

# Coastal Management Strategy

April 2017





# 1. INTRODUCTION

The City of Karratha coastline stretches for approximately 350km. It is home to a diverse and precious coastal ecosystem and unique cultural heritage, while supporting an economic powerhouse of national and international importance. As such, the environmental, social and economic values of the coastal environment need to be kept in a constant balance as changes occur. Seasonal coastal processes (e.g. storm surge and erosion) and longer term changing climatic conditions create a highly dynamic environment. It is therefore important for existing and proposed developments and uses within the coastal environment to be considered in that context. This includes planning and management that minimises coastal hazard risks.

This Coastal Management Strategy (CMS) has been developed through both technical studies and community and stakeholder engagement. This has included reviewing and collating the large amount of background material and scientific coastal modelling undertaken over recent times. This CMS provides a framework for the long term management of the coastal environment, taking a quadruple bottom line approach that considers social, economic, environmental and governance factors.

The vast majority of residents living, recreating and working within the City of Karratha have a strong connection with the coastal environment. This has the potential to degrade the coastal environment. As such, coastal access, use and management responsibility are key issues addressed by this CMS.

This CMS collates and interprets the various coastal demands and influences in order to define a range of appropriate short, medium and long term management strategies. Through this CMS the City of Karratha (City) takes responsibility for ensuring each of the management strategies are delivered, either directly or via support of the appropriate agency and/or stakeholder.



## 1.1. PURPOSE

This CMS is the City's overarching coastal management document. The purpose of the CMS is to ensure the City has a consistent and transparent approach towards existing and planned coastal management policies, plans and strategies.

This CMS establishes a framework for the use, management and conservation of the City's coastal environment. The beaches, islands and estuarine environments along the City's coastline support a high diversity of activity including; a unique marine ecology, urban settlements, major industrial infrastructure and diverse recreational pursuits. The interaction of these various activities needs coordinated planning and management. Balancing multiple uses while maintaining a healthy coastal environment is a shared responsibility. All tiers of government, private industry, community and Traditional Owners have a role in the sustainable use, development and management of the City's coastal environment.

Over the last decade the City has undertaken various coastal planning strategies and management plans to guide use, development and management across the coastal environment. With ever increasing development and use occurring within the coastal environment, this CMS provides much needed alignment of the various coastal policies and procedures prepared both by the City and other organisations and agencies.

## 1.2. VISION

The vision of this CMS was developed in response to feedback from community and stakeholder consultation, and in respect of the work already undertaken through a range of existing documentation. This includes the objectives of the City's Environmental Strategy and recently drafted Local Planning Strategy. The vision aligns with the intent of State Planning Policy 2.6 – State Coastal Planning (SPP2.6) in consideration of economic, social and environmental characteristics:

**The City of Karratha coastal environment is recognised for its social, cultural, economic and environmental values that are of significant state, national and international significance. Coastal land uses will be managed in a balanced, equitable way that ensures the preservation of all coastal values now and into the future.**

## 1.3. OBJECTIVES

In consideration of existing and anticipated coastal challenges, four strategic objectives have been developed to guide the preparation of the CMS and ultimately achieve the vision for the City's coastline.



**Conservation of coastal biodiversity**



**Provision of land and access for Industrial Development**



**Management of sustainable coastal recreation**



**Protection of residential, community, cultural and heritage assets in a changing climate**

## 1.4. STUDY AREA

The City's municipality comprises an area of approximately 15,278km<sup>2</sup>. It is bordered by the Town of Port Hedland (east), the Shire of Ashburton (south) and the Indian Ocean (north and west). Figure No.1 depicts the location and extent of the municipality. This CMS applies to the coastal environment within the City's municipality including the coastal hinterland and near coast areas. The extent of influence over which this CMS prevails is not delineated by a physical boundary. Coastal influences can vary seasonally, as such a limit of application cannot be precisely defined. However, practical boundaries will be defined through the development of individual Foreshore Management Plans.

The City's coastline stretches approximately 350km and comprises a diverse range of marine environments. The coastline includes sandy beaches, rocky ridges, tidal mudflats and mangrove environments. There are five (5) major river

catchments connecting to the coastline; the Robe, Fortescue, Maitland, Harding and Sherlock Rivers.

## Settlements

Within the municipality there are six (6) population settlements located within, or in close proximity to the coast including; Karratha, Dampier, Roebourne, Wickham, Point Samson and Cossack. These settlements are serviced by various coastal recreation nodes including; Dampier Foreshore, Hearson Cove, Karratha Back Beach, Cleaverville, Wickham Boat Beach, Point Samson Foreshore and Cossack/ Settlers Beach. In addition, there are a range of more remote coastal recreation areas including Balla Balla, Fortescue River, Maitland River and Gnoorea Point/ 40 Mile Beach.

In light of the above, and in consideration of previous coastal planning strategies undertaken by the City, ten (10) priority coastal nodes have been identified for more detailed consideration and planning including; Karratha, Point Samson, Wickham, Dampier, Cossack, Cleaverville, Hearson Cove, Gnoorea Point/ 40 Mile Beach, Balla Balla, and the Fortescue River Mouth.

## Land Use

The vast majority of the City's coastal environment comprises of Crown Land reserved under the City's Town Planning Scheme No. 8 (TPS8) for 'Conservation, Recreation and Natural Landscapes'. Moving inland from the coastal environment, the majority of land is zoned 'Rural' under the provisions of TPS8. The majority of the southwestern portion of the Burrup Peninsula, which surrounds the Dampier town site, has been zoned for 'Strategic Industry' under the provisions of TPS8.

Development and use within the coastal environment comprises of a range of uses including urban, industrial, pastoral, recreation, tourism and conservation. There are five (5) pastoral leases within the municipality which adjoin the coastline including; Sherlock, Warambie, Mount Welcome, Karratha and Mardie Stations. In addition, there are large expanses of the coastline that are subject to mining tenements comprising both live and pending licences.

The municipality is a major State and National hub for the processing and exportation of iron ore, salt and natural gas. As such there are a number of deep water ports, onshore processing and export support facilities existing along the City's coastline. In addition, Dampier Salt has a significant salt extraction facility within the coastal environment.

## Native Title

The majority of land within the municipality is within the determined Ngarluma/ Yindjibarndi Native Title Claim (WAD6017/96 and WAD 165/08). While a number of Indigenous Land Use Agreements (ILUA) are in place for the use and development of land within the determination area, the majority of the coastline is not covered by any ILUA.

The majority of the western area of the municipality is currently under two separate Native Title Claims which have been accepted for registration, namely; Yaburara & Mardudhunera (WAD127/1997) and Kuruma Marthudunera (combined) (WAD6090/1998). The Yaburara & Mardudhunera (WAD127/1997) claim is yet to be determined. The Kuruma Marthudunera (combined) (WAD6090/1998) has been determined and it was considered that Native Title does exist in parts of the determination area.

## Marine Environment

The North-West Commonwealth Marine Reserve Network (Reserve Network) covers an area of approximately 335,437km<sup>2</sup>. The Reserve Network contains thirteen marine reserves ranging in size from 304km<sup>2</sup> to 146,000 m<sup>2</sup>. There are two reserves adjoining the City's coastline, namely; the Dampier Archipelago and Montebello Islands Commonwealth Marine Reserves. These reserves are currently under the management control of the Department of Parks and Wildlife (DPaW) as further detailed within this CMS. DPaW managed reserves that abut City managed lands provide opportunities for partnerships and joint management arrangements.

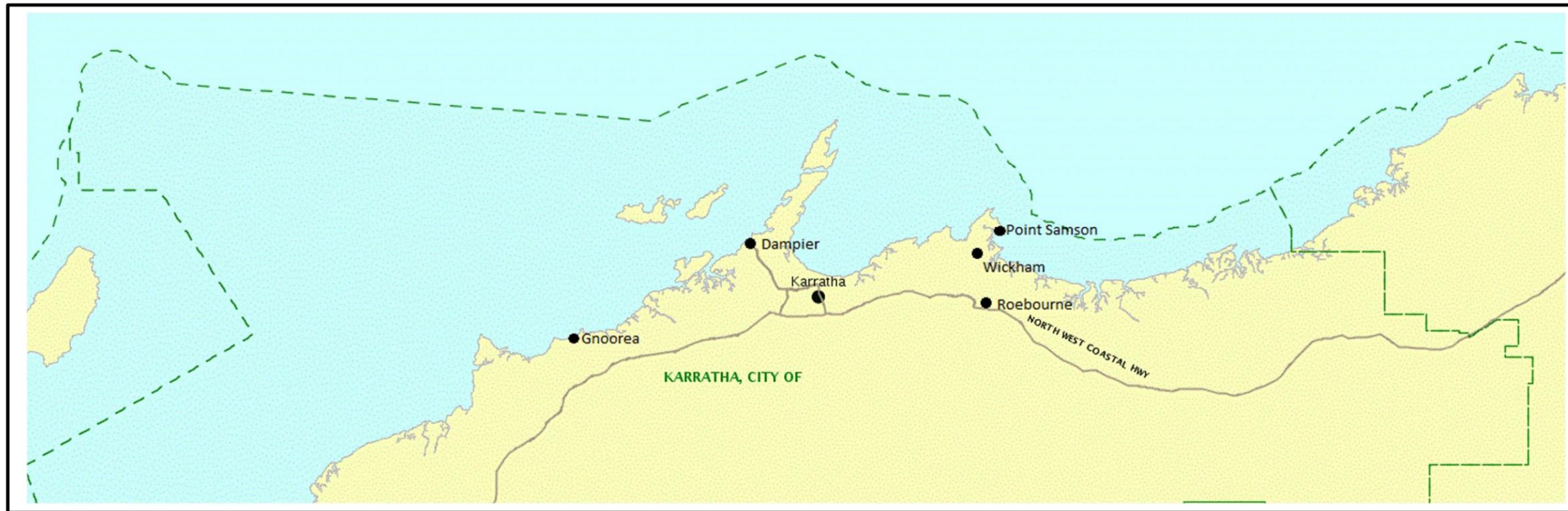


Figure 1 – Study Area

### 1.5. PREVIOUS PLANNING STUDIES

This CMS is underpinned by a significant body of work on environmental and cultural values, coastal processes, strategic land use planning and foreshore management planning. In 2005 the City completed a draft Coastal Management Strategy which was never formally adopted. Since 2005, a significant amount of investigation has been undertaken to provide greater detail on coastal processes, acceptable uses and management responsibility of coastal areas. A summary of the various documents that have informed the development of this CMS are summarised within Figure No.2.

### 1.6. CONSULTATION

In support of this CMS, the City prepared and implemented a Stakeholder Engagement Plan (SEP) to ensure opportunity was provided to the local community and relevant stakeholders to voice their concerns, interests and opinions in regards to management of the coastal environment. The results from the SEP have been collated with the findings obtained through the literature review to provide a comprehensive understanding of influencing values and priorities.

In addition, the stakeholder engagement process provided an opportunity for the City to enhance partnerships between community groups, government and non-government organisations. Through the SEP, eighty individual stakeholder groups were identified and targeted through a range of relevant consultation mechanisms. The objectives of the SEP were to ensure:

- All community members affected by coastal management decisions are to be provided with the opportunity to influence those decisions.
- Different stakeholder perspectives are considered during engagement. This includes engaging in a way that suits preferences and needs of stakeholders.
- Stakeholders gain a clear understanding of the purpose of the engagement and are provided sufficient information and enough time to contribute effectively; and
- Ongoing and effective communication through the life of the project, including provision of follow-up feedback after engagement has concluded.

The comments gathered through the consultation have been captured within this CMS and used to guide the development of strategies and actions. Key influencing results from the consultation are addressed within the Management Objectives section of this CMS.

### 1.7. APPROACH

The management measures outlined within the CMS recognise the cumulative nature of development impacts. The State Government's vision for sustainable growth and prosperity is underpinned by diversity, liveability, connectedness and collaboration (State Planning Strategy, 2012). Therefore, planning for land use and development within the coastal environment requires the competing impacts to be managed at sustainable levels. This CMS incorporates a quadruple bottom line assessment to evaluate the various impacts and costs associated with management of the City's coastal areas.

Through this quadruple approach, this CMS provides a comprehensive decision making framework for the ongoing planning and management of the City's coastal environment.

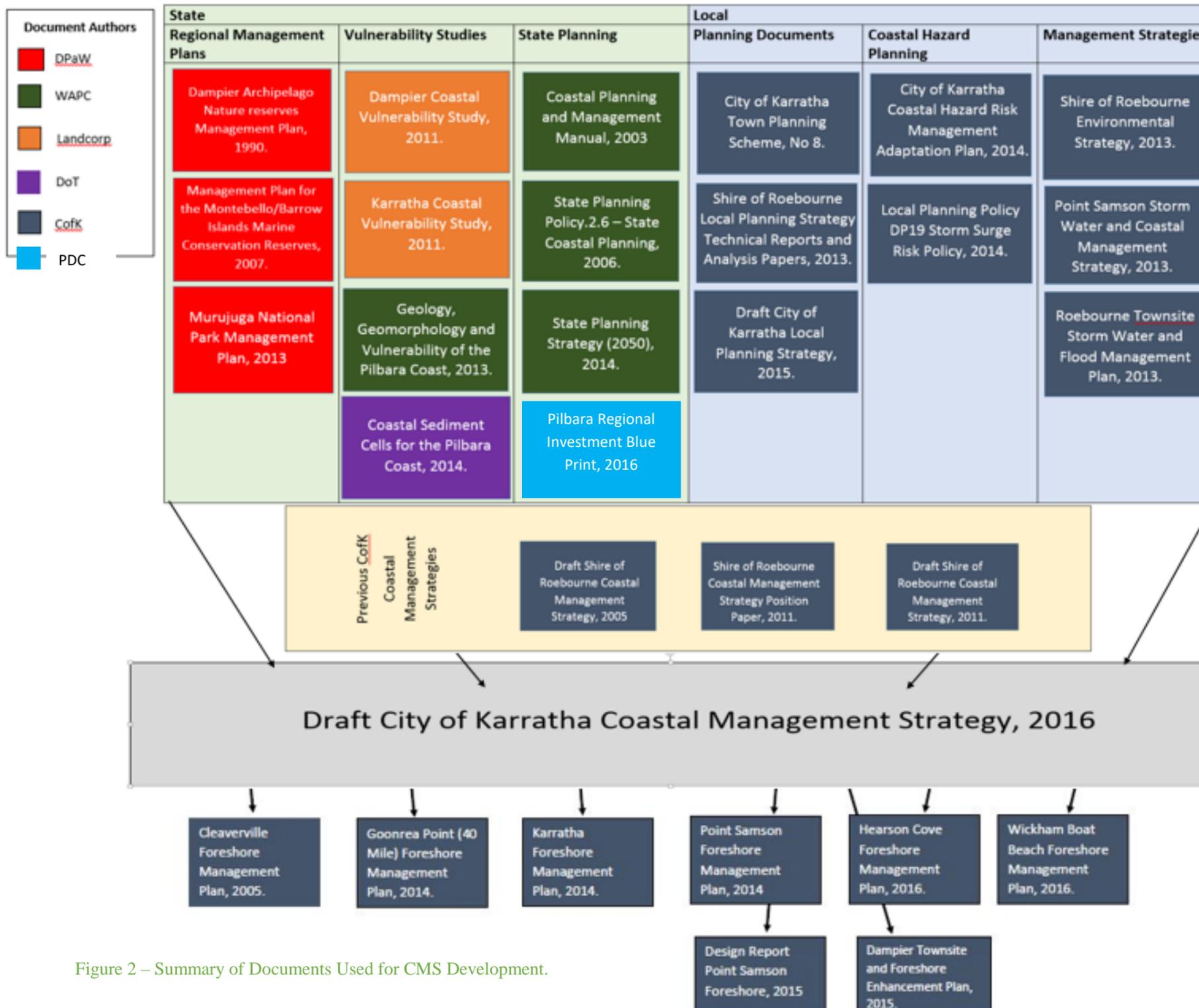


Figure 2 – Summary of Documents Used for CMS Development.

