council control and upgrade as required including scour potential in locations downdrift of the walls (terminal scour) and the risk to public safety (particularly significant for the northern most seawall situated along public reserve/picnic area).
26	Education
26.1	Partner with Coastcare and others to deliver education programs about: <ul style="list-style-type: none"> - Local weed species and the use of local native species in residential gardens. - Garden waste and general waste disposal. - Responsible pet ownership including having dogs on leads at all times, unless in a designated dog off leash area, where they must still be under effective control and respond to the owner's commands. - The ecology and threats to native wildlife including marine turtles and shorebirds.



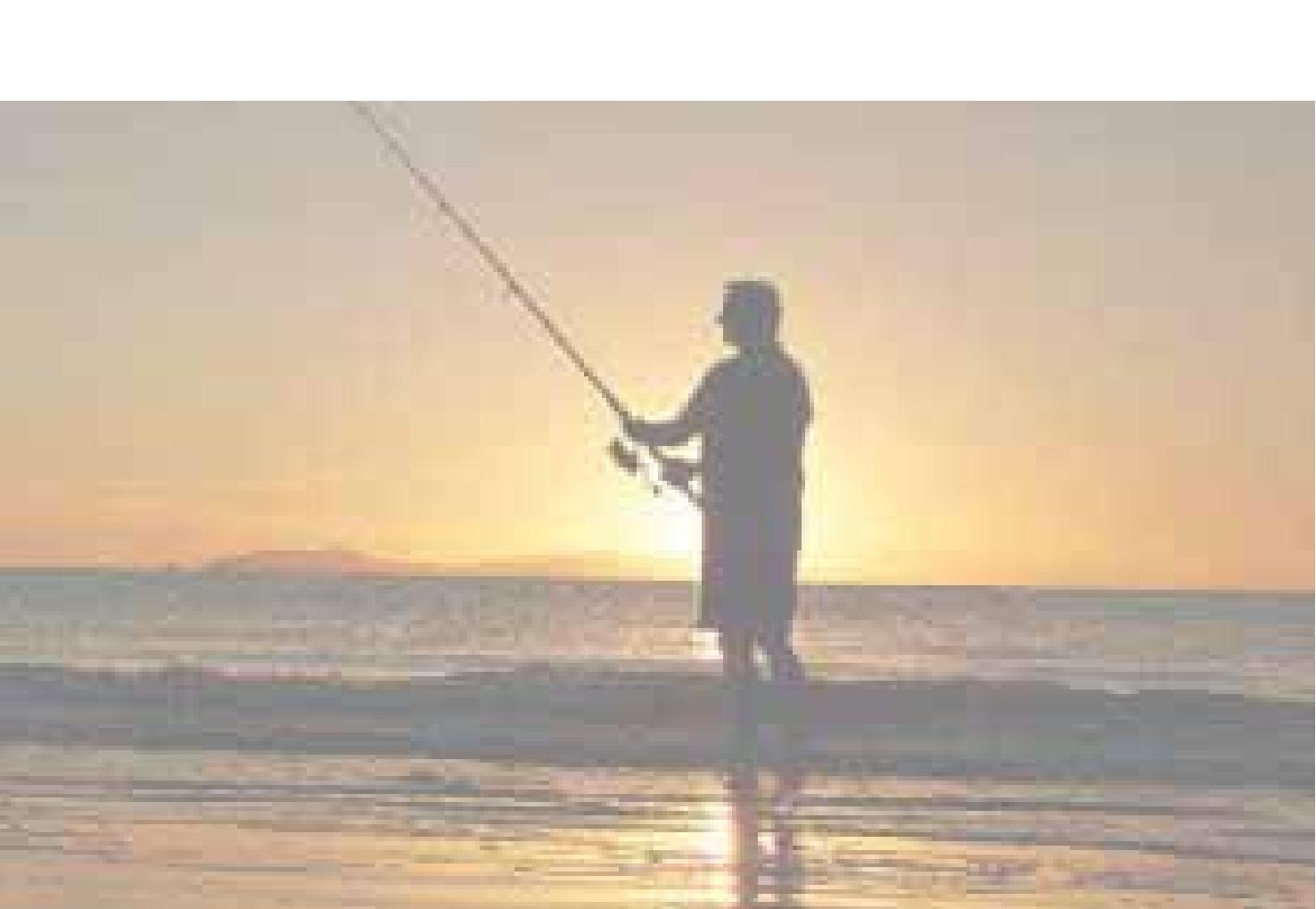
8 Implementation and Review

The implementation of the *Blacks Beach Local Coastal Plan* will occur on a prioritised basis as resources become available.

In addition to Council's Natural Environmental staff and *Natural Environment Levy* funding, multiple external opportunities for funding and resources to assist in the implementation of the *Blacks Beach Local Coastal Plan* exist. These include:

- Federal Government grant opportunities.
- State Government grant opportunities.
- Corporate grant opportunities.
- Regional natural resource management group (Reef Catchments Mackay Whitsunday Isaac) partnerships.
- Specialist organisations such as the Mackay and District Turtle Watch Association, Birdlife Mackay, and Queensland Wader Study Group.
- Local community groups.
- Local community volunteers as part of the Coastcare program.

A formal review of the *Blacks Beach Local Coastal Plan* should take place every five years as feasible. However, Council may seek to update the plan at any stage based on the results of monitoring programs, and in line with the need to further protect the natural environmental values of the area.



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10 Appendices

Appendix 1: Clarke Connors Range Fire Management Guidelines

The cover of the document features a yellow background with a stylized illustration of a tree's branches in white and black. The title 'The Clarke Connors Range bushfire consortium' is written vertically on the left side. A small paragraph of text is located in the upper right corner. The main title 'FIRE MANAGEMENT GUIDELINES' is positioned in the center. Logos for various organizations are arranged in a grid on the right side.

The Clarke Connors Range Bushfire Consortium is a Reef Catchments Initiative with funding support from the Australian Government's Caring for Our Country and Queensland Government's Blueprint for the Bush.

FIRE MANAGEMENT GUIDELINES

REEF CATCHMENTS
Wardlow Whitsunday Inc.

KIRRI FIRE SERVICE

Queensland Government

Blueprint for the Bush

CARING FOR OUR COUNTRY

Introduction

Blacks Beach and the Clarke Conors Catchments Rural Fire Catchments is a community based, not-for-profit organisation that has a proven track record in advancing natural resource management in the Mackay Whitsunday Region. Rural Catchments work voluntarily across the private and all levels of the public sectors to deliver the results where they matter. For more information and contact details visit the website ruralcatchments.com.au

The Blacks Beach Catchment was formed to begin reducing the threat of bushfires on the outstanding natural and economic values of the Clarke-Conors Range on the Central Queensland coast. This area experiences an extremely variable climate and receives frequent Bureau of Meteorology and Intense dry season weather events documented over the last 10 years. The concern is that a drier and hotter climate may further increase the incidence of these fires with consequent environmental and economic impacts. Rural communities recognise the magnitude of these risks, and their effects on life, property, productivity, and the environment. However, the wider community has not had access to good information on appropriate fire management practices until now.

Rural Catchments, in partnership with Volunteer Rural Fire Brigades, Government and non-Government landholders, and the Queensland Fire and Rescue Service, has taken up the challenge of providing the best information available on fire management and planning in the region. These Fire Management Guidelines are the culmination of informative discussions with experienced members of Volunteer Rural Brigades and other respected fire managers and fire scientists.

The Clarke-Conors Catchments Rural Fire Catchments developed these guidelines to assist the community of Mackay Whitsunday to manage fire risk in the catchments. This document is provided for information purposes only. No advice is made as to the accuracy or suitability of the material. The user of this document does so at their own risk.

These Guidelines are one of the products of the Blacks Beach Catchment and are intended to be used by Volunteer Rural Fire Brigades and landholders who are on the front line in managing fire in rural communities. They are intended to be used to help land managers plan hazard reduction burning, and in undertaking planned burns for improved production and conservation outcomes.

Using these Guidelines

These Fire Management Guidelines have been developed for 12 landscape types in the Mackay Whitsunday region. These landscape types are composed of vegetation types that require similar fire prescriptions.

- Four important factors to consider when planning for fire management are:
1. Fire frequency - how often should an area be burnt;
 2. Fire friendly - how hot does the fire need to be;
 3. Severe - what time of year will usually provide the desired conditions for a planned burn;
 4. Burning mosaic - the percentage of ground cover remaining unburnt after a fire.

Other important factors to consider are fuel loads, wind speed, humidity, fuel curing, slope and aspect.

These guidelines are not intended to account for all circumstances. Seasonal, yearly and even daily conditions can vary dramatically. Plan ahead to carry out burns when conditions are suitable and always obtain conditions and adherence of a permit from your fire warden.

Green - Under most circumstances the number of years between burns should fall within the GREEN range. This range is generally considered acceptable for fire hazard management, production and conservation objectives.

Orange - Under some circumstances there may be a need for more or less frequent fire but the whole fall within the ORANGE range. Generally, this would occur as a 'bit of a bit' two days to 3 years to reduce a bushfire threat.

Red - Generally, it would be considered undesirable for the frequency to fall within the RED range. For example, these long periods of time between fires would result in undesired regeneration thickening and loss of pasture productivity.

Note: Burning frequency by 'years' can be misleading as, in these cases of strength or particularly high rainfall, some fire regimes provide 'annual 'turnover systems,' dominated by burning needed to 25% of the total average annual rainfall by May.

Green - Under most circumstances the desired conditions will be available within the GREEN range of months.

Orange - Despite the conditions will sometimes fall within the ORANGE range of months under the specific requirements for a particular burn will differ in a particular circumstance e.g. storm burning requires relatively high temperatures.

Red - Under most circumstances conditions within the RED range of months would result in damage to the understory fire that is difficult to control.

Polytely fuels produced by mobile burns can be very effective in reducing the intensity and spread of wildfire without risking the complete loss of delicate structures, loss of soil and nutrients, weed invasions or environmental damage that sometimes result from complete removal of the ground layer from large areas.

Different fire intensity perform different land management tasks as described within the following text.

LOW INTENSITY fire < 1m in height.

MEDIUM INTENSITY fire < 2m in height.

HIGH INTENSITY fire > 2m in height.

The Clarke Conors Range Fire Management Guidelines

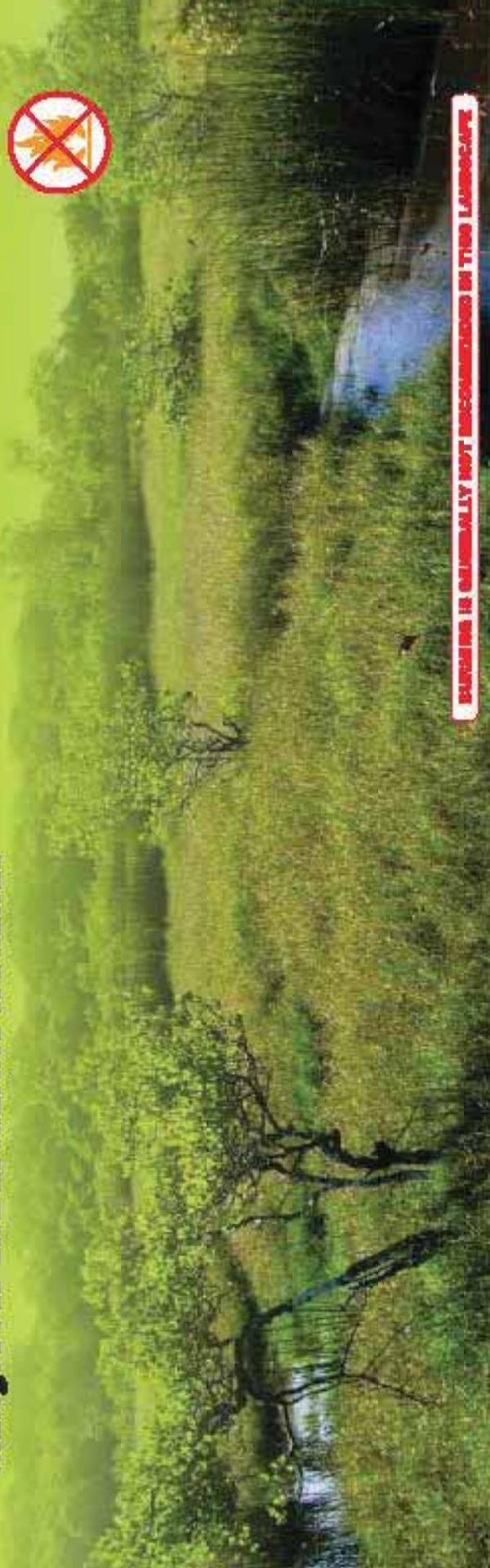


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Mangroves and Estuarine Wetlands

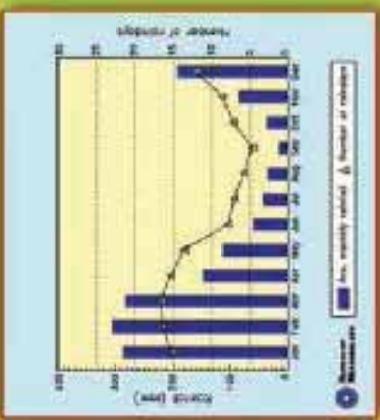
Fire Management Guidelines for Central Queensland Coast

Landscape 1



BURNING IS ESSENTIALLY NOT NECESSARY IN THIS LANDSCAPE

Mangrove, saltmarsh, saltwater couch, areas of saltpan and fringing malleumus forests and heathlands.



The Clarke Connors Range
is the highest point in the landscape.

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Habitat Restoration

Saltmarsh and saltwater couch grasslands are regularly inundated by high tides which maintain high soil moisture and ensure continued green growth throughout the year. Because of this these areas rarely represent a fire hazard risk. Risk is further minimised by the fact that the grasslands rarely accumulate large amounts of fuel and tend to be broken up by patches of saline clay and sparse saltmarsh.

The native ground cover within fringing meadows, woodland and forests is also saltwater couch and this does not represent high fire hazard. However, in many areas Guinea grass and other exotic grasses have invaded and these can accumulate high fuel loads that pose a fire risk in the dry season. Guinea grass and many other exotic grasses tend to quickly increase their biomass after fire, often reaching a similar fuel load in as little as one season. The most effective long-term fire hazard reduction strategy is to remove these grasses using herbicide such as glyphosate.

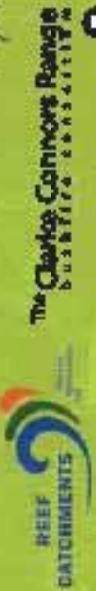
Pests

Because of high salt levels in the soil, weed infestations are rarely a problem in saltwater couch grasslands and burning for weed control does not need to be undertaken. Saltwater couch is a perennial grass and pasture condition is strongly dependent on normal tidal cycles. Fire does

not improve productivity and instead, fire can lead to loss of important nutrients. Saltmarsh and saltwater couch grasslands are an important food source, and refuge for juvenile fish. There is strong evidence that juvenile fish feed heavily in these areas on high tide. A decrease in biomass through removal by fire, or overgrazing, may have a significant impact on coastal fisheries production.

Conservation

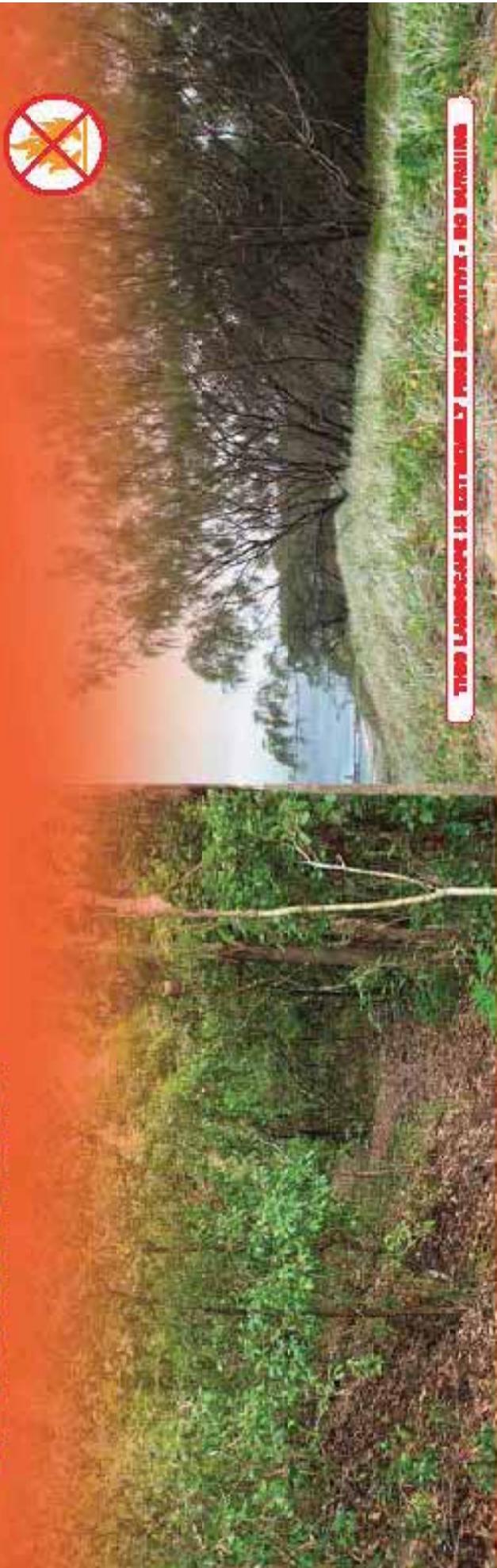
Apart from their values to coastal fisheries, mangroves, saltmarsh and saltwater couch grasslands provide essential habitat for a range of conservation dependent species. Minimising fire and other disturbance within these areas provides significant positive benefits for migratory and resident shorebirds, seabirds and the threatened mangrove mouse.