Table 1 – Quadruple Bottomline

Considerations	Description
<b>Environmental</b>	Understanding the value of features and processes within the coastal environment.
<b>Social</b>	Understanding the value of the coastal environment to the community and Traditional Owners.
<b>Economic</b>	Understanding the value of economic operations within the coastal environment.
<b>Governance</b>	Understanding the roles and responsibilities for management of the coastal environment.

The City's draft Local Planning Strategy (LPS) identifies areas earmarked for future development and use. The recommendations outlined within the LPS inform relevant management measures recommended within this CMS. The following points outline the methodology undertaken in the preparation of this CMS:

- Interpret and incorporate recommendations within relevant Commonwealth, State and Local coastal policies and strategies;
- Review the defined coastline vulnerability in regards to existing and proposed development in the short, medium and long term;
- Review land tenure, management responsibility and quality of the natural environment within the coastal environment;
- Identify the existing and proposed land uses within the coastal environment;
- Identify key issues impacting the sustainable use and management of the coastal environment;
- Engage with stakeholders to identify key coastal access areas and the use, development and management being undertaken in those areas;
- Develop sustainable coastal hazard risk management strategies including consideration to avoidance, retreat, accommodation and protection;
- Recommend development controls and guidelines for coastal land use and development through the incorporation of appropriate provisions in the City's Local Planning Scheme, Local Planning Policies and/ or Local Laws.

## 1.8. DOCUMENT STRUCTURE

The CMS is a municipality wide coastal management document which collates information from a range of sources to articulate key coastal processes and local socioeconomic, environmental and governance characteristics. The structure of this CMS provides an understanding of the overarching coastal policy framework and local characteristics before articulating the future management consideration and the development of strategies and actions.

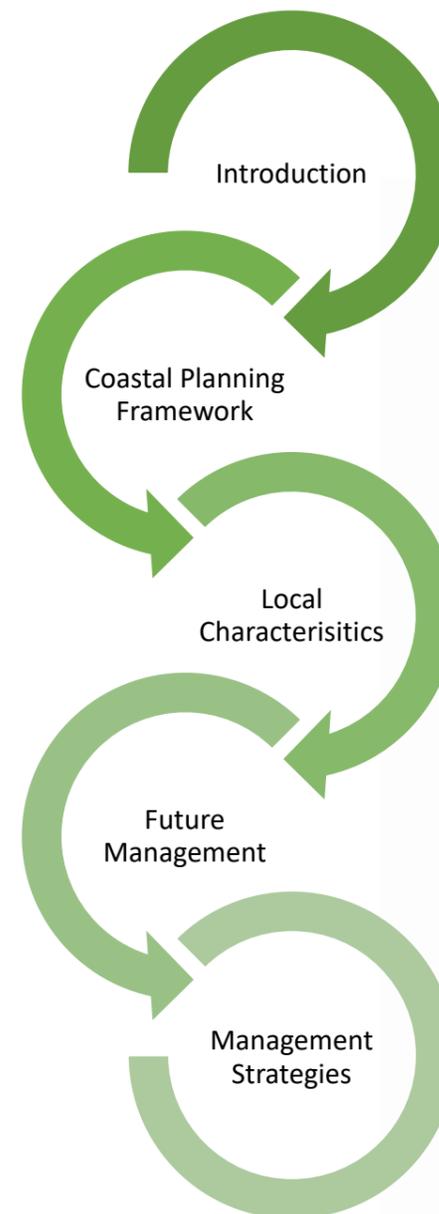
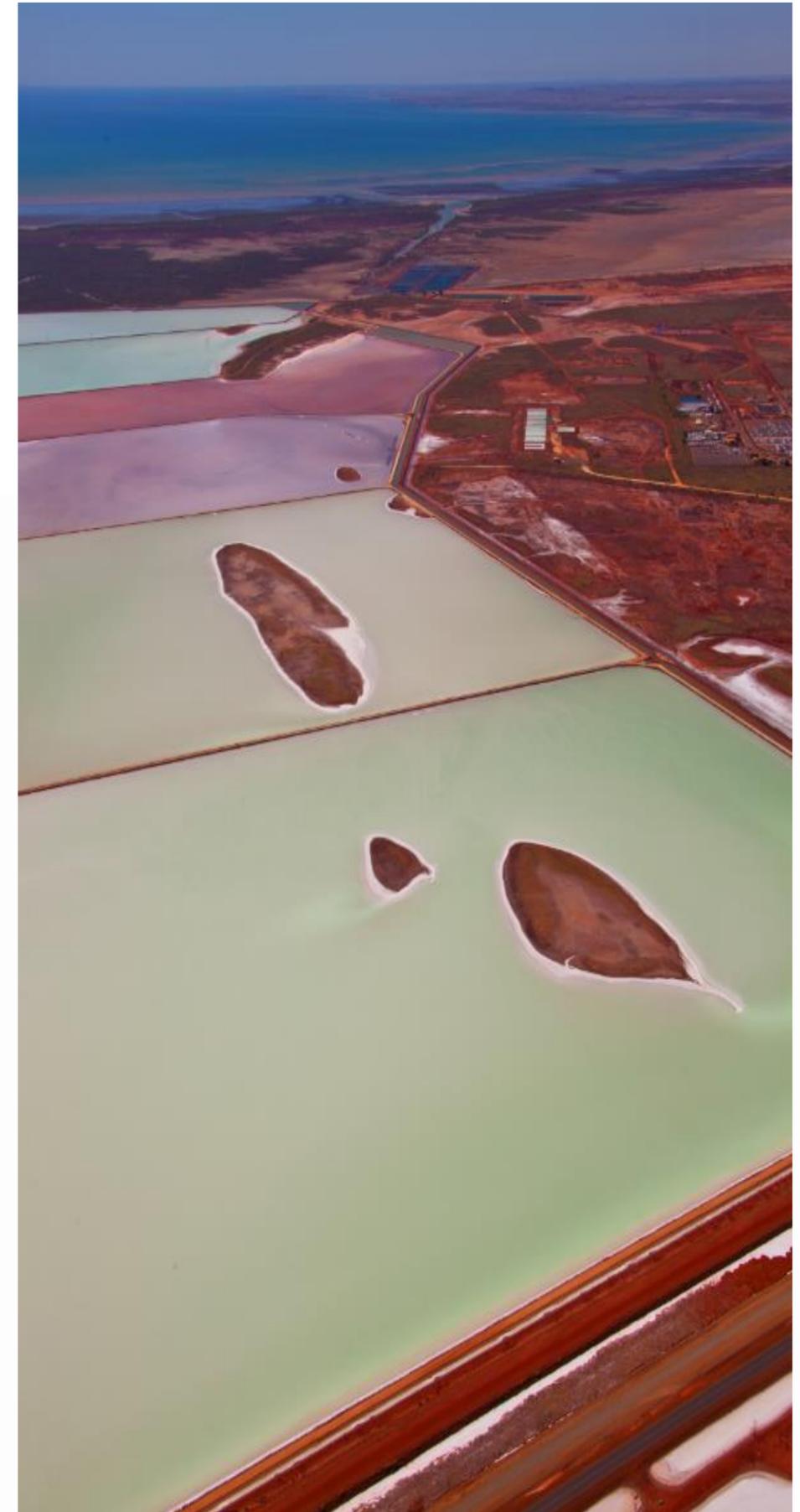


Figure 3 – Document Structure



## 2. POLICY FRAMEWORK

### 2.1. STATE PLANNING STRATEGY

The Western Australian Planning Commission (WAPC) published the State Planning Strategy 2050 in 2014. The document provides the strategic context and basis for the integration and coordination of land-use planning and development across the State's regions and local jurisdictions. The Strategy is established on six interrelated state planning principles which underpins a vision that:

*By 2050, Western Australia will have a diverse range of interconnected and vibrant local communities and regional centres. The people in these communities will be healthy, resilient, active, prosperous, respectful of cultural difference and participate in the public domain. Standards of living will continue to be amongst the highest in the world. Improved connections and smarter technologies will enhance the State's ability to attract global and domestic investment capital where and when it is most needed. A 'can do' attitude will prevail, inspiring new ways of thinking and working, which will deliver optimal outcomes for the economy and communities of Western Australia.*

The vision is implemented through a number of Principles, Strategic Goals and Actions. The provisions relevant to the strategic management of the City's coastal environment are identified as:

- *Environment Principle – Conserve the State's natural assets through sustainable development:*
  - o *State's biodiversity and natural resources are well-managed so that short-term gains do not compromise future opportunities.*
- *Strategic Goal 5 – Conservation:*
  - o *Increase the resilience of the State's natural environment by limiting the clearing of native vegetation, maximising natural habitat protection and rehabilitation, avoiding development in environmentally sensitive areas, and reducing the fragmentation of vegetation by urban and industrial development.*
- *Spatial Dimensions – Northern Sector:*
  - o *Harmony must be found between conservation of the Northern sector's unique environment and its opportunities for economic development.*
- *Interrelated State Strategic Directions – Environment:*

- o *To conserve biodiversity, achieve resilient ecosystems, protect significant landscapes and manage the State's natural resources in a sustainable manner.*
- o *Vulnerability mapping for the coastline will identify the areas of highest risk, so that adaptation strategies can continue to be implemented to anticipate sea level rise and extreme weather events.*
- o *Planning and development decisions are required to account for the economic, social and environmental value of natural resources and assets in the public interest.*
- o *Consideration of the cumulative impacts upon the environment and natural resources, particularly vulnerable areas of the State, will require ongoing collaboration at all scales of planning and across all tiers of government.*

### 2.2. STATE PLANNING POLICY 2.6 – STATE COASTAL PLANNING

The State Planning Policy 2.6 – State Coastal Planning (SPP2.6) promotes increased community consultation in decision making. SPP2.6 outlines the need to balance environmental management with support of social and economic growth. The precautionary principle, withholding potential damaging actions, is also strongly advised by the WAPC as a prudent step toward a more sustainable future.

SPP2.6 and the supporting Guidelines provide a framework for coordinating coastal uses to ensure an integrated approach to coastal planning and coastal management. SPP2.6 outlines objectives, policy measures and guidelines for coastal management, planning and development. This CMS has been prepared to ensure consistency with the objectives of SPP2.6 namely to:

- *Protect, conserve and enhance coastal values, particularly in areas of landscape, nature conservation, indigenous and cultural significance;*
- *Provide for public foreshore areas and access to these on the coast;*
- *Ensure the identification of appropriate areas for the sustainable use of the coast for housing tourism, recreation, ocean access, maritime industry, commercial and other activities; and*
- *Ensure that the location of coastal facilities and development takes into account coastal processes including erosion, accretion, storm surge, tides, wave conditions, sea level change and*

*biophysical criteria.*

In addition, this CMS has been prepared to ensure that as a minimum, the objectives set out in the Coastal Planning Policy Guidelines have been addressed and take into account the following:

- *Coastal processes, coastal hazards, landform & stability, natural vulnerability, climate change, ecological values, water quality, recreation & public access, marine resource & access, landscape, seascape & visual landscape, Indigenous heritage, cultural heritage and land capacity.*

### 2.3. COASTAL PLANNING AND MANAGEMENT MANUAL

The WAPC Coastal Planning and Management Manual (Manual) outlines a hierarchy of plans to facilitate inclusive and coordinated coastal management:

- *Regional Plans:*
  - o *Cover hundreds of kilometres, several local government areas and set broad direction for land use and/or management of an area.*
- *Local Plans:*
  - o *Such as coastal and foreshore management plans are more detailed, address management of all or part of a local government area, and provide sufficient detail for management of key coastal nodes.*
- *Site Plans:*
  - o *Provide direction for on ground management of a particular location.*

This CMS is a Local Plan under the hierarchy outlined within the Manual, it has been prepared to complement the City's draft Local Planning Strategy. While the CMS covers the whole of the City's coastline, more detailed planning of specific coastal nodes will be undertaken through site specific Foreshore Management Plans. The Coastal Vulnerability Studies and Storm Surge Mapping for Karratha, Dampier, Point Samson, Wickham and Roebourne outline the proposed risks to these areas in respect to coastal hazards and risk and storm surge inundation.

## 2.4. CITY OF KARRATHA TOWN PLANNING SCHEME NO. 8

At the local level, the City's coastal management objectives and statutory provisions are guided by Town Planning Scheme No. 8 (TPS8). The statutory provisions within TPS8 establish special control areas for flood management, set parameters for considering storm surge risk and outline the approach to prepare Local Planning Policies. Specifically, Clause 1.6 within TPS8 outlines an objective to:

*Facilitate community input into planning for the appropriate balance between economic and social development, conservation of the natural environment, and improvements in lifestyle and amenity.*

Within TSP8, particular regard is given to the natural environment on the Burrup Peninsula, Cape Lambert, Point Samson, Cossack, Dampier Archipelago, Maitland River (Mairee Pool) and portions of pastoral stations containing or adjoining coastal recreation nodes such as Gnoorea and Cleaverville. This CMS aligns with current statutory provisions outlined within TPS8 and associated Local Planning Policies.

## 2.5. CITY OF KARRATHA LOCAL PLANNING STRATEGY (DRAFT)

The purpose of the draft Local Planning Strategy (LPS) is to ensure future growth of the City to 2031. The draft LPS sets a strategic planning direction, that takes advantage of identified opportunities and acknowledges development constraints to ensure that future growth of the City supports a vision for:

*A cohesive and vibrant community, celebrating diversity and working together to create a sense of place and a sustainable future.*

The LPS outlines four (4) key themes which consider a triple bottom line approach to balance the future growth of the City, through:

- *Theme 1: Community*
  - o *Deals with issues associated with population characteristics, housing, community facilities and services, recreation and open space;*
- *Theme 2: Economy*
  - o *Deals with retail and commercial space, economic development and diversification including tourism, industry and support to major projects;*
- *Theme 3: Environment*
  - o *Deals with issues associated with minimising risk from*

*natural hazards, protecting recognised environmental values and landscapes, urban design and public realm enhancement, protection from inappropriate development; and*

- *Theme 4: Infrastructure*
  - o *Deals with ensuring there is adequate utility and transport infrastructure capacity to service future growth.*

Under the key theme of Environment, the draft LPS outlines the following objectives:

- *To encourage appropriate recognition and management of the City's climate and natural environment;*
- *To promote and celebrate the City's unique natural and manmade heritage, character and sense of place; and*
- *To ensure planning and management of rural and environmentally sensitive land enables appropriate and sustainable use of the land and its resources.*