Beaches and foreshores

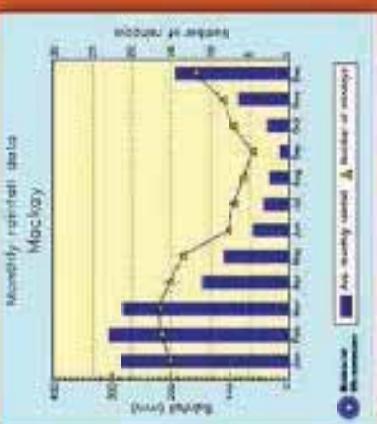
Fire Management Guidelines for Central Queensland Coast

Landscape 2



THIS LANDSCAPE IS ENTITLED TO FIRE MOSAIC - NO BURNING

Coastal shrub & beach scrub (rainforest) in protected areas.



The Clarke Connors Range
Mackay

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Coast live-oak and beach scrub habitats are fire sensitive and will be killed or severely degraded by even low intensity fire. The native ground cover within beach scrub and coastal forest/scrub does not accumulate large amounts of fuel and does not represent a high fire hazard. However, infestations of exotic grasses and weeds can significantly increase hazardous fuel, especially along disturbed edges of this landscape.

weeds into otherwise intact areas. Management of stock access and provision of shade and sheltering points away from beach scrub and foredunes will reduce the impacts of disturbance in the long term.

Reducing weed impacts by means other than fire around buffers and in degraded areas will protect, and facilitate recovery of, these sensitive coastal areas.

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Hazard reduction burning is generally not suitable in coastal areas as Guinea grass and other fire loving grasses quickly increases their biomass after fire, often regaining a similar fuel load in as little as one season.

An effective long-term strategy is the use of registered herbicide to reduce pest hazards where required. Apply when grasses are actively growing, preferably prior to dry season.

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Many remaining areas of beach scrub are islands in a sea of cleared land, and much remaining forested vegetation is the only buffer between the land and the sea.

Undisturbed forest floor and beach scrub are fairly resistant to weed invasions, however smaller patches and disturbed areas are more prone to weed invasion and associated fire.

Disturbances caused by birds trampling and the presence of
water may both contribute greatly to losses.



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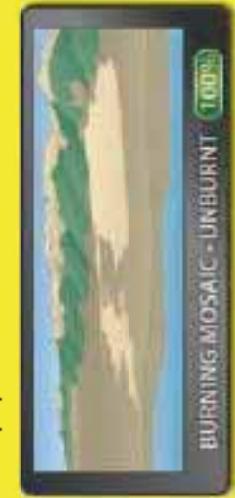
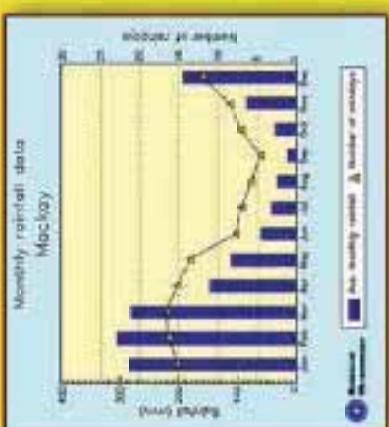
Hind Dunes

Fire Management Guidelines for Central Queensland Coast

Landscape 3



Mixed vegetation on hind dunes (behind main beach and foreshore areas) (including: Moreton Bay ash, acacia, coastal banksia, paperbarks, bloodwoods, black she-oak, peppermint and stringy banks & grasslands on sand dunes)



The Clarke Connors Range
is a high fire risk area

Planned Burnt Area

Burning is not generally recommended in coastal dune systems and adjacent buffer zone unless for rehabilitation or protection purposes in special circumstances.

Exotic grass infestations such as *Gulinea* grass are common along the edges of coastal dune vegetation. Many introduced grasses are favoured by disturbance and rapidly re-grow after fire, often accumulating similar fuel loads in as little as one season.

Landcare area In some built up areas may decide protection burning to reduce hazards. Fire should only be used to gain initial control of weedy areas as part of a long term weed management strategy. Burn with low intensity fire; ensure good soil moisture is present (e.g. after 60mm of rain) no more than once every 3-5 years. Avoid regular or repeated burning and do not burn in dry conditions when risk is high.

Management of exotic grasses and other weeds Is best achieved by using a registered herbicide when the plant is actively growing. *Gulinea* grass is easily killed after fire with minimal herbicide use.

Pastureland

Clearing and introduction of exotic pasture species coupled with impacts of stock can severely impact on fragile dune systems. Exotic species can out-compete natives in disturbed areas and alter natural fire regimes.

Open dune grasslands supporting native grasses such as black spear grass would tolerate a low intensity fire every 3-7 years. Planned burns should only be conducted when rapid

regeneration of the grassy layer is expected; burn with good soil moisture and where there is a good chance of follow up rain. Avoid regular or repeated burning as loss of groundcover and soil nutrients will encourage weeds and less favourable grasses.

Disturbance of ground layer Leads to weed invasions and loss of native grasses. Minimise disturbance from stock trampling and manage weeds using other methods than fire.

Greenbelts

Lack of knowledge of this ecosystem and its need for fire is a major obstacle to effective fire management. In general, fire should only be applied for regeneration of native grasses and canopy trees and responses carefully monitored.

Fire management should be tailored in areas supporting a native grass ground layer. A low intensity fire no more than once every 5-7 years with good soil moisture is advised. Indicators of successful fire management include: germination of canopy tree species; maintaining native grass density; fauna abundance; and reducing exotic grass dominance.

Many areas supporting beach scrub pioneer species in the understorey will naturally revert to beach scrub; actively exclude fire from these areas.

Coastal landscapes support a diverse range of plants and animals and their habitats are vulnerable to disturbance. Reducing disturbance and managing weeds rather than fire will protect coastal habitats and wildlife such as the orange footed scrub fowl (pictured above).



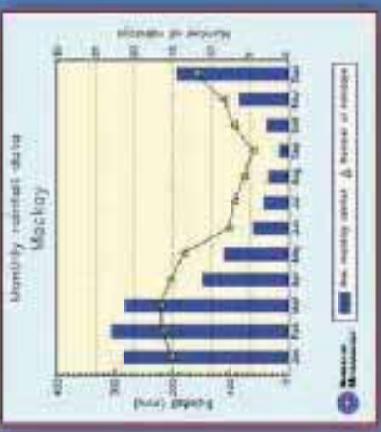
Wetlands associated with sand dune systems

The Management Guidelines for Central Queensland Coast
Landscape 4

Wetlands associated with sand dune systems



Mixed vegetation on hind dunes (behind main beach and freshwater areas) (including: Moreton Bay airo, acaena, coastal banksia, paperbush, broad-leaved black sheoak, paperbush and stringybark & grasslands on sand dunes)



The Climate Change Range



Management Recommendations

Melaleuca swamps in their natural state are relatively fire tolerant due to high moisture levels in the soils and low rates of litter accumulation. They can also act as a natural fire break in the landscape.

Disturbed or degraded Melaleuca swamps may contain exotic grasses and weeds around the fringes and where water flow has been altered, ponded pasture grasses can dominate wetter areas. Guinea grass, native Hyparrhenia and pennisetum can fuel intense damaging fires.

Burning for weed control and property protection needs to be carefully managed. Protection zones should not be burnt more than once every 4-8 years. Fire can reduce para grass and Hyparrhenia weed infestations temporarily but it is essential to burn when moist to reduce intensity and risk of canopy tree death. Planned burns are generally best prior to the dry season when soil moisture is high but standing water is reduced.

Weed control using a registered herbicide is effective spot-burn or to hazard of fire. Follow up management and ongoing observation is required for unburned ground. Incidence of success includes native wetland plant abundance, canopy tree health & reduction in extent and dominance of exotic grasses.

Prescription

Many areas of coastal Melaleuca swamps are grazed although pasture is development limited as they may be inundated for 3-6 months of the year.

Some areas of coastal Melaleuca swamps have been modified to establish ponded pastures. These commonly include para grass or native Hyparrhenia, one of the top 20 Weeds of National Significance, and can completely choke our wetlands. Heavy dry

season grazing can reduce their extent and density when the risk is at its greatest. Burning to reduce infestations can be effective and is best done in conjunction with grazing to reduce fuel and damage to wetlands.

Heavy grazing pressure in Melaleuca swamps can disrupt native ground layer species and lead to woody weed invasions including Devil's Fig and Brazilian pepper tree. Fire is generally not recommended to manage woody weeds in Melaleuca swamps. Approved herbicides or other methods are preferred. Burning undertaken in land adjacent to Melaleuca swamps should ensure hot fires do not scorch edges or intrude into the wetlands.

Conservation

Melaleuca swamps are dynamic ecosystems and the timing of fire and wet and dry events play a key role in these dynamics. Too frequent fire from adjacent cane land, grazing pastures or weedy urban fringes will reduce ground layer diversity and kill young Melaleuca. However, Melaleuca germination is enhanced by fire and occasional fires will maintain recruitment of trees into the canopy.

To maintain the integrity of melaleuca wetlands, a fire every 10 years or more is recommended. Burning can be undertaken more often, every 5-10 years, providing fire intensity is low to moderate and a patchy burn is achieved. Native wetland vegetation will not promote intense fires however great care needs to be taken when burning exotic grasses to ensure fire does not damage or kill canopy and habitat (bellow bearing) trees. Fire retardants should not be used as they damage the ecology of these sensitive areas.

Varying the season, intensity and frequency of planned burning promotes diversity and a range of different vegetation ages.



The Gladys Captain Range
BUSH FIRES



Queensland
Government

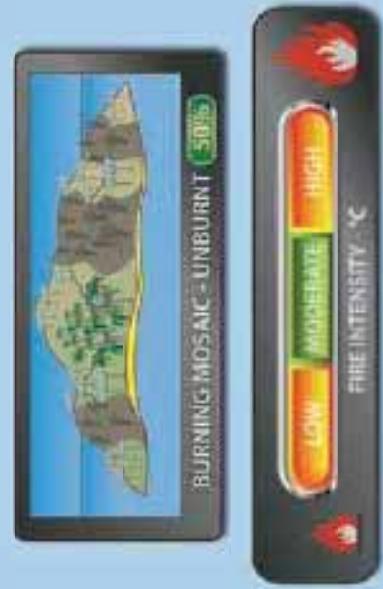
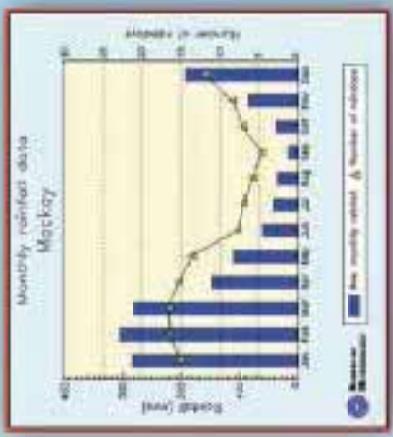


Island and rocky headland landscapes

Landscape 12



Grazing headlands to scrub and brushbox and ironbark forest-shrubland, blue gum and poplar gum woodlands (Producing firebreak), Western Bay with wet blue gum woodland with a dense understorey of vine forest species.



Hazard Reduction

Island woodlands and coastal headlands can be infested with introduced grasses and lantana which promote hotter fires and rapidly regrow after fire. In general, it is the more disturbed areas impacted by weeds. Disturbance can be from repeated fires in the past.

Control of weeds and exotic grasses by means other than fire may be preferred in areas surrounding campgrounds, island leases and picnic areas.

Where hazard reduction burning is required, fuel loads of 1500kg/ha are adequate to ensure fire intensity is low to moderate. Greater fuel loads will increase fire intensity and the chance of fire spreading.

On the mainland, four wheel drive tracks and other areas of high vegetation are a conduit for introducing weeds which can pose a fire risk to surrounding areas.

Generalities

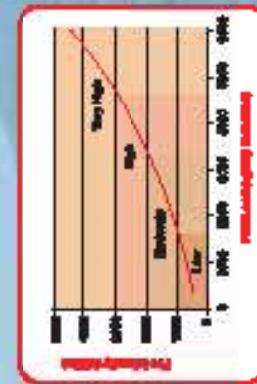
Some areas of open grassland are being invaded by woodland or vine forest pioneers whilst other areas remain as open grasslands. Research is needed to determine the role of fire in maintaining vegetation types to determine optimum fire regimes.

Dense thickets of swizzle bush (*Timonius timor*) are replacing grasslands in some areas. Swizzle bush flowers and fruits between July & November, and could be burnt if burnt at during this time. Hotter fires may be needed to reduce woody vegetation and maintain an open canopy, requiring

Fuel loads of 2000-3000 kg/ha.

Maintain leatent and areas of greenheads, where they remain by trailng burning every 2-3 years with a low-moderate intensity fire; retain at least 50% unburnt. Monitor vegetation and adapt management depending on response to fire regime.

Lantana can be managed by fire in the same way as other woody vegetation. Suitable fuel loads must be available, between 2000-3000 kg/ha, to reduce intensities. Slow burning moderate intensity fire can suppress lantana as it damages the root and lower stem zone.



The Great Barrier Reef
Marine Park Authority

REEF
CATCHMENTS
Initiative

2017

Appendix 2: Regional Ecosystem (RE) descriptions as found on Council managed land within the coastal unit

RE 8.1.1 describes the mangrove community that borders the residential subdivision in the south, along Pacific Drive. This ecosystem occurs on Reserve land tenure and is clearly distinguished by its dominance of mangrove tree and shrub species (EPA 2005). Mangrove communities thrive in muddy, saline, intertidal areas, such as that of Mc Creadys Creek. Depending on their position in relation to tidal channels and the amount of freshwater received; the mangroves can form a variety of different compositional communities. At the seaward edge RE 8.1.1 *Rhizophora* species dominate, whereas white mangrove (*Avicennia marina*), blind your eye mangrove (*Excoecaria agallocha*), puzzle nut mangrove (*Xylocarpus moluccensis*), black mangrove (*Lumnitzera racemosa*), yellow mangrove (*Ceriops species*), myrtle mangrove (*Osbornia octodonta*) and other predominant species (*Bruguiera* and *Rhizophora* species) are more likely to occur on the landward side. Mangrove communities are vital breeding grounds for a diverse range of species including invertebrates, crocodiles and reef fish species (Fukuda et al. 2007) and are therefore both culturally and biotically significant ecosystems. At Blacks Beach, RE 8.1.1 is exposed to inappropriate vehicle and boat access, marine debris and stormwater runoff. It is important to recognise that onshore activities act to protect or threaten marine vegetation systems and appropriate management of recreational access and improved stormwater management practices will assist in protecting offshore ecosystems.

RE 8.1.2 describes samphire open formland on salt pans and plains adjacent to mangroves and is characterized by succulent saline-adapted herbaceous species such as sea purslane (*Sesuvium portulacastrum*), glasswort species (*Tecticornia spp.*, and *Sarcocornia spp.*), seablite (*Suaeda australis*), marine couch (*Sporobolus virginicus*), and sedge species (*Cyperus spp.*, and *Fimbristylis spp.*) that inhabit intertidal mud flats. Within the beach unit RE 8.1.1 and RE 8.1.2 occur on soils consisting of marine sediments. Soil salinity is a principal driver of zonation within estuarine systems. Salt accumulates at the soil surface as a result of evaporation, however is reclaimed during high tides or flooding events. However changes in surface topography as result of unofficial vehicle access can encourage accumulation of salts and increase soil salinity. Continued, this process can lead to very high soil salinities, which discourages re-establishment of salt marsh plants. The diminished health of RE 8.1.1 and can impact coastal fisheries production, through loss of habitat and food sources (Reef Catchments, 2009). Appropriate management of recreational access will assist in protecting RE 8.1.2 and its associated offshore ecosystems.