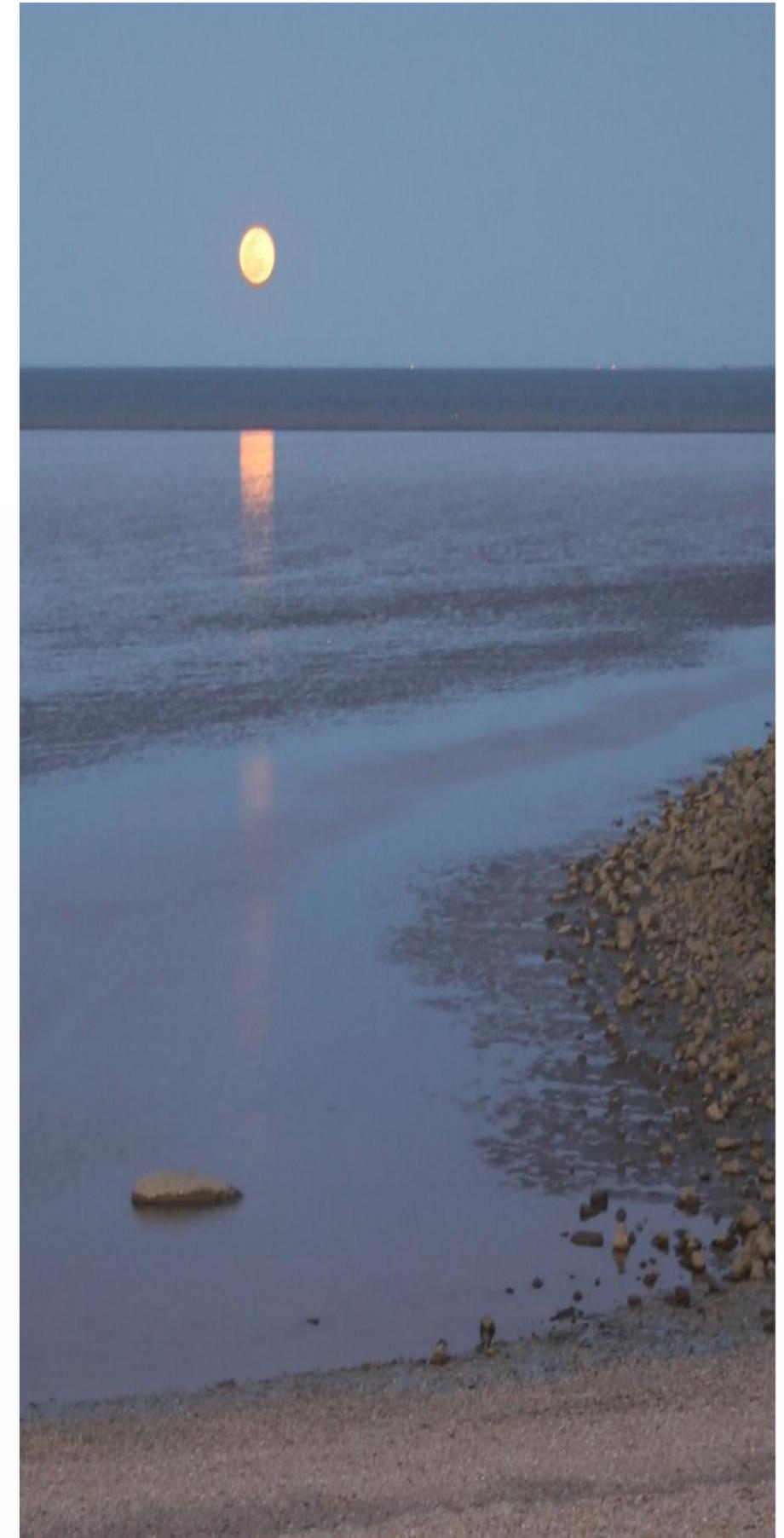
In addition to the above, the draft LPS sets an overarching City wide strategic plan, plus five specific settlement level plans. These settlement level plans guide the growth and development of the major population centres of Karratha, Dampier, Roebourne, Wickham and Point Samson.

## 2.6. CITY OF KARRATHA ENVIRONMENTAL STRATEGY

The City's Environmental Strategy provides a framework to achieve better environmental management outcomes. The Environmental Strategy has identified key outcomes with regards to the management of the coast, namely:

- *Recognition and enhancement of natural, cultural and recreational values of the coast;*
- *No further loss or degradation of coastal habitat; and*
- *Management of assets and protection of values in areas susceptible to coastal vulnerability.*

The Environmental Strategy has also identified thirty-three (33) proposed management actions to achieve its objectives. These actions include the development of a climate change strategy and a coastal recreation plan, the ongoing development of foreshore management plans, the delivery of education programs and the on ground implementation of threat eradication programs. The Environmental Strategy, its objectives and proposed actions has been used to guide and inform the development of this CMS.



# 3. LOCAL CHARACTERISTICS

## 3.1. NATURAL ENVIRONMENT

### Climate

#### Temperature

The City is within the arid-tropical, semi-desert Pilbara region. Climate is controlled largely by the seasonal migration of a belt of high-pressure anti-cyclonic systems lying across the continent for about six months of the year. It is also influenced by northern tropical rainfall systems. The area experiences a long winter from May to November while summer weather conditions prevail from December to March. There are brief transitional periods between these seasons.

Summer is hot, with a mean daily temperature of 36.2C reached in January and February, while winter is mild with a corresponding temperature of 26.1C in July. Mean daily minimum temperatures range from 26.5C in February to 12.2C in July. The general trend for Karratha indicates gradually increasing temperatures.

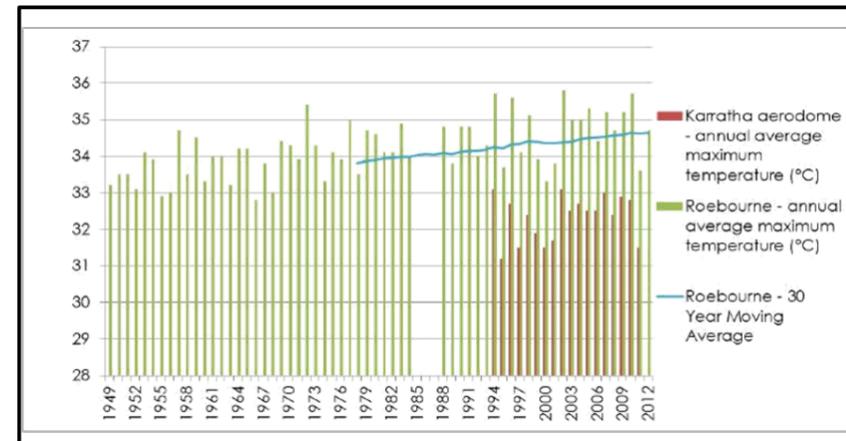


Figure 4 – Karratha and Roebourne climate trend – temperature.

#### Rainfall and Cyclones

Rainfall is generally erratic from year to year, but still exhibits seasonal characteristics. The average annual rainfall is low being only 230mm, with an initial peak between January and March (due to a combination of thunderstorms and cyclonic rains) and a lower trough in May and June.

Tropical cyclones deliver extreme weather systems which affect the region between November and April. Cyclones develop in the Timor Sea and travel

southwest along the northern coast of Western Australia, following a variable and frequently unpredictable path. Winds circulate in a clockwise direction about the eye of the cyclone, with coastal areas potentially affected by gale and hurricane force winds (160 km/hr). On average the region can be expected to experience two to three cyclones per year.

The trend in rainfall does not indicate an obvious decline or increase for the municipality (Figure No. 4). More significant than annual rainfall amount, is the change in distribution of events. There is a clear trend in recent rainfall records towards less frequent, more significant events which may have implications for City operations.

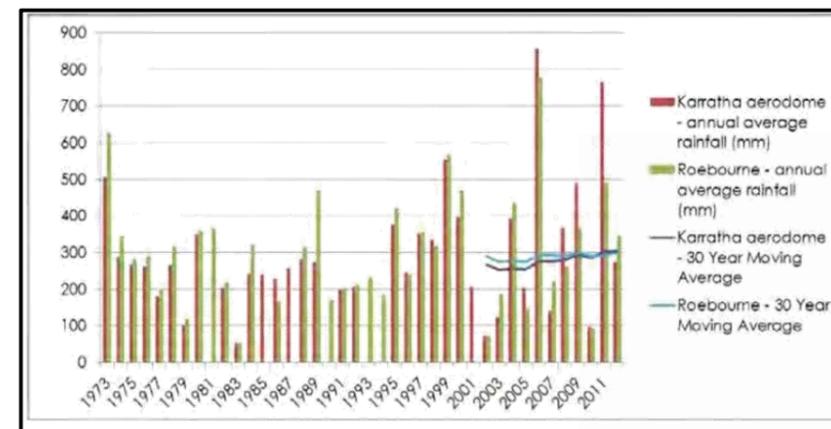


Figure 5 – Karratha and Roebourne climate trend – rainfall.

### Vegetation

The coastal flora communities experience significant and harsh environmental conditions including windborne salt, extreme tidal movement, periodic cyclone events, dramatic water erosion, extreme temperatures, high evaporation leaving hyper saline flats, silt deposition during flood and tidal events and strong wind erosion from varying directions. The vegetation communities able to tolerate these conditions include mangroves, shrubs (including wattles, creepers, herbs and succulents) and grassland (including soft spinifex and other grass communities). There are no prescribed threatened ecological communities along the City's coastline.

Mangroves line the upper banks of tidal creeks. Their presence indicates the importance of tidal creeks as habitats for a wide variety of marine organisms. This section of the Pilbara coast provides some of the best examples of tropical arid-zone mangroves in the world. Pockets of mangrove species (called Mangals) are highly productive ecosystems. They provide a sheltered environment, a haven for juvenile fish and crustaceans and support a wide variety of animal life. The root systems of mangroves bind silty mud allowing

coastal areas to experience severe storms without extensive damage. Destruction or removal of mangrove communities destabilises coastal areas, potentially leading to severe coastal erosion and loss of biodiversity.

Vegetation communities found along the coast include Mangal systems along creek and river courses, and a wide variety of spinifex, shrubs, steppe and grassland. Flora surveys have been confined largely to DPaW managed land including parts of the Burrup Peninsula and islands in the Dampier Archipelago. Invasive weeds including Buffel grass and Kapok bush are a significant problem along the coastline and dominate many disturbed areas. Populations of Prickly Pear have occurred on islands and have spread to the mainland. Cacti have become weeds, along with the Date Palm, Mesquite, Parkinsonia, Passion Vine, Tamarisk, Thistles and Ruby Dock. In conjunction with various partners, DPaW undertakes successful control of weed invasions across some areas of the municipality.

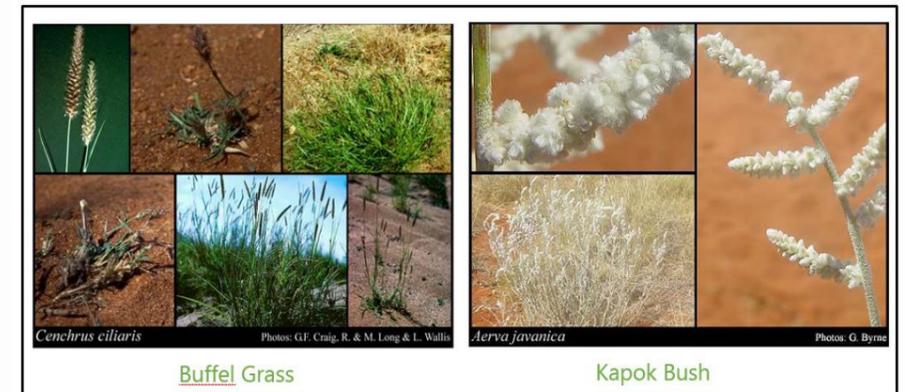


Figure 6 – Common City of Karratha Coastal Weeds.

### Fauna

Fauna diversity in the region is strongly influenced by the arid climate and specific vegetation communities. Due to these two factors, endemic reptiles including Gecko and Goanna species are prominent. The coastal islands function as refuges for vulnerable species that are either rare or extinct on the mainland such as the Western Chestnut Mouse. The coastal environment and offshore islands are also significant breeding sites for turtles and seabirds. Surveys of the Burrup Peninsula and Dolphin Island show the 141 vertebrate species are widely distributed across these areas. None of the identified species are classified as rare under Section 14 of the *Wildlife Conservation Act 1950 (WA)*.

Seabed habitats of the North West Shelf support the highest biodiversity recorded anywhere in the world, with a remarkable array of marine fauna

including tropical fish, sea turtles, migratory whales, hard and soft corals, sponges and many crustaceans. Below the water, there are a number of reefs with great productivity and diversity found relatively close to the coastline. High conservation status species such as turtles (Green, Loggerhead, Flat Back, Hawksbill and Leatherback), Dugongs, migratory seabirds/ waders and Whale Sharks all inhabit the Pilbara waters. The types of fauna found within the coastal environment is listed in Table No. 2.

Table 2 – Types of Fauna Existing within the City of Karratha Coastal Environment.

Type of Animal	Species
<b>Marine Turtles</b>	Flatback, Loggerhead, Hawksbill, Green and Leatherback turtles frequent the islands, Wickham Boat Beach, Cleaverville, Cape Preston and Gnoorea Point.
<b>Mammals</b>	Mammals include the Western Grey Kangaroo, Euro and Rothschild's Rock Wallaby, echidnas and carnivorous marsupials, rats, mice, wild dogs, foxes, feral cats and the Flying Fox.
<b>Birds</b>	Water birds including the Wader, Stilts, Cranes, Oystercatchers, Pelicans, Nankeen Heron, Ibis, Cormorants, Frigate Birds, Storks, Plovers and Dotterels. Birds of prey and carrion eaters include the osprey, owl, eagles, hawks, kites, falcons and crows.  Also found are; Bustard, Quail, Thick Knees, Pigeons, Doves, Parrots, Cuckoos, Cuckoo-Shrikes, Nightjars, Kingfishers, Swallows, Pipits, Fantails, Wagtails, Robins, Thickheads, Old world Warblers, Australian Wrens and Warblers, Honeyeaters, Pardalotes, Finches, Silvereyes, Wood Swallows, Magpies and Bowerbirds.

Type of Animal	Species
<b>Reptiles and Amphibians</b>	Reptiles and amphibians include Sea Turtles (mentioned above), Tree Frogs, Southern Frogs, nine (9) species of Geckos, two (2) species of Legless Lizards, three (3) species of Dragons, four (4) species of Goannas, eight (8) species of Skinks, Blind Snakes, Olive Pythons, Desert Death Adders, Yellow Face Whip Snake and Mulga Snake.  Of the Skink species the endemic Cape Lambert Slider ( <i>Lerista neviniae</i> ) and Four-chained Slider ( <i>Lerista quadrivincula</i> ) are rated respectively as 'rare or likely to become extinct' and 'of the highest priority'.



*Lerista neviniae*

A recent CSIRO study into the management of the Pilbara's conservation significant flora and fauna, revealed a comprehensive list of significant flora and fauna species within the Pilbara IBRA (Interim Biogeographic Regionalisation of Australia) subregions. The Pilbara IBRA subregions consists of: Chichester,

Fortescue, Hamersley and Roebourne. The City of Karratha sits within the Roebourne subregion.

The significant flora and fauna species found within the Roebourne subregion are listed in Table No.3 and Table No.4. The presence of these significant species within coastal areas will require confirmation through site specific flora and fauna surveys. These surveys should be undertaken through the development of specific Foreshore Management Plans and/ or development applications.



Figure 7 - Pilbara IBRA Subregions (CSIRO)

Table 3 – Conservation Significant Species, Roebourne Subregion.

Category	Scientific Name	Common Name	Conservation Status	Image (source : CSRIO, 2014)
Flora	<i>Goodenia pallida</i>	Mardie fanflower	Priority 1	
Vertebrate	<i>Burhinus grallarius</i>	Bush stone-curlew Bush think-knee	Priority 4	
	<i>Ctenotus augusticeps</i>	Airlie Island ctenotus	Threatened	
	<i>Dasycercus spp.</i>	Mulgara	Threatened	
	<i>Dasvurus hallucatus</i>	Northern quoll	Threatened	
	<i>Lagorchestes conspicillatus</i> subsp. <i>leichardt</i>	Spectacled hare-wallaby	Priority 3	
	<i>Leggadina lakedownensis</i>	Lakeland downs mouse	Priority 4	
	<i>Lerista neviniae</i>	Cape Lambert Slider	Threatened	

Category	Scientific Name	Common Name	Conservation Status	Image (source, CSRIO, 2014).	
Vertebrate	<i>Lerista quadrivincula</i>	Four-chained slider	Priority 1	No Image	
	<i>Liasis olivaceus subsp. barroni</i>	Pilbara olive python	Threatened		
	<i>Macroderma gigas</i>	Ghost bat	Priority 4		
	<i>Macrotis lagotis</i>	Greater bilby	Threatened		
	<i>Mormopterus loriae cobourgaiana</i>	Little north-western freetail bat	Priority 1	No Image	
	<i>Notoscincus butleri</i>	Lined soil crevice skink	Priority 4		
	<i>Peropele lateralis subsp. lateralis</i>	Black-flanked rock-wallaby	Threatened		
	<i>Pezoporus occidentalis</i>	Night parrot	Threatened		
	<i>Ramphotyphlops aenei</i>	Gane's blindsnake	Priority 1	No Image	
	<i>Smithopsis longicaudata</i>	Long-tailed dunnart	Priority 4		
	<i>Underwoodisaurus seorsus</i>	Pilbara barking gecko	Priority 1		
	Invertebrate	<i>Dupucharopa millestriata</i>	Dupuch Land snail	Priority 2	No Image

### 3.2. LANDFORMS AND COASTAL PROCESSES

The City's coastal environment is a large and complex natural system with a variety of social, economic and environmental uses. Coastal planning and management requires understanding of the forces affecting the shoreline, and what effect these forces have on landforms, sediment mobility and changes in the shape of the coastline. Understanding the short, medium and long term changes in the coastal landform makes it possible to appropriately plan the use of the coast, and determine the impact planned land uses will have on coastal processes.