RE 8.2.1 describes Casuarina equisetifolia woodland and/or sparse herland to open scrub on foredunes and beaches and is easily recognisable along the foredune of Bucasia Beach. It can be distinguished from all other regional ecosystems as it is predominantly distributed along the foredunes and typically

comprise of species such as coastal sheoak (*Casuarina equisetifolia* subsp. *Incana*) and ground cover species such as beach grass (*Spinifex sericeus*) beach bean (*Canavalia rosea*), goats foot (*Ipomoea pes-caprae*) and birds beak grass (*Thuarea involuta*). Common species in the canopy or lower tree and shrub layers include: portia tree (*Thespesia populnea*), necklace pod (*Sophora tomentose*), thatch screw pine (*Pandanus tectorius*), beach hibiscus (*Hibiscus tiliaceus*), soap tree (*Alphitonia excelsa*), flintwood (*Geijera salicifolia*) and gray nicker nut (*Caesalpinia bonduc*). Shrub layers often include: coastal vitex (*Vitex trifolia*), scrambling clerodendrum (*Clerodendron inerme*), tuckeroo (*Cupaniopsis anacardioides*), forest indigo (*Indigofera pratensis*), beach berry bush (*Colubrina asiatica*), and octopus bush (*Argusia argentea*). Vegetation within this community is usually zoned according to tidal inundation/ exposure with the herbaceous communities closest to the sea and the open forest to woodland communities furthest away. At Bucasia, the largest distribution of RE 8.2.1 occurs along the northern half of the beach unit. Disturbance can result in erosion and weed invasion, where problematic weeds include: southern sand burr (*Cenchrus echinatus*), red natal grass (*Melinis repens*), lantana (*Lantana camara*), tridax daisy (*Tridax procumbens*), tumble weed (*Salsola australis*), Guinea grass (*Megathyrsus maximus*), pink periwinkle (*Catharanthus roseus*), prickly pear (*Opuntia stricta*), corky passionflower (*Passiflora suberosa*), buffel grass (*Cenchrus ciliaris*) and snakeweed (*Stachytarpheta jamaicensis*).

RE 8.2.11 is described as *Melaleuca* spp. woodland and is located in front of freehold land to the south of the Blacks Beach coastal unit. The ground cover of this ecosystem is generally moist, decomposition rates are high and consequently fuel accumulation is low. Dominant canopy species can include one or many of the following *Melaleuca* species: leaved paper-bark (*M. leucadendra*), broad leaved paperbark (*M. quinquenervia* and *M. viridiflora* var. *attenuate*) and tea tree (*M. dealbata*) and occasional associated species occur including weeping cabbage bush (*Livistona decora*), morton bay ash (*Corymbia tessellaris*), coastal banksia (*Banksia integrifolia* subsp. *Compar*), soap bush (*Alphitonia excelsa*), and screw pine (*Pandanus* species). RE 8.2.11 has established on the newly forming parallel dune swales and is susceptible to weed invasion and erosion associated with coastal development and recreational activities. Common problem weeds include lantana (*Lantana camara*), corky passionflower (*Passiflora suberosa*), *Ipomoea cairica* and *Solanum seaforthianum*. Although this community is considered fire tolerant, hydrological events (i.e. 69 seasonal flooding) are likely to have a major influence on this ecosystem's health (EPA, 2005). RE 8.2.11 and RE 8.2.6a share a similar extent. RE 8.12.13a occurs on slopes, crests and ridges of headlands and islands, such as the area north of Blacks Beach Park, where the rocky outcrop of Dolphin Heads dominates the landscape.

RE 8.2.13a is a palustine wetland comprising of *Melaleuca* spp. and/or *Corymbia* spp. and/or *Lophostemon suaveolens* and/or *Acacia* spp. open forest on dune sands mixed with alluvial material +/- marine sediment. Sparse to mid-dense sub-canopy and lower tree layers commonly represented include weeping cabbage (*Livistona decora*), coastal banksia (*Banksia integrifolia*), tea trees (*Melaleuca dealbata* and *M. leucadendra*), northern wattle (*Acacia leptocarpa*), screw pine (*Pandanus cookii*), cocky apple (*Planchonia careya*) and soap bush (*Alphitonia excelsa*). Shrub layers consist of saplings from the upper layers, and shrubs such as cheestree (*Glochidion lobocarpum*). The ground layer is very sparse and mainly consists of tree seedlings, vines, sedges, and shade tolerant grasses. Remnants are susceptible to hydrological changes caused by the alteration of the surrounding terrain, i.e. development. Weed invasion in remaining remnants is common and problematic species include lantana (*Lantana camara*), corky passionfruit (*Passiflora suberosa*), siratro (*Macroptilium atropurpureum*), molasses grass (*Melinis minutiflora*), Guinea grass (*Megathyrsus maximus*), giant rats tail grass (*Sporobolus pyramidalis*) and chinese burr (*Triumfetta rhomboidea*). Guinea grass, lantana and rubbervine can increase fire severity and/or shade ground layer plants.

RE 8.2.2 is described as a semi-evergreen microphyll vine thicket to vine forest, on coastal dunes and occurs at the southern extent of the beach unit. Due to extensive development in the northern and midsection of Blacks Beach, remaining patches this of critical endangered vegetation community (Figure 8) exist within 2.5 ha of this area. Reserve tenure supports the protection of this ecosystem from threats associated with coastal development and recreational use. RE 8.2.2 is known to stabilise sand dunes and can protect coastal communities and inland vegetation from storm surges. The height of the canopy varies between 1-25 m and is dependent on the level of exposure to external factors such as salt laden winds. RE 8.2.2 canopy consists primarily of rainforest species on coastal dunes with trees such as red condoo (*Mimusops elengi*), tuckeroo (*Cupaniopsis anacardioides*), and in some places, brown tulip oak (*Argyrodendron polyandrum*), scaly ebony (*Diospyros geminata*), yellow tulipwood (*Drypetes deplanchei*), droopy leaf (*Aglaia elaeagnoidea*), canary beech (*Polyalthia nitidissima*), scaly ash (*Ganophyllum falcatum*), yellow boxwood (*Planchonella pohlmaniana*), tuckeroo (*Cupaniopsis anacardioides*), mongo (*Sersalisia sericea*) and peanut tree (*Sterculia quadrifida*). A low tree or shrub layer and the ground layer is present but sparse. Vines such as burney vine (*Trophis scandens*), native jasmine (*Jasminum simplicifolium*) and smooth water vine (*Cissus oblonga*) are common and epiphytes such as the golden orchid (*Dendrobium discolour*) are also found within the tree branches. Many plants found within this ecosystem will return after fire (i.e. rainforest pioneers), however the ecosystem is highly fire sensitive and should not be burned. Disturbance by fire promotes weed infestation including by guinea grass (*Megathyrsus maximus*). Weeds alter the structure of the ecosystem and add to the fuel load, which translates to a greater risk of additional fire and higher fire

intensities. Problem weeds include: lantana (*Lantana camara*), pink periwinkle (*Catharanthus roseus*), mossaman river grass (*Cenchrus echinatus*), corky passionflower (*Passiflora suberosa*), tridax procumbens (*tridax daisy*), and common guava (*Psidium guajava*).

RE 8.2.6a describes Corymbia open forest on parallel dunes and currently dominates the Spit in the south and extents northwards along the shoreline. RE 8.2.6a acts as a buffer between the beach and residential properties and supports the dune system. A very sparse to mid-dense sub-canopy tree layer is often present, with typical species including black wattle (*Acacia leptocarpa*), coastal banksia (*Banksia integrifolia* subsp. *Compar*), cocky apple (*Planchonia careya*) and screwpine (*Pandanus cookii*). A well-developed rainforest component in the sub-canopy often exists presenting other species such as tuckeroo (*Cupaniopsis anacardioides*), soap bush (*Alphitonia excelsa*), broad-leaved native cherry (*Exocarpos cupressiformis*), australian almond (*Terminalia muelleri*), native olive (*Chionanthus ramiflorus*), ribbonwood (*Euroschinus falcatus*), indian beech (*Milletia pinnata*), hard aspen (*Acronychia laevis*) and burdekin plum (*Pleiogynium timorense*). A low tree or shrub layer and the ground layer is present but sparse. Dune forests are a naturally restricted community (i.e. in terms of the home range they can inhabit) and are also vulnerable to erosion and weed invasion. Large proportions of this community are in moderate to poor condition due to coastal development and disturbance by recreational users, which often results to weed incursion. Such threats reduce the quality of the ecosystem, thus weaken its resilience against natural extreme events. The fire management strategy urges not to deliberately burn beach ridge communities that have a component of littoral vine forest (RE 8.2.2). Infestations of exotic grass such as Guinea grass (*Megathyrsus maximus*), need to be addressed immediately as they increase fuel load and reduce ecosystem health. Problem weeds include lantana (*Lantana camara*), corky passionflower (*Passiflora suberosa*), chinese burr (*Triumfetta rhomboidea*), blue couch (*Digitaria didactyla*), guinea grass (*Megathyrsus maximus*), red natal grass (*Melinis repens*), *Stylosanthes humilis* and tridax daisy (*Tridax procumbens*). RE 8.2.6a and 8.2.11 cover 12 ha of the Blacks Beach coastal unit.