#### Geology, Geomorphology and Landforms

Analysis of the geology and landforms of an area is an important factor in coastal management in that it provides a history of coastal evolution essential to our understanding of present shoreline configuration.

*Coastal dynamics within the region are recognised to be a complex interplay between rock features, fluvial systems and coastal floodplains, requiring assessment to be undertaken at a range of scales, with active and adaptive coastal management (Eliot, I et al. 2013).*

The surface geology across the City is diverse and ranges from very soft to hard foundations. In coastal areas, soils are predominantly alluvial and colluvial sand with silt and clay deposited on floodplains. Further inland, clay soils surround rocky and stony soils which extend towards the Karratha Hills (see figure 6).

#### Coastal Processes

A range of coastal processes occur across the City which act to shape the coastal landform and subsequently control the extent of use of the coast. The most significant coastal process controlling the future use and development of the coastal environment stems from cyclones and storm events. In addition, coastal currents and seasonal winds combine to effect the movement of sedimentation along the shoreline. These storm events combine with the significant tidal movements experienced in the Pilbara region to create inundation and erosion hazard risks across the coastal environment.

#### Swell, Wind and Waves

Knowledge of the prevailing swell patterns is important. Swells affect sediment transport by influencing the direction of littoral drift along sections of the coast. The City's coastline is subject to a low westerly swell that originates in the 'Roaring Forties' in the Southern Indian Ocean. The swell generates a littoral

drift that moves sediment to the northeast along the north coast of Western Australia (Woods, 1980).

Waves shaping the regional coastline come predominantly from the southeast during winter, and from the west and southwest during summer months (ERMP, 1979). Afternoon west-north-westerly sea breezes blow regularly throughout the year, producing choppy seas along the coast. Local variations in wave direction are apparent in the Dampier Archipelago. Wind velocity influences both the height and energy of waves. Along the Dampier coastline, wind generated waves are variable, but generally small being less than 1.3m in height (Semeniuk et al. 1982). Storm events are accompanied by larger wave activity with the strongest winds and highest waves occurring during cyclones.

#### Tides and Tidal Currents

Tides are an important factor affecting the coastal environment in that they increase the range of wave and current action along the coast (Wright et al 1982).

The large tidal range along the City's coastline creates a wide inter-tidal zone which is inhabited by a diverse range of plant and animal life. High tides which occur during storms and cyclones can contribute significantly to the degree of beach erosion, by increasing the reach of storm waves. Daily activity patterns along the coast are significantly influenced by the tidal regime of the region. Boat launching and swimming, for example, can be restricted to the high tide in some locations, whereas fossicking and beach combing can be pursued during low tide.

#### Storm Surge

Coastal vulnerability studies have been completed for the Karratha and Dampier foreshore areas. In addition, stormwater, flood and coastal management plans have been completed for Roebourne, Point Samson, Cossack and Wickham. These studies evaluate the combined effects of storm surge, inundation and/or shoreline movement.

The Karratha Coastal Vulnerability Study was completed in 2012. This study demonstrates that predicted climate change will increase flood inundation levels and realign the shoreline. In particular, the tidal creek around western Nickol Bay is predicted to expand destabilising fringing mangroves. Destabilisation of mangroves along west and east Karratha is also predicted to occur. The Dampier Coastal Vulnerability Study was completed in 2012. This study shows that existing urban development in Dampier is unlikely to be affected by an extreme storm surge event. However, it does indicate the current Dampier

shoreline is likely to change within the 100-year timeframe due to ongoing climatic events.

Based on the outcomes of the various vulnerability and flood studies undertaken over existing settlements, it is clear that having regard for coastal processes is an important consideration as part of planning the installation of any future coastal infrastructure.



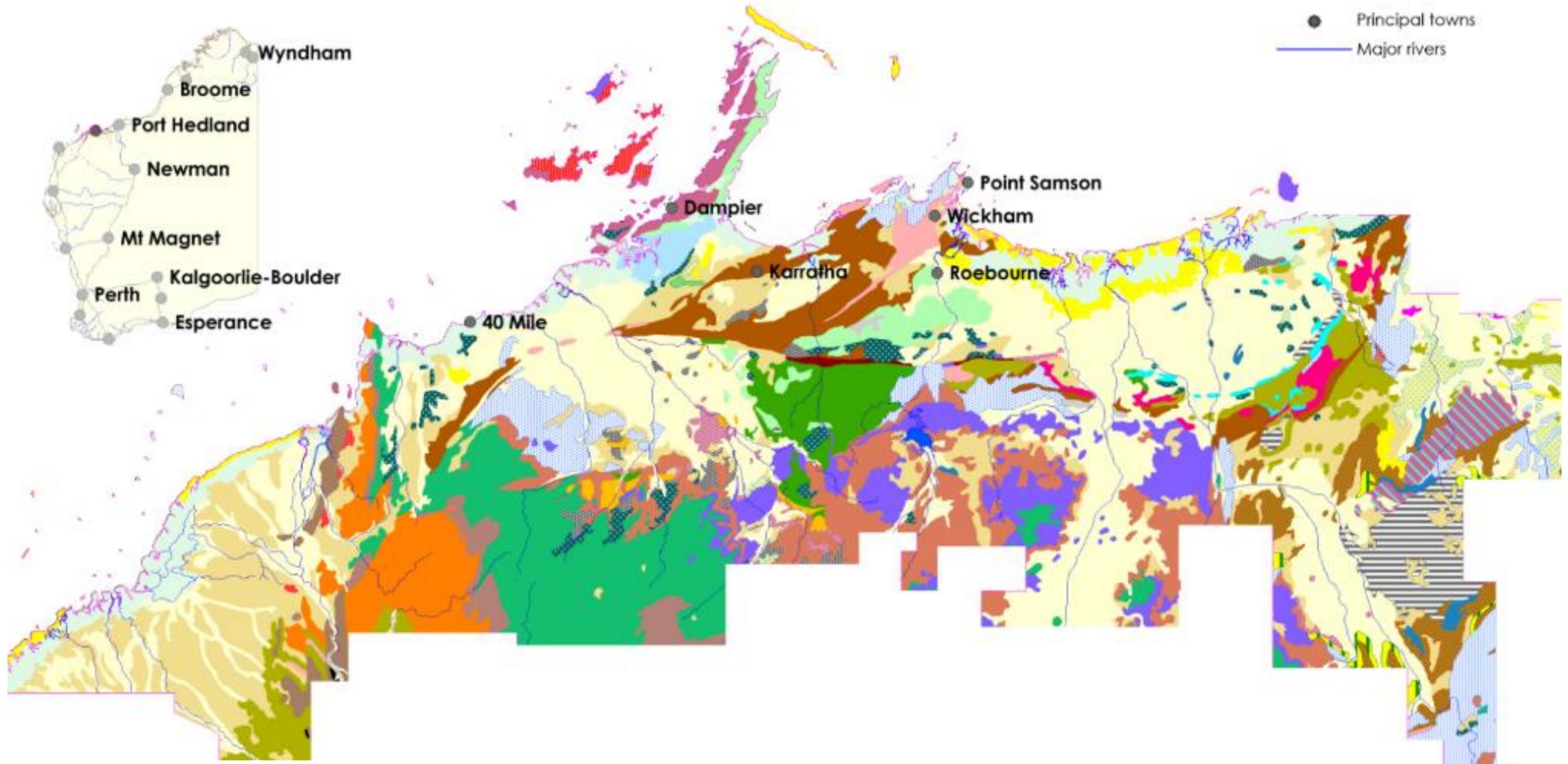
(a) During Normal Conditions



(b) During the Storm Surge generated by TC Glenda in March 2006

#### Climate Change

The City's coastal environment is vulnerable to a range of changing factors including significant tidal ranges, storm surges (including wave set-up), sea level rise and potential tsunamis. Low lying coastal areas of the City are



Surface geology

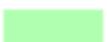
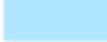
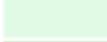
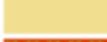
 Basalt, komatite - Awr, Abcl	 Calcrete - Czk	 Ultramafic volcanic rock - Aep	 Shale - Ashm, Asd, Ascsm, Awc, Kswm, Lsy, Awfj
 Clay (metamorphic rock) - Anyp	 Lateritic duricrust - Czl	 Basalt - Abcn	 Dolerite - Adfc, Adp, Adf, Ad, Adm
 Granophyre (igneous felsic rock) - Aggy	 Diorite - Agipw	 Mylonite - Azp	 Gabbro - Adgy, Adbh, Adrd, Adro, Adrr, Adrw, Adav
 Lake sediments - Qt	 Basalt, andesite - Abfk	 Sand (coastal dunes, limestone, sand plain) - Qdc, Qi, Qd, Czs	 Dacite - Afpr, Afck
 Andesite (basalt, chert) - Awf	 Rhyolite - Lfhw	 Olivine gabbro - Adlo, Adrs	 Granodiorite - Agaiw, Agaij, Agpf, Ager
 Estuarine sediments - Qe	 Iron formation, chert - Lchb	 Alluvial sediment - Qa, Cza	 Tonalite - Agbif, Agzl, Agait, Agij
 Basalt, dolerite - Abh	 Basalt, basaltic andesite - Abfm	 Chert, banded iron formation, mudstone - Acg, Achm	 Water
 Colluvial sediment - Qrc	 Sandstone, siltstone - Awfh	 Granite - Agi, Agis, Agnl	
 Greywacke, banded iron formation - Ascc	 Greenstone (metamorphosed rock) - Atp	 Monzogranite - Agpo, Agyn, Agaie, Agail, Agiel, Agpb, Agyt, Agai, Ag, Agaia, Agair, Agaic	
 Alkali feldspar granite - Agir	 Tuff, limestone, shale - Awft	 Mafic volcanic rock - Abfr, Adlm	

Figure 8 – Surface Geology in the City of Karratha

particularly vulnerable to inundation during tropical cyclones, storms and tsunami events. Modelling has been undertaken to identify the extent of likely flooding in a 100-year and 500-year ARI event. This modelling indicates that all town sites are affected by these storm events to varying degrees over the 100-year planning timeframe.

The impact of projected climate change varies depending on the underlying geology across the coastal environment. These changes include tidal creek expansion, tidal flat and mangrove destabilisation and breaching of coastal protection systems including dunes, rock features and bunding. Stronger and more variable wind has over time connected, what were once islands, to the mainland of the Pilbara coast. This trend is expected to continue to impact dune systems into the future. The Point Samson town site and its surrounds is a good example of a landscape that has formed as a result of historical accretion.

Tidal creek expansion is expected for the Western Nickol Bay and Nickol River Delta in response to sea level rise. Western Nickol Bay has a projected expansion in length and width of 60% by 2060, with the potential to reach 180% by 2110. The Nickol River Delta is projected to disappear over time due to sea level rise.

Tidal flat and mangrove destabilisation is likely to occur in the Western Nickol Bay and West Karratha areas over the longer term. Destabilisation of fringing mangroves at Western Nickol Bay is projected to occur due to increased sediment transport between 2070 and 2090. A breach of the dune system adjacent to the airport is likely to occur due to insufficient material (sediment) storage. The West Karratha area includes the majority of the Karratha town site which is protected by a largely continuous coastal dune. Destabilisation of the fringing mangroves, and sediment demand from the coastal dune, is likely to result in general scarp formation, with more focused erosion adjacent to tidal creeks. Breaching of the coastal dune is likely to occur by 2110 during extreme cyclone events.

There are two central coastal hazard risks resulting from changing climate along the City coastline, namely; coastal erosion through storm surge and sea level rise, and coastal inundation through cyclonic flooding.

### Sediment Cells and Geomorphology

Sediment cells are compartmentalised areas along the coast, classified according to the landforms and associated coastal processes that are contained within. The delineation of sediment cells identifies connections between marine and terrestrial landforms allowing better coastal management by grouping areas for coastal stability assessment, consideration of historical trends, contemporary processes and projection of future coastal change.

The landform of a coastal area is typically the product of historic environmental conditions. The various types of materials, coastal landforms and coastal processes interact over time to develop a sedimentary budget (the difference between overall erosion and accretion events). The sedimentary nature of the City's coastline comprises of an ancient hard rock terrain overlain by coral reefs, floodplains and river deltas deposited over the past 2 million years. In places, these sediments have been lithified to form coastal limestone outcropping. In other areas, mobile sediments are intermittently delivered to the coast by numerous rivers and flowing streams, most notably the Fortescue River.

The sedimentary landforms of the City's coastal environment impose restrictions upon the type of land use that each node is capable of supporting. Dunes, mud and silt flats are unconsolidated and susceptible to erosion if vegetation is disturbed. The mud and silt flats are particularly sensitive to changes in sea level especially when fringing mangroves are cleared and/or destroyed by erosion. Similar to mud and silt flats, the presence of expansive clays in silty sand can create major engineering problems along the coastal plain.

Rocks on the surface of the coast line can also be weakened through weathering and erode to form scree slopes. Development on the Burrup Peninsula in particular needs to consider these engineering issues. Generally, the older Precambrian rocky hill areas provide the most stable development sites within the City's coastal environment.

In 2013, the Department of Planning commissioned the Geology, Geomorphology and Vulnerability of the Pilbara Coast (Geology Study). The study area included the Shires of Ashburton, East Pilbara and Roebourne and the Town of Port Hedland. The report categorises the City's coastline into five tertiary sediment cells based on grouping similar geomorphology (see figure 9).

A summary of the geomorphic processes is outlined in Table No. 5. The report also provides a range of mapping including the mapping of sediment cell and their associated landform stability. This information will be used in the high level consideration of future land use planning for the City, and guide management actions for the coast, especially outside of established coastal settlements.

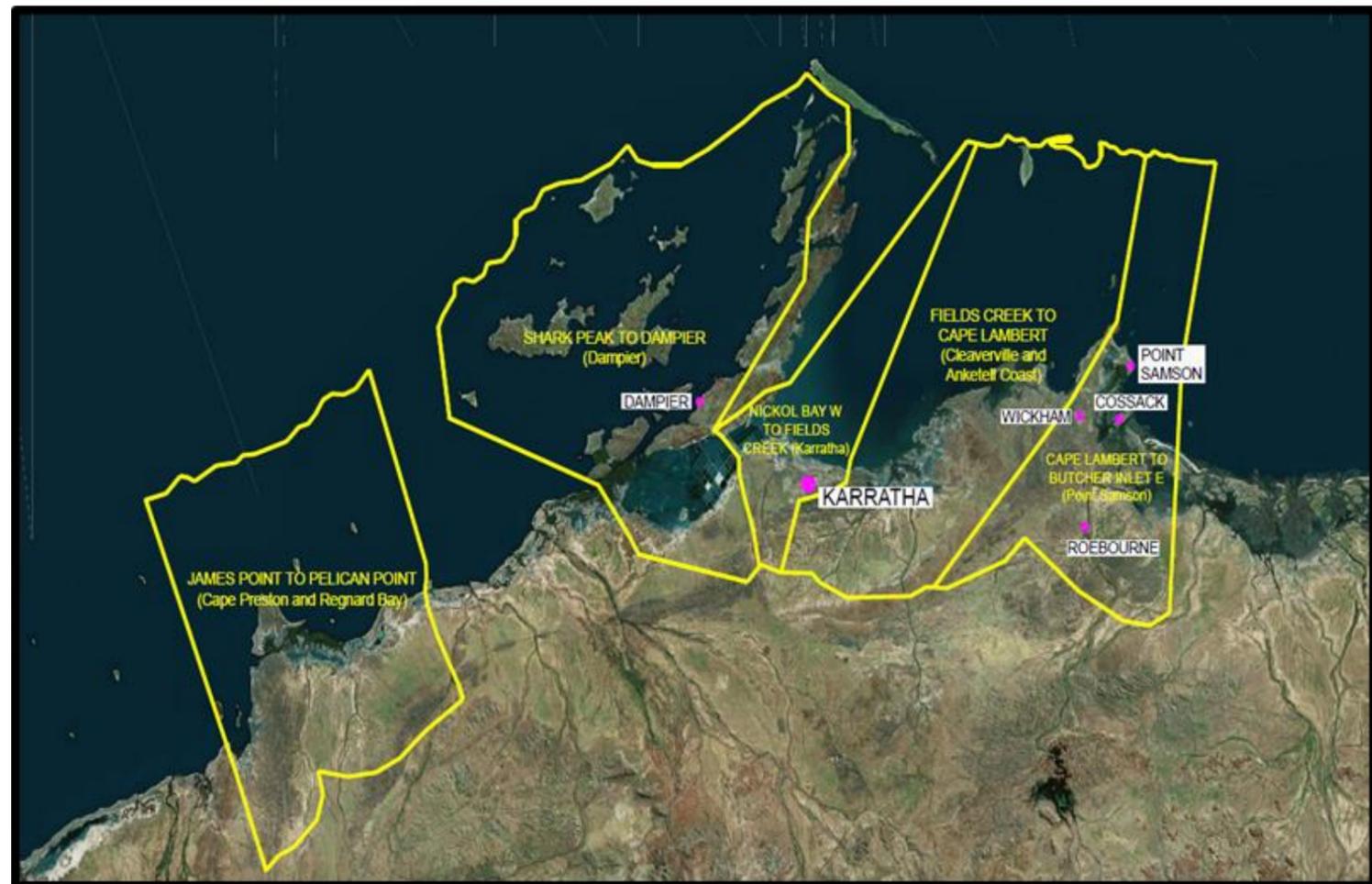


Figure 9 – Tertiary Sedimentary Cells Along the City of Karratha Coast.

Location	Landforms and Sediment Cells	Coastal Vulnerability
<p><b>Cape Preston and Regnard Bay</b></p> <p>Rock-controlled coast, with high sediment supply from the Fortescue River and low sediment supply to Regnard Bay.</p>	<p>Aerial imagery shows limited historical change at the vegetation line with most changes at, or below, the water line and on floodplains. The rocky points provide structural control, limiting potential long-term coastal movement, with the most significant change occurring on western-facing beaches and at entrances to tidal creeks.</p>	<p>The potential influence of sea level rise upon this section of the coast is significant, as it represents a large change relative to the shallow depths across rock platforms, and may drastically reduce the capacity for low-lying rock features to provide structural control.</p> <p>The higher topography present across much of the Cape Preston headland determines the inundation issues are predominantly restricted to lower-lying tidal wetlands south and east of Cape Preston. The Regnard Bay coast has limited supply of sediment and coast-defining rock features. This causes high sensitivity to all forms of climate variation.</p>
<p><b>Dampier</b></p> <p>Rocky shoreline, with low sediment supply (see figure 8 – Hearson Cove).</p>	<p>Aerial imagery shows the shoreline has historically been relatively stable and is strongly controlled by underlying, alongshore and supratidal rock features. The majority of the observed change is in response to human interventions, including facilities and coastal protection works. Erosion is occurring at coastal road embankments and at eastern areas of embayments.</p>	<p>Is relatively insensitive to weather systems and environmental change, due to presence of high mainly rocky topography. Exceptions largely occur at artificial or highly modified sections of the coast.</p>
<p><b>Karratha</b></p> <p>Low-lying sedimentary coast, structurally controlled by rock outcrops.</p>	<p>The majority of observed change is vertical variation and/ or modifications to channel networks. In the Western Nickol Bay there is evidence of increased tidal exchange suggesting the mudflats may be deepening, with increased capacity to capture sediment. At the Karratha town site there has been little change to Karratha town beach, with some localised lowering of the mud flats and loss of mangroves.</p>	<p>Mixture of low-lying mangrove fringed coast, and rocky land with higher topography. Significant coastal dunes are present along the landward side of the western coastal lagoon and adjacent to the Karratha town site. The sheltered and structurally controlled nature of Nickol Bay limits the susceptibility of the low-lying shore to variation of weather conditions. However, this part of the coast is highly susceptible to extreme events and sea level rise. The coastal dunes and the higher rocky topography are expected to provide a fair level of protection over a planning horizon of 100 years, although extreme events may cause dune breaching, or cause flooding through existing gaps in the dunes.</p>
<p><b>Cleaverville and Anketell Coast</b></p> <p>Mixture of rocky coast and tidal lowlands (see figure 9 – Wickham Boat Beach).</p>	<p>Aerial imagery shows limited change on the rock controlled coast with tidal lowlands. The majority of observed change is localised spit growth, modification of subtidal channels and tidal creeks.</p>	<p>Highly controlled by rock structures and relatively intolerant to variations in weather conditions.</p> <p>The low-lying sections of coast are subject to tidal flows and therefore have the capacity for significant coastal change in response to sea level adjustments, including floodplain infill and extension of tidal creeks.</p>
<p><b>Point Samson</b></p> <p>Low-lying floodplain, with relict barrier system and tidal creeks.</p>	<p>Interaction of low-lying sedimentary features with irregular rock formations. The rock provides a degree of control which restricts coastal mobility, giving limited change of the vegetation line. In contrast, sedimentary features such as mudflats, terraces and spits are highly dynamic, with a cycle of erosion during extreme events, followed by a general pattern of recovery, albeit sometimes significantly less than erosion.</p>	<p>Is partly controlled by rock structures, which act as training systems for channels, including the tidal creeks adjacent to Point Samson and Cossack.</p> <p>The low-lying nature of much of the coast determines that inundation during extreme events is a significant issue, although the barrier systems provide a large degree of protection against direct wave attack.</p>

Table 4 – Geomorphic Processes of the Tertiary Cells.

### 3.3. MANAGING COASTAL VULNERABILITY

The City has taken a precautionary approach to the management of the coastal environment. This includes investigating coastal hazards and vulnerabilities, incorporating modelling into policy work and constructing a risk management framework for assessing coastal development proposals. In addition, available flood modelling will be used to plan and implement upgrades to the drainage network to reduce the risk of flooding.

The City will evaluate land use and development in the context of likely effects of 100-year and 500-year ARI events as appropriate. The extent of potential coastal hazards and shoreline stability will determine town site expansion areas across the municipality. The City will ensure the impacts from coastal hazard risks are avoided or reduced to acceptable levels through Foreshore Management Plans and/or through Coastal Hazard Risk Management and Adaption Plans. This approach allows for the incorporation of the most current scientific information as it becomes available.

The consideration of sea level rise for coastal development and infrastructure has also been undertaken through the use of recommended coastal setbacks. In addition to risks of inundation from storm surge and sea level rise, coastal erosion will be investigated for new development in the coastal environment. Consideration of erosion will include allowances within the 100-year planning horizon for:

- The current risk of storm erosion;
- Historic shoreline movement trends;
- Erosion caused by future sea level rise; and
- Allowance for uncertainty.

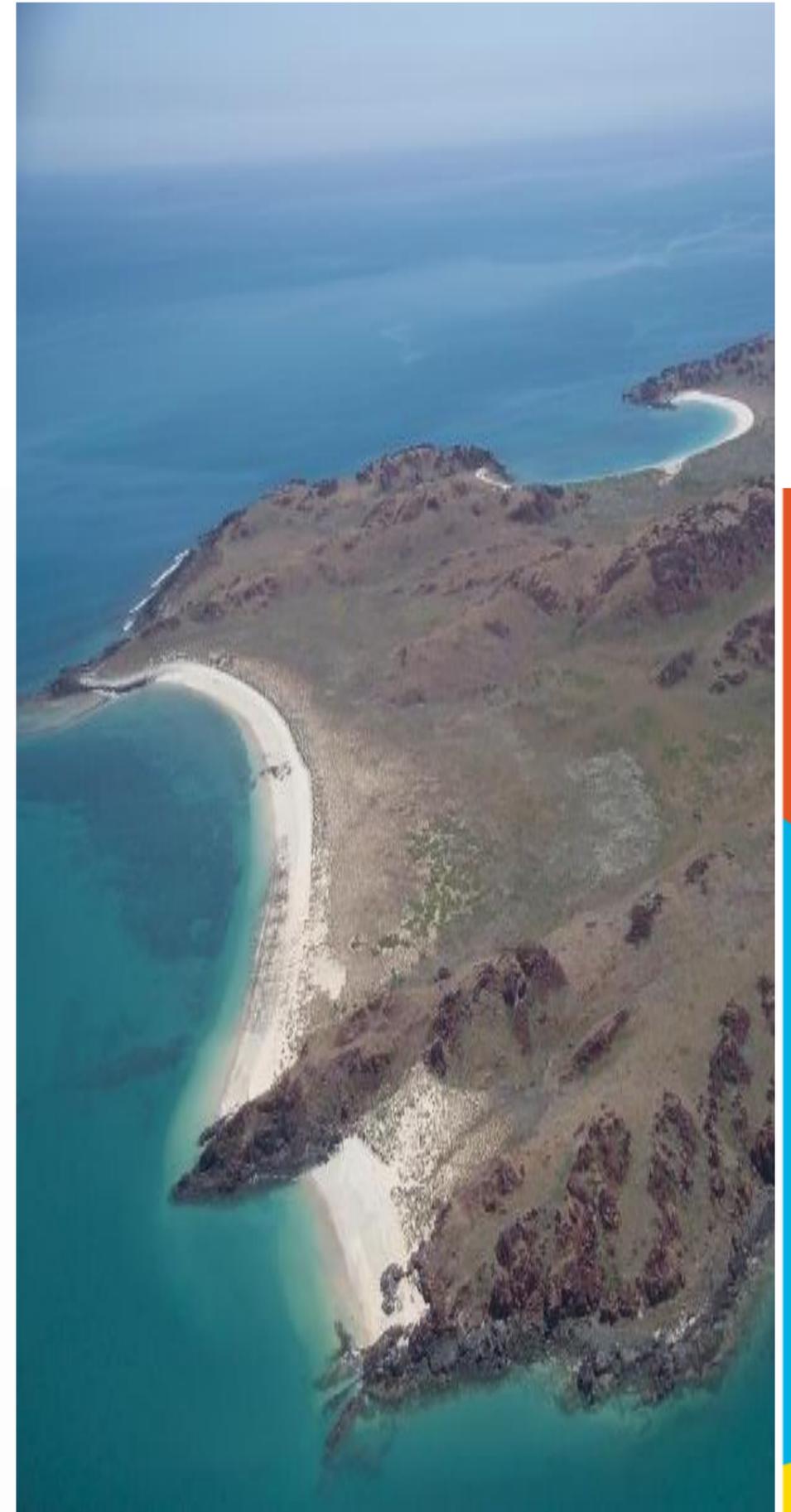
Furthermore, understanding how sediment cells function, provides guidance on the type of management solutions most suitable for specific coastal nodes. Marine and terrestrial landforms are connected. Development or construction in one sediment cell may have effects on other cells. There are four key sediment cell considerations in coastal planning:

1. Coastal stabilisation works can transfer stresses along the coast, which is manageable if there is a balance of erosion and accretion within a sediment cell.
2. Coastal stability issues that affect an entire cell will require an improvement of coastal resilience, for example through transferring sand from the nearshore to the beach and dune system.
3. Erosion and accretion occurring differently between cells will require

long-term management for effective balancing.

4. Erosion or accretion occurring across multiple cells implies a significant dominant issue for management consideration, which can be addressed by identifying sacrificial coastal nodes.

To manage coastal vulnerability, the City has completed a Coastal Hazard Risk Management Adaptation Plan (CHRMAP). The CHRMAP provides guidance to applicants and decision makers looking to develop buildings and infrastructure on land identified as being affected by the 500-year ARI storm surge event. The CHRMAP enables the City to determine where a coastal hazard risk is acceptable and if so, under what management conditions. If development is not covered by existing mapping, or if the existing mapping is not adequate, the onus is on proponents to undertake the necessary coastal hazard identification process in accordance with the requirements of the CHRMAP.



## 4. SOCIOECONOMIC ENVIRONMENT

### 4.1. HISTORIC COASTAL USE AND ACTIVITY

Following European settlement of the Roebourne area, whaling and pearling industries were established along the coast. However, it was the pastoral industry established in the nineteenth century that proved to be the mainstay of the regional economy up until the 1960's. There are currently six (6) pastoral leases that are adjacent to the coastal environment, the largest being Mardie Station which abuts approximately 30% of the City coastline. Post 1960's the iron ore industry provided much of the economic impetus and infrastructure. In addition to the mining and pastoral industries, aquaculture and tourism are continuing to provide additional diversified growth for the region.

Resource developments in the Pilbara since the 1960's have led to the creation of significant infrastructure including ports and urban centres. The City of Karratha is one of the major locations in the state for the exploration, processing and exportation of iron ore, natural gas and salt. As such, a number of deep water ports and onshore processing and export support facilities have been developed along the City coastline. Additional facilities are also being planned at Anketell (near Wickham), Cape Preston and Balla Balla.

Town sites located on or near the coast include the regional centre of Karratha and the towns of Dampier, Roebourne, Wickham and Point Samson. These coastal settlements are serviced by coastal recreation nodes such as Cossack/Settlers Beach, Dampier Foreshore, Hearson Cove, Karratha Back Beach, Cleaverville, Point Samson Foreshore and Wickham Boat Beach. More remotely located are a number of managed coastal camping areas at Forty Mile – Gnoorea Point and Cleaverville, and unmanaged coastal camping areas at the Fortescue River Mouth and Balla Balla. All of these locations are well patronised, with a considerable number of people visiting these areas, particularly during the cooler months between April and September. In addition, there are a significant number of informal access routes which provide access along the regional coastline.

Offshore, the Dampier Archipelago comprises 42 islands. This Archipelago, together with the associated marine areas lying within 45km of the Dampier town site, is the richest area of marine biodiversity in Western Australia (DEC 2009). The Archipelago also contains the largest concentration of rock art in the world and is 'a virtually continuous cultural landscape providing a detailed record of both sacred and secular life reaching from the present back into the

past, perhaps to the first settlement of Australia' (Burrup Technical Report, p. 6). Long standing Aboriginal traditions of ritual and complex land management practices have shaped the nature of the environment to its near current form. The Dampier Archipelago is also a significant recreational area for residents and visitors.

The establishment of ports and industry within the Dampier Archipelago has resulted in the creation of an artificial peninsula known as the Burrup Peninsula. The Murujuga National Park comprises much of the Burrup Peninsula. Murujuga has been listed in the National Trust of Australia Endangered Places register. In 2009, nearly all of the remaining rock art areas of the Dampier Archipelago were placed on the National Heritage List. The towns of Karratha, Roebourne, Wickham and Point Samson are all within close proximity to the Dampier Archipelago.