RE 8.12.13a is comprised of sparse tussock grassland or *Xanthorrhoea latifolia* shrubland. Because the ecosystem is largely comprised of grasses, fire is not a prominent concern, especially when the soil is moist. Threats include encroachment by rainforest species, weeds and grazing. Several weeds are a serious threat to this ecosystem, including jamaica snakeweed (*Stachytarpheta jamaicensis*), lantana (*Lantana camara*), *Centrosema molle*, *Bidens pilosa*, guinea grass (*Megathyrsus maximus*), red natal grass (*Melinis repens*) and grader grass (*Themeda quadrivalvis*). Other currently less serious but often prominent weeds include *Ageratum conyzoides* subsp. *Conyzoides*, prickly pear (*Opuntia stricta*), *Passiflora foetida*, tridax daisy (*Tridax procumbens*), chinese burr (*Triumfetta rhomboidea*) and sheda grass (*Dichanthium annulatum*).

Appendix 3: Coastal revegetation principles

Encouraging the natural regeneration of native species is the best method for restoration of an area. For this to occur a viable seed bank must be present, and re-growth must include all native plant species from each stratum level. In areas where natural regeneration is to occur, the area should be clearly marked to exclude public access. In these areas, ongoing maintenance is required to minimise re-growth of weed species. However, the planting of local native vegetation (revegetation) is sometimes required due to insufficient cover or re-growth of native species.

Revegetation techniques

Revegetation in natural areas aims to reinstate Regional Ecosystems communities as described by Queensland Herbarium (Regional Ecosystem Description Database). In disturbed areas, pre-clearing mapping is available to inform what Regional Ecosystems were present prior to vegetation clearing.

Suggested techniques for coastal revegetation in the Mackay Regional Council area include:

- Local native species for planting should be sourced from within the Sarina Proserpine lowlands Subregion of the Central Queensland Coast Bioregion.
- Site preparation, such as weed control, should be carried out prior to planting.
- Depending on the site-specific circumstances coastal plantings may benefit from the use of mulch, weed mats, stakes, and/or tree guards.
- Tubestock planted in sandy soils will benefit from the addition of a wetting agent and fertiliser at the time of planting (eg. Terracottem).
- Ongoing maintenance of the site is required.

Consideration of fire risk

State Planning Policy 1/03 under the Sustainable Planning Act 2009 deals with the mitigation of adverse impacts of bushfire, and includes a natural hazard assessment for bushfires and the subsequent provision of safety buffers. According to this policy, a low hazard score and no prescribed safety buffer width is allocated to “narrow strips of coastal vegetation with a linear shape, less than 50 hectares in area and more than one kilometre from the nearest extensive vegetation, on 0-5% slope, with an eastern aspect.”

All revegetation activities undertaken as part of coastal projects will be done so with consideration of this State Planning Policy. Designated space for fire breaks and emergency vehicle access will be provided between freehold properties and natural environment areas being revegetated, as per Mackay Regional Council Coastal Management Guidelines (2009).

Selecting plants for revegetation

The table below provides a generic list of recommended species for dune revegetation in the Mackay region, compiled from characteristic species of relevant Regional Ecosystems (8.1.1, 8.1.2, 8.12.20a, 8.1.3, 8.2.1, 8.2.2, 8.2.6a, 8.2.9, 8.3.1a, 8.3.2), various coastal species lists from Subregion 2, revegetation recommendations, and field observations.

The species selected for revegetation at any particular location will ultimately depend on current and pre-clearing Regional Ecosystem mapping, and site-specific conditions (such as aspect, topography, existing vegetation, soil condition, availability of appropriate plants, etc).

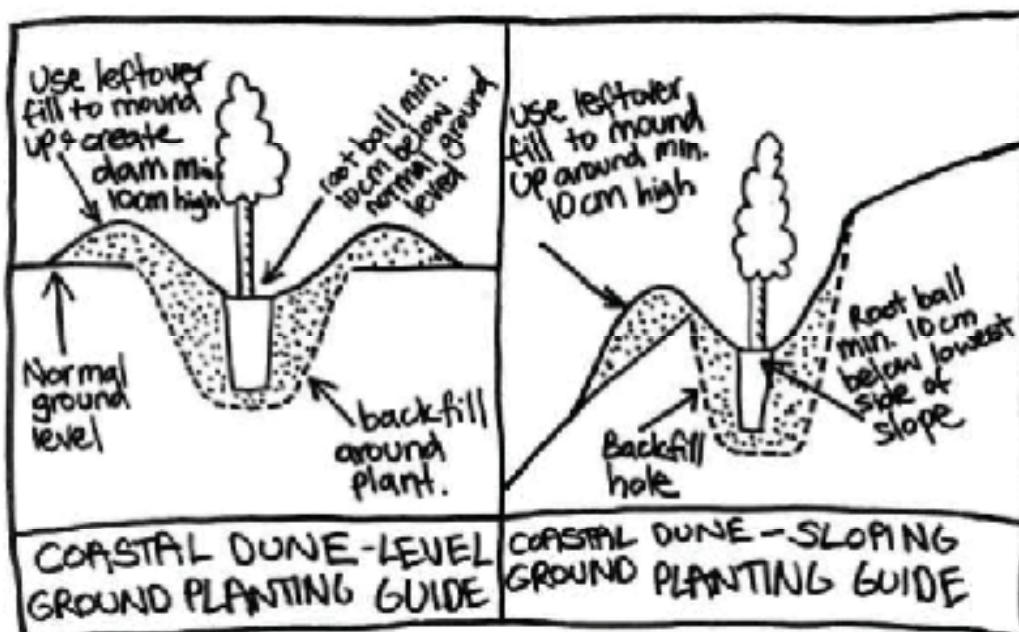


Figure 1: Coastal dune planting guide

Appendix 4: Native plant list

Species name	Common name	Habit	Regional Ecosystem
<i>Acacia leptocarpa</i>	north coast wattl, selnder fruited wattle	Tree	8.2.6
<i>Acacia oraria</i>	coast wattle	Tree	8.2.2; 8.2.6
<i>Acronychia laevis</i>	hard aspen, glossy acronychia, yellow wood	Tree	8.2.2
<i>Alphitonia excelsa</i>	red ash, soapy ash	Tree	8.2.1; 8.2.6
<i>Argusia argentea</i>	octopus bush	Tree	8.2.1
<i>Banksia integrifolia subsp. Compar</i>	coastal banksia	Tree	8.2.6
<i>Calophyllum inophyllum</i>	beauty leaf, beach calophyllum, ball nut	Tree	8.2.1
<i>Canavalia rosea</i>	beach bean	Groundcover	8.2.1
<i>Capparis lucida</i>	coastal caper	Tree	8.2.1; 8.2.2
<i>Casuarina equisetifolia</i>	coastal she oak	Tree	8.2.1
<i>Chionanthus ramiflorus</i>	native olive	Tree	8.2.2; 8.2.6
<i>Clerodendrum floribundum</i>	lolly bush	Tree	8.2.2; 8.2.6
<i>Clerodendrum inerme</i>	coastal lollybush	Shrub	8.2.1
<i>Corymbia tessellaris</i>	Morton Bay ash	Tree	8.2.6
<i>Crimum pendunculatum</i>	river lily, swamp lily	Tuft	8.2.1
<i>Crotalaria mitchellii</i>	sand rattlepod	Herb	8.2.9
<i>Cupaniopsis anacardioides</i>	tuckeroo	Tree	8.2.1; 8.2.2; 8.2.6
<i>Cymbopogon refractus</i>	barbed wire grass	Grass	8.2.9
<i>Cyperus pedunculatus</i>	pineapple sedge	Sedge	8.2.1; 8.2.9
<i>Dianella caerulea</i>	blue flax lily	Tuft	8.2.6; 8.2.9
<i>Dianella longifolia</i>	smooth flax lily	Tuft	8.2.6a; 8.2.9
<i>Diospyros geminata</i>	scaly ebony	Tree	8.2.2; 8.2.6
<i>Dodeonaea viscosa subsp.viscosa</i>	sticky hop bush	Shrub	8.2.1
<i>Drypetes deplanchei</i>	yellow tulip	Tree	8.2.2
<i>Eragrostis interrupta</i>	coastal love grass	Grass	8.2.6; 8.2.9
<i>Eriachne triodioides</i>	wanderrie grass	Grass	8.2.6; 8.2.9
<i>Eugenia reinwardtiana</i>	beach cherry	Shrub	8.2.2
<i>Euroschinus falcatus</i>	ribbonwood	Tree	8.2.2; 8.2.6
<i>Eustrephus latifolius</i>	wombat berry	Climber	8.2.2; 8.2.6
<i>Ganophyllum falcatum</i>	scaly ash	Tree	8.2.2; 8.2.6
<i>Geitonoplesium cymosum</i>	scrambling lily	Climber	8.2.2; 8.2.6
<i>Heteropogon triticeus</i>	giant spear grass	Grass	8.2.2; 8.2.9
<i>Hibbertia scandens</i>	goldenguinea flower, snake vine	Climber/Ground cover	8.2.1
<i>Hibiscus heterophyllus</i>	native hibiscus	Shrub	8.2.6
<i>Imperata cylindrica</i>	blady grass	Grass	8.2.6; 8.2.9
<i>Ipomoea pes-caprae</i>	goats foot convolvulus	Groundcover	8.2.1
<i>Jagera pseudorhus</i>	foam bark	Tree	8.2.6
<i>Jasminum didymum</i>	native jasmine	Climber/Shrub	8.2.2; 8.2.6
<i>Lomandra longifolia</i>	spiny-headed mat-ruxh	Tuft	8.2.6
<i>Macaranga tanarius</i>	macaranga	Tree	8.2.2; 8.2.6
<i>Mallotus philippensis</i>	red kamala	Tree	8.2.2; 8.2.6
<i>Melia azedarach</i>	white cedar	Tree	8.2.6
<i>Mimusops elengi</i>	red coondoo	Tree	8.2.2
<i>Morinda citrifolia</i>	giant morinda, cheese fruit, smelly cheese tree	Tree	8.2.1
<i>Pandanus tectorius</i>	beach pandan, coastal screw, pine pandanus	Tree	8.2.1; 8.2.6
<i>Pittosporum ferrugineum</i>	rusty pittosporum	Tree	8.2.1; 8.2.6
<i>Planchonia careya</i>	cocky apple	Tree	8.2.6
<i>Pleiogynium timorense</i>	Burdekin plum	Tree	8.2.2; 8.2.6
<i>Scaevola taccada</i>	sea lettuce	Shrub	8.2.1