### 4.2. ABORIGINAL HERITAGE VALUE

The Yaburara Aboriginal language group are recognised as the original inhabitants of Murujuga (Burrup Peninsula). Over two thousand Aboriginal heritage sites have been identified across the municipality and protected under the *Aboriginal Heritage Act 1972*. This demonstrates the volume of internationally significant archaeological relicts found across the region. Midden sites, stone scatters, rock engravings, standing stones and stone arrangements used for hunting and ceremonial practices are not uncommon, particularly on Murujuga and Depuch Island. Over time a number of Aboriginal burial sites concentrated within sand dunes, have been unearthed. These sand dunes and coastal verges also contain concentrations of shell middens and grinding stones.

The Aboriginal heritage sites across the municipality provide profound cultural meaning and strength to Traditional Owners. Significant concern is raised where the desecration of burial sites occurs due to the commonly accepted recreational pastime of driving vehicles over sand dunes, as well as other activities such as sand extraction and unrestricted access. Surveying for Aboriginal heritage sites is an ongoing process and in undeveloped areas is a requirement prior to development.

### 4.3. NATIVE TITLE

Native Title has been determined over the majority of the City's coastal environment to the benefit of the Ngarluma people through the Ngarluma/Yindjibarndi Native Title Determination (WAD6017/96 and WAD 165/08). The Federal Court determined that exclusive and non-exclusive Native Title rights and interests exist, except where identified in the determination as

being extinguished. While a number of Indigenous Land Use Agreements (ILUA) are in place for the use and development of land within the determination area, specifically the various town sites, the majority of the coastline is not covered by any ILUA. In addition, the majority of the western area of the municipality is currently under two separate Native Title Claims. These claims are the Yaburara & Mardudhunera (WAD127/1997) (yet to be determined) and the Kuruma Marthudunera (combined) (WAD6090/1998) (has been determined to have Native Title in the claimant area).

Only the vesting of certain reserves may extinguish Native Title. Unvested reserves, pastoral leases and Unallocated Crown Land (UCL) are generally subject to native title rights and interests despite their usage. In order to pursue management responsibility for areas of the coastal environment currently within Native Title determined areas, the City will be required to negotiate an Indigenous Land Use Agreement (ILUA) with the Native Title holders. The benefits of developing ILUAs are that they provide a framework for formalising agreements for the future use and management of areas, especially when areas are important for Aboriginal heritage. There are opportunities for coastal management considerations to be incorporated into an ILUA and pursued in partnership between the City and the Native Title holders.

### 4.4. LAND USES

The City's Town Planning Scheme No. 8 (TPS8) prescribes various types of zones and reserves across the municipality. Under the provisions of TPS8, the vast majority of the City's coastal environment is reserved for 'Conservation, Recreation and Natural Landscapes'. Moving inland from the coastline, the majority of land is zoned 'Rural', apart from the southwestern portion of the Burrup Peninsula, surrounding the Dampier town site, which has been zoned for 'Strategic Industry'. The various settlements across the municipality are also covered by TPS8 comprising a range of various zones and reserves to facilitate orderly urban development.

Outside of the designated settlements, the vast majority of land within the City's coastal zone is currently under ownership of the State of Western Australia. The land comprises a mixture of reserves, leases (predominately pastoral leases) and UCL. While the various reserves and leases have identified land uses and/or purposes, parcels of UCL have no identified use or purpose.

In addition to the identified zones and reserves under TPS8, there are a number of mining tenements across the municipality, including within the coastal environment. The Department of Mines and Petroleum (DMP) is the responsible agency for administering mining registrations and titles. The DMP is not required to refer tenement and mining applications on UCL to other

agencies, including the City. This can have significant consequences where a mining tenement is granted close to an identified foreshore node or settlement. One way that this potentially could be minimised is to establish City managed 'buffer' reserves around intended nodes. As the majority of land within the municipality is under Native Title determination, this would most likely invoke a Future Act process under the *Native Title Act 1993*. The type of Future Act will depend on the purpose and intent of the reservation. The City is currently undertaking a process of establishing a 'buffer' reserve at Point Samson.

Identification of potential future buffer areas for incorporation into City reserves will be completed during the development of the City's Local Biodiversity Strategy. Once identified buffer areas could be formalised through the Local Planning Strategy. Buffers will also be determined in light of the recently adopted Basic Raw Materials Local Planning Policy 2.6. There are two (2) areas along the City's coastline which are subject to an Improvement Plan/Scheme. These are Improvement Plan No. 42: Anketell Strategic Industrial Area gazetted on 8 May 2015, and Improvement Plan No. 44: Maitland Improvement Plan gazetted on 21 July 2016. Anketell Improvement Scheme has been advertised.

Improvement Plans are strategic instruments used to facilitate the development of land in areas identified by the WAPC as requiring special planning. Improvement Plans are still subject to Local Planning Scheme requirements, whereas Improvement Schemes have priority over Local Planning Schemes. By preparing an Improvement Plan the WAPC is signalling its intention to be the development control authority in these areas and to have responsibility for determining applications. In the case of the Anketell, potential impacts have been identified for access to the Cleaverville foreshore area. The City's response to any Improvement Plan and/or Scheme will consider the impact they may have on foreshore areas and the City's ability to implement a particular coastal management recommendation.

The City supports commercial and/or tourist operations being located within coastal nodes, either within existing City reserves, or on adjacent lots as long as the nature and scale of the proposal is appropriate. The City will work with proponents to facilitate future development.

## COASTAL LAND TENURE

Vesting of land within the coastal environment includes Freehold, State Nature Reserves, Crown Reserves, Pastoral Leases, Aboriginal and mining interests, Unallocated Crown Land and Special Crown leases. As a general rule, lot boundaries extend to the high water mark. However, an examination of the

survey plan for individual lots would be necessary to determine if any lots extend further to the low water mark.

Definitive land tenure such as reserves, leases and freehold land can only apply to the defined lot on a survey plan. Subsequently in the majority of cases there will be a strip of Unallocated Crown Land seaward of the High Water Mark. Pastoral boundaries adjoining the coastline begin 40 metres above the mean high tide. Marine Reserve Area jurisdiction extends 40 metres landward of the high water mark (meeting the pastoral lease boundary).

The majority of the City coastal environment comprises of Crown Reserves adjoining pastoral and mining leases. The exception is the coastal recreation nodes around the settlements of Dampier, Karratha, Wickham, Point Samson, Cossack and Roebourne where a complex array of tenure and usage has been established. Pastoral leases that have land extending into the coastal area are Mardie, Karratha, Mt Welcome, Warambie, Sherlock and Mallina. The complex nature and future consideration of tenure around recreation nodes is outlined within Table No. 6 (location of each node is represented in Figure 11). In addition, Appendix No. 1 contains diagrams that detail the current and proposed future tenure for each of the coastal nodes.

Table 5 – Tenure Arrangements at Coastal Nodes.

Coastal Location	Current Tenure	Future Tenure Changes
1. Fortescue River Mouth	<ul style="list-style-type: none"> <li>- UCL</li> <li>- Reserve – Public Purpose</li> <li>- Cape Preston Marine Park</li> <li>- Native Title.</li> </ul>	Possible change of vesting of UCL and Public Purposes to be vested with the City and change of purpose to reflect proposed land use, i.e. recreation and camping. Any change will require a future act process under the <i>Native Title Act 1993</i> .
2. Gnoorea Point	<ul style="list-style-type: none"> <li>- UCL</li> <li>- Reserve - Recreation and Preservation</li> <li>- Construction and Launching Facilities (unvested)</li> </ul>	<p>Inclusion of 'Camping' into the purpose of the City of Karratha vested reserve.</p> <p>Unvested reserve 46598, purpose 'Construction and Launching Facilities', should be vested by way of a management order to determine future management responsibility and purpose.</p>

		All UCL subject to a future act process under the <i>Native Title Act 1993</i> .
3. Dampier	<ul style="list-style-type: none"> <li>- Rio Tinto Lease</li> <li>- Crown Reserves (vested and unvested)</li> <li>- Private Landholdings</li> </ul>	A Management Order is being considered that will consolidate crown reserves into reserves vested with the City. This includes areas currently leased and managed by the Rio Tinto. Consultation with Department of State Development (DSD)
4. Hearson Cove	<ul style="list-style-type: none"> <li>- Parks and Recreation</li> <li>- National Park (vested with Murujuga Aboriginal Corp. and DPaW</li> <li>- Industrial Development (held in freehold tenure by Landcorp and leased to proponents for industrial development).</li> </ul>	Investigation is required into the development of a formalised industrial buffer zone, between the National Park and neighbouring industry.
5. Balla Balla	<ul style="list-style-type: none"> <li>- UCL</li> <li>- Common purposes (vested with CofK)</li> <li>- Crown reserves (unvested)</li> </ul>	A number of unvested reserves exist in this area for different purposes i.e. Cemetery, Public Utility and Stock Route. Although unvested, these areas are subject to non-exclusive Native Title Rights under the Ngarluma/Yindjibarndi claim. Any change of vesting would require a future act process.
6. Karratha Back Beach	<ul style="list-style-type: none"> <li>- Parks and Recreation (vested with the CofK)</li> <li>- UCL (1. North of Millstream Road 2. Coastal Fringe)</li> </ul>	UCL is subject to the Ngarluma/Yindjibarndi determination. There is the possibility of incorporating UCL fringe into reserve 36708 by way of management order to the City.
7. Point Samson	<ul style="list-style-type: none"> <li>- UCL</li> <li>- Recreation (vested with the CofK)</li> </ul>	Investigation into creation of a reserve for 'Conservation, Recreation and Landscape Protection' in current UCL

	<ul style="list-style-type: none"> <li>- Industry Purposes (vested with DSD).</li> <li>- Harbour Purposes (vested with DoT)</li> </ul>	as a buffer between industry, the town site and current recreation reserves. Should this investigation proceed, consultation with DSD required.
8.Cleaverville	<ul style="list-style-type: none"> <li>- Recreation and Camping (vested with the CofK)</li> <li>- Harbour Purposes (vested with DoT)</li> </ul>	Reserve 51015 is vested with the Department of Transport and set aside for 'Harbour Purposes'. Consultation with Department of Transport may be required (especially for jetties, boat ramps etc.). Reserve 33775 is vested with the City and set aside for "Recreation and Camping". The native title rights over this reserve are not extinguished and therefore
9.Wickham	<ul style="list-style-type: none"> <li>- UCL</li> <li>- Recreation (vested with CofK)</li> <li>- Harbour Purposes (vested with DoT)</li> </ul>	All UCL is subject to a future act process under the <i>Native Title Act 1993</i> . Any works around the current yacht club and boat ramp will require consultation with the Dept. of Transport.
10.Cossack	<ul style="list-style-type: none"> <li>- UCL</li> <li>- Recreation (vested with CofK)</li> <li>- Use and Benefit of Aboriginals (vested with the Aboriginal Lands Trust)</li> </ul>	N/A

### 7.1. RESERVES AND MANAGEMENT

Figure No. 10 depicts the location plan of the ten coastal nodes within the City of Karratha. The City has responsibility for the management of many of these coastal nodes/reserves under various management orders. Coastal management outside of reserves vested to the City, is the responsibility of various agencies. It is not the intention of this CMS to prescribe management actions of land under jurisdiction of other authorities (e.g. port areas). Rather, the approach is to work in partnership with these agencies to consider the implications of development and use both within, and around these areas.

Generally, where a reserve is set aside for a particular public purpose, the use of that land is limited to that purpose. For reserve purposes such as 'Recreation' the use can broadly be applied to any recreational activity, including ancillary and associated uses such as kiosks, club houses and overnight camping. However, the 'Recreation' purpose does not extend to commercial facilities such as restaurants, hotels or caravan parks. Other purposes such as 'Common' and 'Public Utility' may require a change of purpose to better reflect other intended uses. Reserves set aside for the 'Use and Benefit of Aboriginal People' are only available to Aboriginal people for use, and are generally created to allow construction of Community Living Areas. Apart from the land tenure created under the *Land Administration Act 1997*, there are other forms of land tenure created under other legislation. The *Port Authorities Act 1999* allows the Pilbara Ports Authority (PPA), to declare areas of water and coastal strips under its jurisdiction. The PPA has control and responsibility of managing activities within their declared areas (see Figure No.11). for development proposals. This is undertaken through a variety of legislative provisions, including the granting of leases, controlling water vessel movements and requiring approval. The PPA provides for the future development of trade and commerce for the economic benefit of the State of Western Australia.

The Department of Parks and Wildlife (DPaW) is responsible for areas declared as Marine Parks, Marine Management Areas and Marine Nature Reserves under the *Conservation and Land Management Act 1984*. Under this legislation, DPaW controls fishing and other related activities. The Dampier Archipelago and Cape Preston Marine Conservation Reserves are protected by under their reserve status. The Dampier Archipelago, Burrup Peninsula and Dolphin/ Legendre Islands are under responsibility of DPaW (see Figure No. 12, Department of Parks and Wildlife Managed Reserves).

The Department of Transport (DoT) also has responsibility over portions of the coastal environment under various legislation. Under the *Jetties Act 1926*, DoT has responsibility for issuing licences and policing for the construction of jetty and boat launching ramps. DoT also has legislative responsibility in respect to safety issues associated to moorings and other coastal infrastructure, as well as coastal planning and environmental protection (including the allocation of coastal adaption and protection grants). Under the *Marine and Harbours Act 1981*, DoT has responsibility for enforcing the law relating to the liability of owners of ships for damage to harbours and jetties.

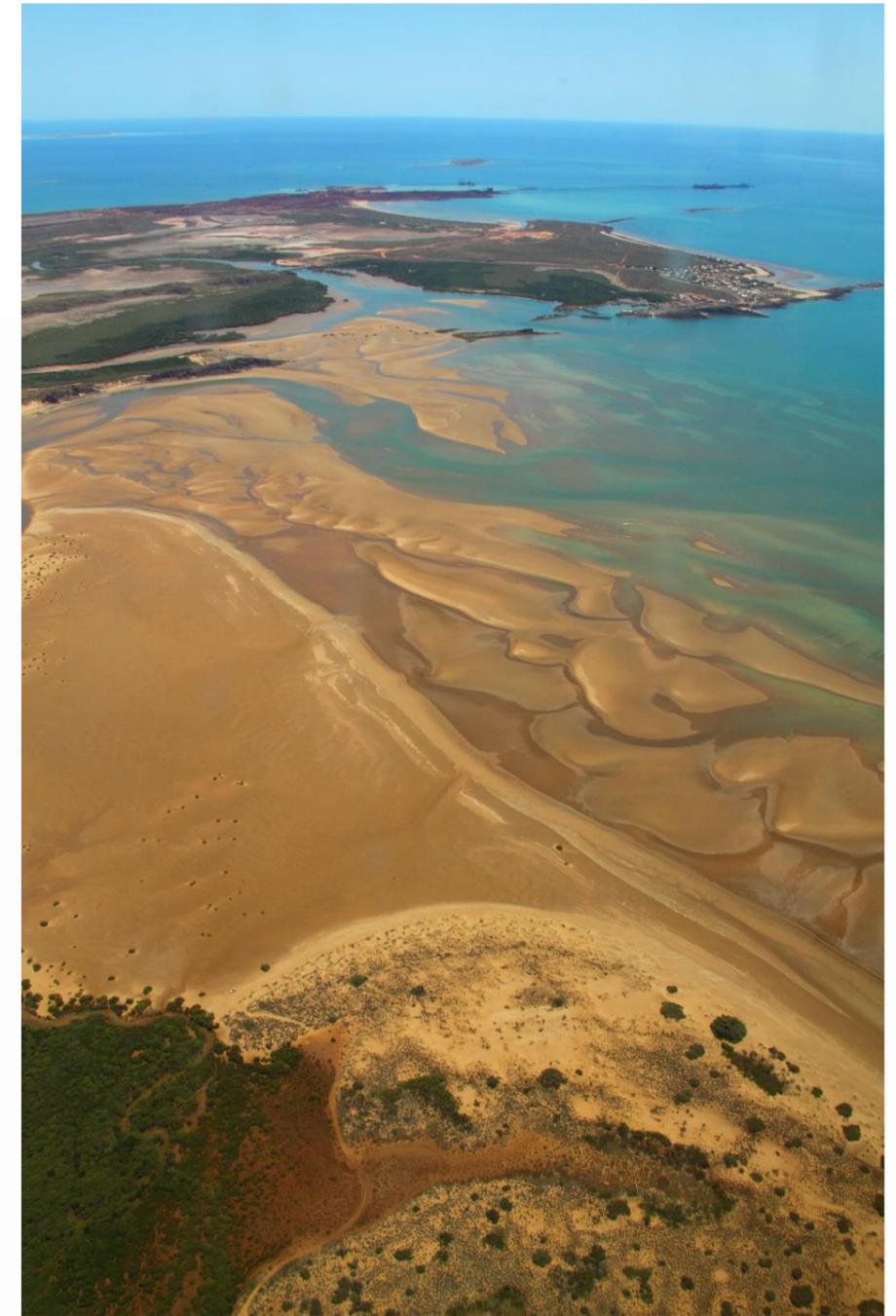
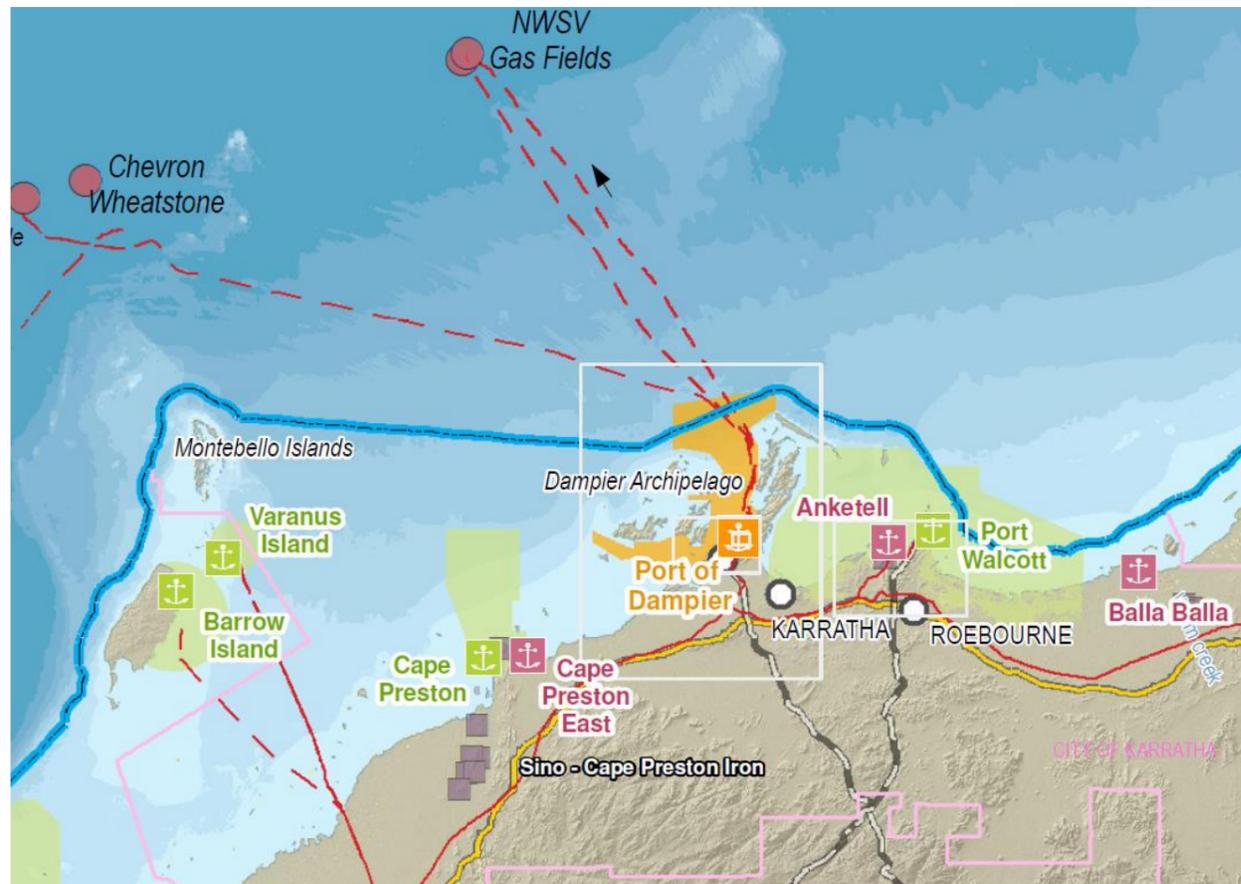
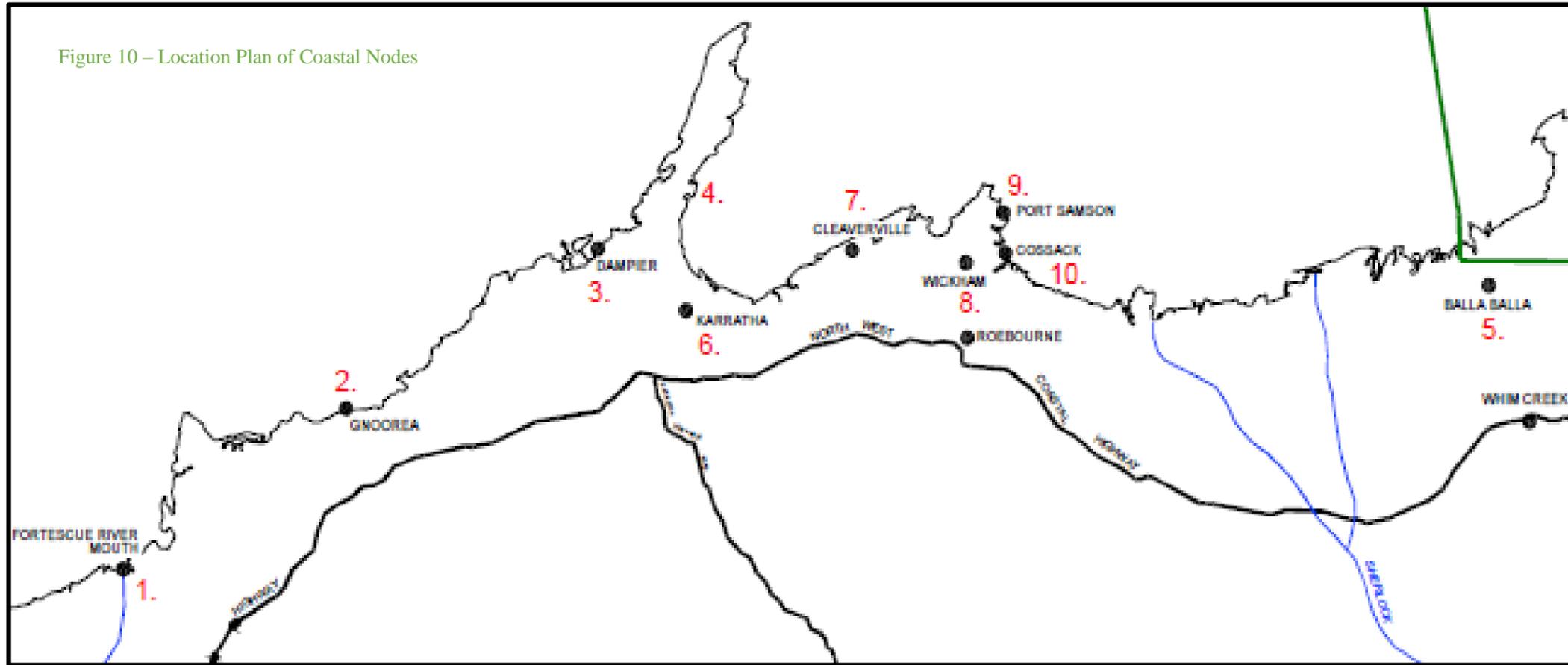


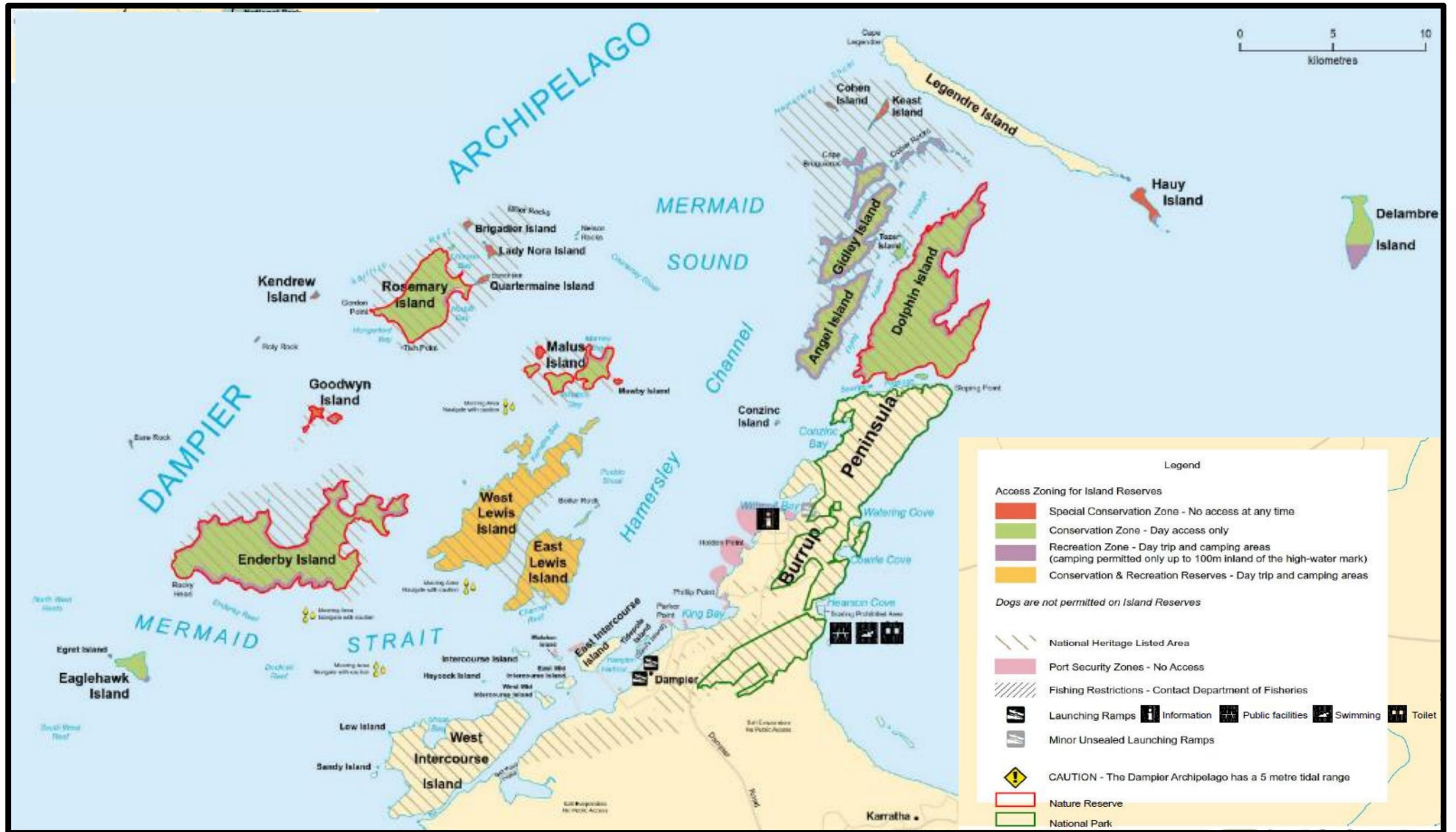
Figure 10 – Location Plan of Coastal Nodes



- Pilbara Ports Authority Port
- Proposed Port Location
- Shipping and Pilotage Act Port
- Port Authorities Act 1999
- Shipping and Pilotage Act 1967
- Limit of State Waters
- Gas Fields
- Gas Pipeline
- Oil and Gas Trunkline
- Operating/Proposed Minesites
- Railway
- Highway
- Local Government Boundary

Figure 11 – PPA Areas of Jurisdiction

Figure 12 – Department of Parks and Wildlife Managed Reserves



## 8. FUTURE MANAGEMENT

### 8.1. OVERVIEW

The City has identified four key coastal challenges that need consideration to ensure the sustainability of the coast and its future management:

- Conservation of coastal biodiversity.
- Balancing the provision of land and access for industrial development.
- Protection of existing and future residential, community and heritage assets.
- Management of sustainable coastal recreation.

The City's coastal environment is expansive and comprises a wide range of social, economic and environmental priorities. This section of the CMS provides the context to each of the identified key coastal challenges which then inform the development of specific strategies and actions.

### 8.2. CONSERVATION OF COASTAL BIODIVERSITY

The City's natural environment comprises of unique ecological values found nowhere else in the world. Many of these values are under direct threat of extinction through increasing human impacts. The City aims to manage the coastal environment, ensuring a balance between the need to provide recreational and industrial opportunities, with the requirement to mitigate the associated impacts on the natural environment.

Table 6 – Threats to the Natural Environment

Direct Threats
Coastal development and land clearing.
Recreational activities including fishing, boating, four-wheel driving and camping.
Increasing rubbish/ waste associated with increased development and use.
Riverine outflow transporting eroded material and transforming the coastline.
Commercial activities, namely commercial fishing.
Establishment and spread of weed species.

Indirect Threats
Coastal development.
Domestic and industrial pollution from boat pollutants, oil pollutants and point sources.
Impacts from shipping including dredging, ballast water and introduction of marine pests.
Solid waste and storm water disposal.
Contaminated Soil Dumping.

Site-specific management practices shall be detailed within Foreshore Management Plans and through subsequent applications for development. However, management practices can be categorised into three high level themes, namely:

- Flora and weeds;
- Fauna and feral animals; and
- The marine environment.

#### Flora and Weeds

Mangroves which occur frequently along the coast have been identified as a priority coastal community requiring protection. The Biodiversity Audit for the Pilbara (CALM, 2002), identified specific communities that require protection. These areas include Balla Balla, Sherlock Bay and Ronsard Island areas, as well as the mouths of the Harding and Cane Rivers, the Cossack to Harding delta complex, Dixon Island, Nickol Bay, West Intercourse Island, Maitland river delta, Fortescue River delta and Robe River delta.

The Environmental Protection Authority (EPA) objective for tropical arid zone mangroves of the Pilbara coastline (Pilbara mangroves), is to maintain ecological function and sustainability. To this end, proposals which, if implemented, would potentially impact on Pilbara mangroves shall be subject to a formal Environmental Impact Assessment (EIA) under the *Environmental Protection Act 1986*.

The EPA in its Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline, has recommended a series of management actions to ensure no development should take place that would

significantly reduce the mangrove habitat or ecological function of the mangroves in these areas. The proposed management actions include:

- *Monitoring to detect change in biodiversity, coverage and productivity;*
- *Avoiding the impacts of dredging (including the disposal of dredge spoil onto mangroves);*
- *Avoiding the direct removal of mangroves or filling of habitat wherever possible; and*
- *Avoiding disturbance of supporting processes on which mangroves depend.*

In addition to the protection of Mangroves, a priority coastal management action is the control of invasive weeds. Areas of Buffel grass and Kapok bush are widespread along the coastline, particularly where disturbance has occurred. Populations of Prickly Pear have occurred on the islands and spread to the mainland. These populations of Prickly Pear are being successfully controlled on the islands. Cacti are common in domestic garden landscapes. Other species identified as weeds include the Date Palm, Mesquite, Parkinsonian, Passion Vine, Tamarisk, Thistles and Ruby Dock.