<i>Sophora tomentosa</i>	silver bean	Shrub	8.2.1
<i>Spinifex sericeus</i>	beach spinifex	Grass	8.2.1
<i>Sporobolus virginicus</i>	marine couch	Groundcover	8.2.1
<i>Stephania japonica</i>	tape vine	Climber/Ground cover	8.2.1; 8.2.2; 8.2.6
<i>Sterculia quadrifida</i>	peanut tree	Tree	8.2.2; 8.2.6
<i>Terminalia muelleri</i>	coast damson	Tree	8.2.1; 8.2.2; 8.2.6
<i>Themeda triandra</i>	kangaroo grass	Grass	8.2.6; 8.2.9
<i>Thespesia populnea</i>	tulip tree	Tree	8.2.1
<i>Thuarea involuta</i>	birds beak grass	Grass	8.2.1
<i>Vigna marina</i>	vigna	Groundcover	8.2.1
<i>Vitex rotundifolia</i>	creeping vitex, beach vitex	Groundcover	8.2.1
<i>Vitex trifolia</i>	coastal vitex, common blue vitex	Shrub	8.2.1
<i>Xerochrysum bracteatum</i>	golden everlasting daisy	Herb	8.2.9

View sensitive native plant list

Species name	Common name	Habit	Regional Ecosystem
<i>Acacia simsii</i>	Sim's Wattle	Shrub	8.2.6
<i>Caesalpinia bonduc</i>	Nicker nut	Climber	8.2.1
<i>Canavalia rosea</i>	Beach bean	Groundcover	8.2.1
<i>Clerodendrum inerme</i>	Coastal lollybush	Shrub	8.2.1
<i>Crinum pedunculatum</i>	River Lily, Swamp lily	Tuft	8.2.1
<i>Crotalaria mitchellii</i>	Sand rattlepod	Herb	8.2.9
<i>Cymbopogon refractus</i>	Barbed Wire Grass	Grass	8.2.9
<i>Cyperus pedunculatus</i>	Pineapple sedge	Sedge	8.2.1; 8.2.9
<i>Dianella caerulea</i>	Blue flax lily	Tuft	8.2.6; 8.2.9
<i>Dianella longifolia</i>	Smooth flax lily	Tuft	8.2.6a; 8.2.9
<i>Dodonaea viscosa subsp. <i>viscosa</i></i>	Sticky hop bush	Shrub	8.2.1
<i>Eragrostis interrupta</i>	Coastal love grass	Grass	8.2.6; 8.2.9
<i>Eriachne triodioides</i>	Wanderrie grass	Grass	8.2.6; 8.2.9
<i>Eustrephus latifolius</i>	Wombat berry	Climber	8.2.2; 8.2.6
<i>Geitonoplesium cymosum</i>	Scrambling lily	Climber	8.2.2; 8.2.6
<i>Heteropogon triticeus</i>	Giant spear grass	Grass	8.2.6; 8.2.9
<i>Hibbertia scandens</i>	Golden Guinea Flower, Snake Vine	Climber/ground cover	8.2.1
<i>Imperata cylindrica</i>	Blady Grass	Grass	8.2.6; 8.2.9
<i>Ipomoea pes-caprae</i>	Goats foot convolvulus	Groundcover	8.2.1
<i>Jasminum didymium</i>	Native jasmine	Climber/Shrub	8.2.2; 8.2.6
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Tuft	8.2.6
<i>Scaevola taccada</i>	Sea lettuce	Shrub	8.2.1
<i>Sophora tomentosa</i>	Silver bean	Shrub	8.2.1
<i>Spinifex sericeus</i>	Beach spinifex	Grass	8.2.1
<i>Sporobolus virginicus</i>	Marine couch	Groundcover	8.2.1
<i>Stephania japonica</i>	Tape vine	Climber/ground cover	8.2.1; 8.2.2; 8.2.6
<i>Themeda triandra</i>	Kangaroo grass	grass	8.2.6; 8.2.9
<i>Thuarea involuta</i>	Birds beak grass	Grass	8.2.1
<i>Vigna marina</i>	Vigna	Groundcover	8.2.1
<i>Vitex rotundifolia</i>	Creeping Vitex, Beach Vitex	Groundcover	8.2.1
<i>Vitex trifolia</i>	Coastal vitex, Common blue vitex	Shrub	8.2.1
<i>Xerochrysum bracteatum</i>	Golden Everlasting Daisy	Annual herb	8.2.9

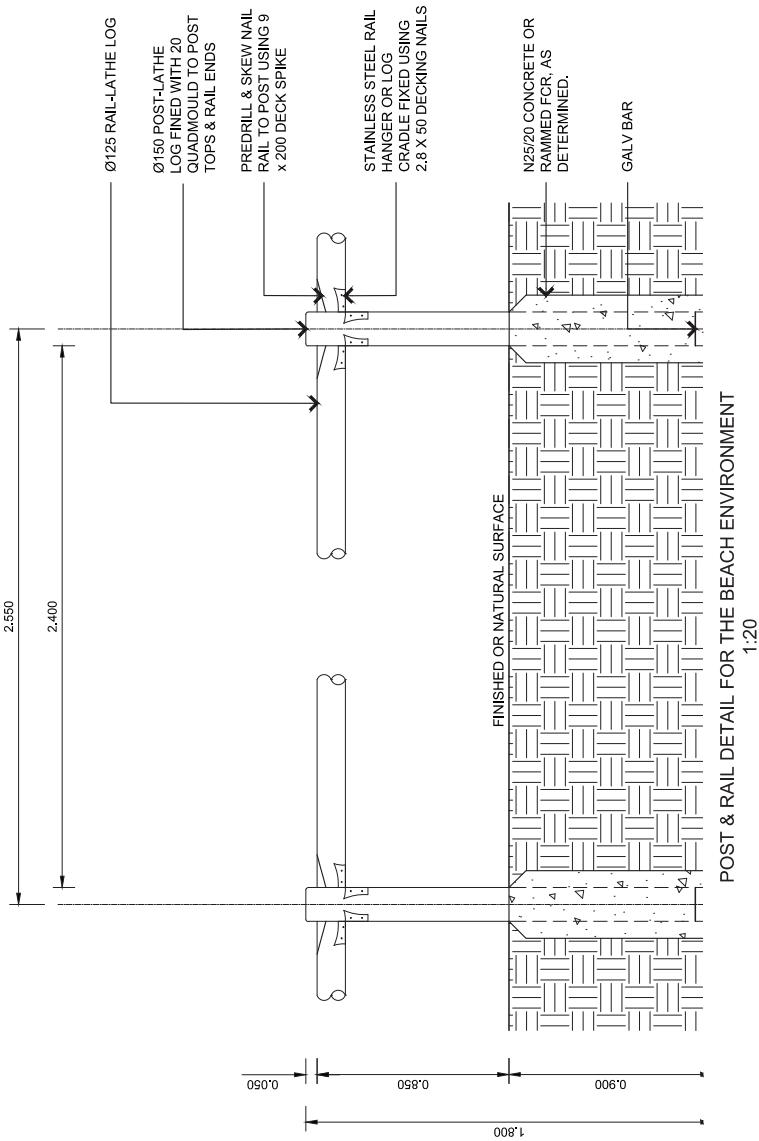
Appendix 5: Weed control principles

Principles	Comments
Staged weed removal	<ul style="list-style-type: none"> • Weed removal should be carried out in a staged approach. • Work outwards from intact remnants of coastal vegetation as a priority. • Particularly important in removal of non-native vegetation along the dune scarp. • Large woody weeds should be removed slowly to ensure the replaced native vegetation provides sufficient habitat value and protection against erosion before more removal of woody species.
Physical weed removal	<ul style="list-style-type: none"> • Physical weed removal, including hand pulling, chipping or cutting weeds is effective in small infestations in environmentally sensitive areas.
Mechanical weed removal	<ul style="list-style-type: none"> • Mowing or brush cutting will suppress weed growth, discourage seeding and spread. • This method should be used particularly in areas bordering large infestations. • Care should be taken to reduce potential disturbance as excessive mowing and brush cutting can facilitate further weed growth and reduce regeneration of native vegetation.
Herbicide weed removal	<ul style="list-style-type: none"> • The application of herbicides includes foliage or basal spraying, cut/ paste and stem injection where applicable. • Spraying may be carried out on large or robust weed infestation, particularly to gain initial control of an infestation. However the majority of spraying is likely to be small scale 'spot spray' applications to minimise non-target impacts. • Roundup Bi-active [*] is recommended due to its low toxicity to wildlife and humans.
Timing	<ul style="list-style-type: none"> • Weed control on foredunes to occur between April and October only, to avoid turtle nesting season (November to March). • Weed control on hind dunes can occur at any time of the year depending on local weather conditions. Herbicide application is ineffective if carried out during rain periods, or once the plants have entered their non-active period during extended dry periods.
Consideration of fire risk	<ul style="list-style-type: none"> • Once treated, remaining dead woody weeds (such as Lantana) should be pulled away from native trees to reduce the fire risk to fire-sensitive coastal vegetation should 'accidental' fires occur. This woody, dry biomass serves as fuel for fires and by pulling it away from native trees it reduces the chances of fire reaching the canopy. • Mulching down of large, dense areas of dead woody weeds using brush cutters or hand tools, would similarly reduce fire risk and allow native plants a better chance at regeneration.
Preventing re-infestations	<ul style="list-style-type: none"> • Keep maintenance vehicles on the existing tracks where possible to reduce disturbance. • Clean maintenance vehicles before and after access to the site to prevent weed spread or introduction. • Monitor the success of weed control techniques and native regeneration following several wet seasons to assess whether revegetation might be needed in large areas of infestation.

Appendix 6: Non-native plant list - main weed species found in coastal areas within the Mackay region

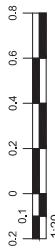
Species Name	Common Name	Form
<i>Agave sp.</i>	sisal hemp / century plant	Succulent
<i>Alternanthera brasiliiana</i>	red-leaved alternanthera	Herb
<i>Antigonon leptopus</i>	coral vine	Climber
<i>Aster subulatus</i>	wild aster, bushy starwort	Herb
<i>Bidens alba var. radiata</i>	cobblers pegs	Herb
<i>Bougainvillea sp</i>	bougainvillea	Vine
<i>Bryophyllum sp.</i>	mother-of-millions	Shrub
<i>Callisia fragrans</i>	callisia	Herb
<i>Catharanthus roseus</i>	pink periwinkle	Herb
<i>Cenchrus echinatus</i>	seaforth burr	Grass
<i>Cocos nucifera</i>	coconut palm	Tree
<i>Corymbia torelliana</i>	cadagi	Ree
<i>Crotalaria pallida</i>	rattlepod	Herb
<i>Dactyloctenium sp.</i>	button grass	Grass
<i>Delonix regia</i>	poinciana	Tree
<i>Dichantium annulatum</i>	sheda grass	Grass
<i>Digitaria didactyla</i>	blue couch	Grass
<i>Duranta erecta</i>	duranta	Shrub
<i>Eleusine indica</i>	crowsfoot grass	Grass
<i>Emilia sonchifolia</i>	emelia	Herb
<i>Euphorbia cyathophora</i>	painted spurge	Herb
<i>Hyparrhenia rufa</i>	thatch grass	Grass
<i>Ipomoea indica</i>	coastal morning glory	Herb
<i>Lantana camara</i>	lantana	Shrub or branched climber
<i>Leucaena leucocephala</i>	leucaena	Small tree
<i>Macroptilium atropurpureum</i>	siratro	Vine
<i>Megathyrsus maximus</i>	Guinea grass	Grass
<i>Melinis repens</i>	red natal grass	Grass
<i>Melinis minutiflora</i>	molasses grass	Grass
<i>Mimosa pudica</i>	sensitive weed	Herb
<i>Momordica charantia</i>	balsam pear	Vine
<i>Oenothera drummondii subsp. <i>drummondii</i></i>	beach primrose	Herb
<i>Opuntia sp.</i>	prickly pear	Succulent
<i>Passiflora foetida</i>	stinking passionfruit	Climber
<i>Passiflora suberosa</i>	corky passionfruit	Climber
<i>Psidium guajava</i>	guava	Small tree
<i>Salsola australis</i>	prickly starwort	Succulent shrub
<i>Sansevieria trifasciata</i>	mother-in-laws tongue	Herb
<i>Sida cordifolia</i>	sida	Sub shrub
<i>Solanum seaforthianum</i>	Brazilian nightshade	Climber
<i>Sphagneticola trilobata</i>	Singapore daisy	Groundcover
<i>Stachytarpheta jamaicensis</i>	snake Weed	Herb or sub shrub
<i>Stylosanthes humilis</i>	stylo	Herb
<i>Themeda quadrivalvis</i>	grader grass	Grass
<i>Tradescantia spathacea</i>	moses in a cradle	Herb
<i>Tridax procumbens</i>	tridax daisy	Herb
<i>Triumfetta rhomboidea</i>	chinese burr	Sub-shrub
<i>Urochloa decumbens</i>	signal grass	Grass
<i>Yucca aloifolia</i>	yucca	Succulent

Appendix 7: Fencing specifications for coastal areas



NOTES:

1. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. CONCRETE STRENGTH: N25/10.
3. ALL TIMBER SHALL BE HA TANALITH E' TREATED PINE LATHE LOGS IN ACCORDANCE WITH AS/NZ 1604.1:2000, OR APPROVED SIMILAR.
4. ALL STEEL COMPONENTS & FASTENERS TO BE HOT DIPPED GALVANISED MIN. COATING THICKNESS AS PER AS/NZ 1214 AND AS/NZ 4680 UNLESS NOTED OTHERWISE.
5. FOR POST AND RAIL INSTALLATION WITHIN A BEACH ENVIRONMENT, THE MASS CONCRETE FOOTING IS TO BE DELETED AND THE POST EXTENDED INTO THE GROUND A MIN. 900mm DEEP, BACKFILL AND COMPACT GRADUALLY WITH EXCAVATED SOIL.
6. ALL FOOTINGS BE TO INSTALLED CLEAR OF ANY W&S ASSETS.



STANDARD			SHEET 1 OF 1
AMEND.	DRAWING No.	WORKS JOB No.	
	A3-00160	B	

Mackay Regional Council

Local Coastal Plan

Blacks Beach 2017

Phone **1300 MACKAY (622 529)**

www.mackay.qld.gov.au/coasts

Email Council@mackay.qld.gov.au

Mail **Mackay Regional Council**
PO Box 41
Mackay QLD 4740

Fax **(07) 4944 2400**

Client Service Centres

Mackay
Sir Albert Abbott Administration Building
73 Gordon Street, Mackay

Mon-Fri
8:30am - 4:30pm

Mirani
20 Victoria Street, Mirani

Mon-Fri
8:30am - 4:30pm

Sarina
65 Broad Street, Sarina

Mon-Fri
8:30am - 4:30pm



Australian Government