Very little formal assessment of the present location, density, impact and variety of environmental weed species has been carried out in the Pilbara. DPaW and the Department of Agriculture and Food are currently carrying out eradication programs on pastoral stations and conservation reserves across the region.

In order to ascertain the impact of weed species, the City will undertake coastal weed surveying through the implementation of Foreshore Management Plans. Management and control of weeds is a complex and resource consuming responsibility. In the absence of a clear weed eradication strategy (i.e. outside of Foreshore Management Plans) priority should be given to eradication of WONS (Weeds of National Significance) on City reserves and freehold land. Where weed infestations appear on land outside of the City's management, it should be reported to the responsible authority and to DPaW.

#### Fauna and Feral Animals

The impacts of feral animals such as the Domestic Cat and the European Fox have historically had and continue to have, a devastating effect on Australian wildlife. This is also evident in relation to the variety of fauna living within the coastal environment and islands. Examples of other introduced animals include the House Mouse on Dixon Island, the European Red Fox and the Feral Cat. It is estimated that 15% of native mammal species in the Pilbara are already extinct as outlined within the draft City of Karratha Coastal Management

Strategy, 2005. While the role of the City is limited in relation to management of feral animals, the City can provide support and resources to assist other organisations such as DPaW and Rangelands NRM.



The EPA report, Environmental Protection and Ecological Sustainability of the Rangelands in Western Australia Position Statement No. 5 (2004), assesses the condition and usage of the rangelands across the State. This Position Statement makes recommendations in regards to the imposition of conditions on pastoral leases, which have significantly impacted on coastal biodiversity through overgrazing. The land degradation of the past is exacerbated by the total grazing pressure of current stock (as well as through the impact of introduced species such as rabbits). The task for coastal managers is to ensure that management and use of resources in rangeland environments that abut the coast is ecologically sustainable.

### The Marine Environment

High conservation status species such as Turtles, Dugongs, Migratory Seabirds/ Waders and Whale Sharks all inhabit Pilbara waters. There are six (6) species of Sea Turtle which inhabit local waters, three (3) of which nest on various beaches within the municipality. The Flatback, Hawkesbill, Green Turtles also frequent a range of islands within the region.

Flatback and Hawkesbill Turtle rookeries are located on Wickham Boat Beach, Cleaverville, Cape Preston and Gnoorea. The beaches that attract nesting turtles usually possess suitable feeding grounds in near shore areas and reasonable access to the ocean during lower tides. On shore sand for nesting also needs to be of suitable depth and quality for incubation of eggs.

Common threats to marine turtles include net entanglement, nest disturbance by trampling and vehicle movement, and predation by Foxes and Goannas. The continuation of the West Pilbara Turtle Program (a joint initiative between Rio Tinto and DPaW) is essential to ensure ongoing assessment of population numbers along the City coast.



The identification of sensitive areas (e.g. Turtle rookeries), the restriction of vehicle access and the introduction of feral animal eradication programs, will help to conserve marine and coastal foreshore areas for marine fauna. Marine water quality is also impacted by storm water discharge, construction within or adjacent to the coastal zone and pollutants entering the marine environment from commercial shipping and recreational boating.

### 8.3. BALANCING THE PROVISION OF LAND AND ACCESS FOR INDUSTRIAL DEVELOPMENT

The Pilbara region is recognised internationally as a major resources hub and is one of Australia's largest resources producing and exporting regions. In 2014/15, the Pilbara accounted for 46% of the of the nation's mineral and petroleum production, including offshore petroleum, and 29% of its merchandise exports including from offshore ports.

Continued growth is forecast with ongoing long term demand from across the globe for local resources. A significant part of the coastal environment is covered by mining tenements, including exploration licences. There is currently a Ministerial Temporary Reserves registered which covers the Burrup Peninsula. The balance of land outside of specific mining tenements consists of pastoral leases and Crown Reserves. The City is one of two major service and extraction hubs in the northwest of Australia, where government and industry infrastructure such as ports, rail, freight and commerce intersect. The City's ports provide vital support to the resources sector and are significant in the evolution of the existing settlements and their associated amenity.

In order to facilitate the forecasted rise in iron ore exportation, the State is leading the development of a multi-user deep water port and industrial precinct at Anketell. This facility is proposed to be a deep water multi-use port with associated rail, stockpile locations and a 1,250ha supporting industrial precinct. The staged development of the facility is outlined within the Anketell Port Master Plan. Stage 1 of the development focuses on developing key infrastructure comprising rail, iron ore stockyards and marine export facilities.

### Major Industry and Ports

Industrial development within coastal areas impacts the coastal foreshore, upper coastal area and marine environment through dredging, wharf infrastructure development and pollutant runoff. In addition, site preparation including the removal of mangroves or other stabilising plants, infill of natural estuaries and lagoons and removal of coastal habitats on a large scale are all potential impacts.

The resources sector holds approximately 25% of the coast in leasehold, with significant established infrastructure located in coastal areas either near existing settlements, or within the coastal hinterland. Some mining leases also retain pastoral businesses (for example Rio Tinto hold the Karratha Station lease). The three major resource and energy companies operate within the City, namely Rio Tinto Iron Ore Limited, Woodside Energy Ltd and Citic Pacific Mining. All three companies operate in coastal environments including:

- North West Shelf Venture Karratha Gas Plant (Woodside);
- Pluto LNG Park and Pluto A Platform (Woodside);
- Dampier Port upgrades and operations (Rio Tinto);
- Cape Lambert Port upgrades and operations (Rio Tinto); and
- Sino Iron project at Cape Preston Port (Citic Pacific Mining).

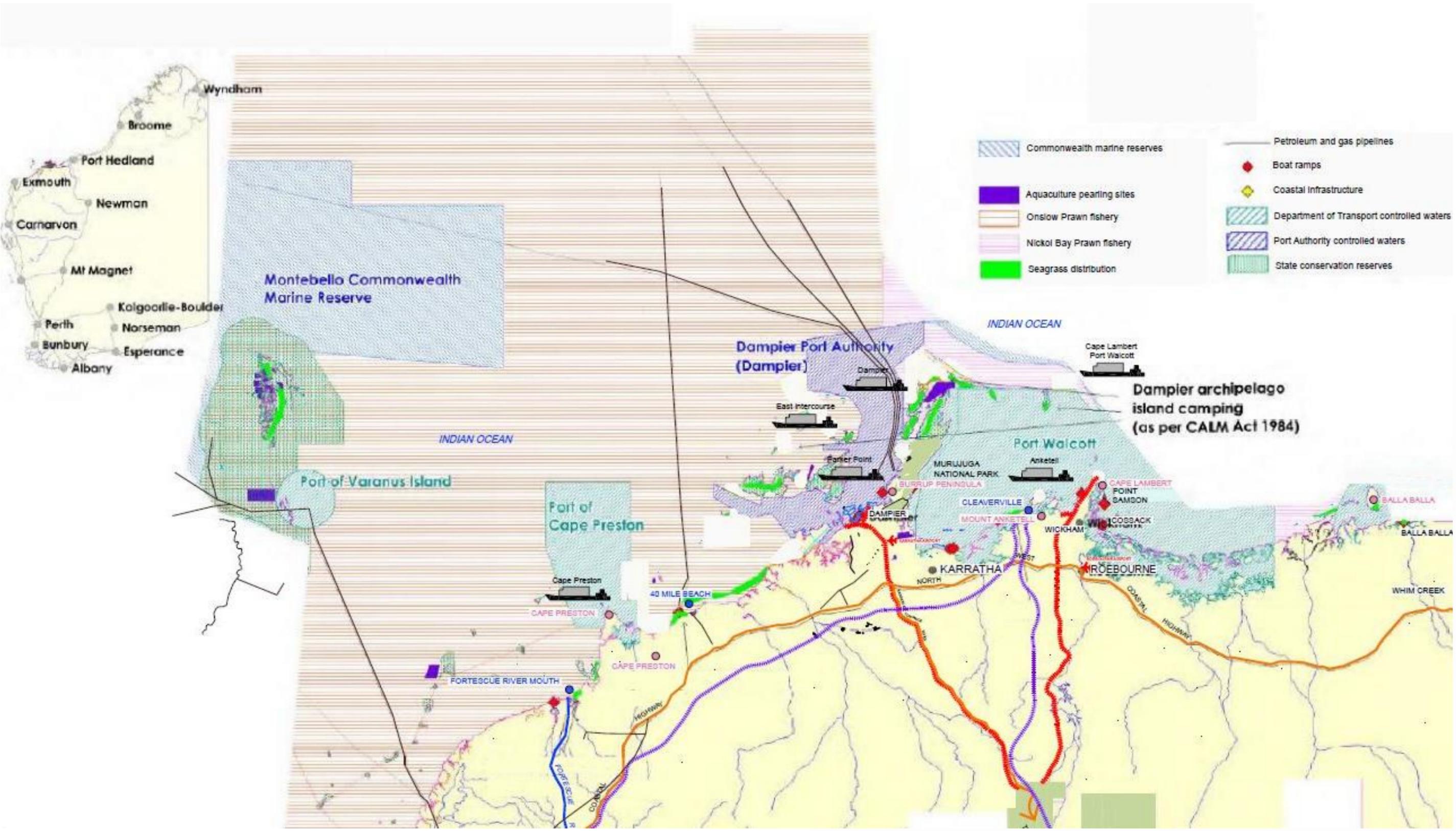


Figure 13 – Major Industries Along the Coast

Dampier Salt is another major land use within the coastal environment. The Dampier Salt operation in Dampier currently produces 4.2 million tonnes of salt per year, with a total operating area of over 10,000 hectares.

In addition to the above, there is further infrastructure planned for Cape Preston East Port and Balla Balla port and rail. The locations of the various ports, infrastructure and major industries within the City's coastal environment are outlined within Figure No.13.

## Basic Raw Materials

Basic raw materials are used primarily in construction, land development and road infrastructure. Basic raw materials are typically high volume/low value resources that are consumed locally rather than exported. Within the City, there is competition for basic raw materials between the domestic construction industry and the enormous requirements of large infrastructure projects (e.g. ports and railway lines). In addition to the economic aspects arising from competing urban development and industry needs, the extraction of basic raw materials can impact on other community values including; residential amenity, access, heritage and environmental values.

The granting of mining tenements (mining leases and exploration licences) or the carrying out of any mining operation is generally authorised under the *Mining Act 1978* which is administered by the Department of Mines and Petroleum (DMP). The DMP maintains a database for all mine sites including extractive industries (Basic Raw Materials), however there is currently no mechanism for ensuring that the City is made aware of applications as they occur across the municipality on Crown Land. However, the City is the regulatory authority for approving the extraction of basic raw materials on private land or Crown Land under management order to the City. The City aims to minimise the potential for land use conflict between coastal recreation and proposals for basic raw material extraction.

The City has developed Local Planning Policy DP26 – Basic Raw Materials. This policy provides a framework which informs decision making on proposed extractive industry projects. With very little freehold land along the coastline, there is limited ability to place controls over basic raw material extraction over the majority of the coastal environment

Easily accessible and removable supplies of basic raw materials in the City are scarce; some coastal deposits are being mined as a result. While there are several mineral leases already granted over coastal dunes, to date only Hearson Cove and Cleaverville have been mined. There is also a significant sand extraction operation at Mulataga (behind Karratha Back Beach). The

islands of the Dampier Archipelago represent potential limestone resources for a variety of industrial uses, notably iron-ore processing, steel making and cement manufacture. Accessibility to beach sand is also important to aid in ameliorating significant erosion events.

It is necessary to ensure basic raw materials are conveniently accessible and in close proximity of town sites or areas of industrial development. However, it is important that extraction of these materials does not compromise other land uses, such as recreational use. Should conflicts exist, the City will generally not support extraction unless agreed management practices can be put in place. In addition, the DMP recommends a conservative approach for generic buffer distances around sand quarries/pits. It is considered that a 500m buffer distance to extraction areas be applied pursuant to the EPA Guidance Statement 3 Separation Distances between Industrial and Sensitive Land Uses (2005).

The taking of sand in can lead to significant detrimental impacts, particularly because of the vulnerability of the Pilbara coastal environment to storm surge and the associated impacts on coastal settlements. Removal of sand from primary dune systems can lead to erosion, recession of the beachfront and reduced natural protection. Therefore, any application for extractive industries should be undertaken in conjunction with the development of a Coastal Hazard Risk Management and Adaption Plan indicating how coastal hazard risks within the coastal foreshore reserve and on the adjacent coastline will be mitigated. This will include applications that may reduce the supply of sediment to the coastal zone from rivers and creeks. It is worth noting here, that a large area on the Burrup Peninsula and to the west of Karratha which is currently exempt from mining under Section 19 of the *Mining Act 1978* will expire in February 2017

## Other Industrial Development

The warm sheltered waters of the Dampier Archipelago provide an environment suitable for both pearling and aquaculture. There are ongoing developments of pearling and aquaculture operations within the City. The Pilbara Development Commission (PDC) is pursuing opportunities in aquaculture along the Pilbara coast. A research report by the Western Australian Department of Fisheries for the PDC showed edible oysters have the greatest promise for the establishment of an aquaculture industry. Recent changes to Western Australia's Fisheries legislation has meant that pearling leases, once restricted to only growing pearls, can be converted into aquaculture leases and licences approved for other species for culture. This has significant implications for the Pilbara coast as there are a number of underutilised pearl leases which could be converted to other species, such as edible oysters.

## 8.4 PROTECTION OF EXISTING AND FUTURE RESIDENTIAL, COMMUNITY AND HERITAGE ASSETS

Urban development places significant pressure on the conservation and protection of coastal ecosystems and processes. This is a key management issue, primarily because the settlements of Karratha, Dampier and Point Samson are already located immediately adjacent to coastal areas.

The Pilbara Cities envisions the City of Karratha to grow to 30,000 by 2020 with an ultimate aspirational population target of 50,000 permanent residents by 2031. This aspirational population increase in combination with continued attraction to the Pilbara region for tourism and recreation will increase pressures on the City's coastal environment.

The City's population growth is highly dependent on the level of economic activity which to date has had a cyclical fluctuation associated with the resources sector. Given the City's historical population pattern, it is important that this CMS is able to provide a framework for managing fluctuating population cycles while protecting coastal values.

Table 7 – Population Forecast

Location	2011	2016	2021	2026	2031	2036
Karratha	17,096	24,050	28,540	33,904	40,914	49,426
Dampier	1,351	1,340	1,463	2,066	2,201	2,228
Wickham & Point Samson	2,538	2,670	3,194	3,380	3,359	3,380
Roebourne Town	1,280	1,307	1,334	1,378	1,405	1,440
Shire Remainder	1,662	1,136	1,027	1,005	983	950
<b>Total</b>	<b>23,926</b>	<b>30,503</b>	<b>35,560</b>	<b>41,733</b>	<b>48,894</b>	<b>57,424</b>

The most significant changes will occur on informal coastal sites within the Nickol Bay subregion and at already highly frequented recreational nodes including Cleaverville, 40 Mile/Goonera Point and along the Burrup Peninsula. Uncontrolled, increased use of these coastal areas will increase the potential for erosion, destruction of coastal ecosystems and loss of cultural heritage. Population growth pressures will also increase the use and operational costs of

current and future coastal infrastructure. Planning sustainable coastal facilities that accommodate projected future coastal usage will improve the lifestyle for residents and visitors while maintaining the integrity of the coastal environment. Coastal infrastructure and amenities should be designed in accordance with the policy measures outlined within SPP2.6 and its supporting guidelines.

Coastal growth pressures can lead to decreased water catchment quality and increased runoff entering coastal and estuarine environments. Integration of sustainable urban design principles such as those outlined in the 'Better Urban Water Management' will reduce negative impacts on water outflow to the coast. Increased urban development is also likely to increase the introduction and spread of animals and feral weeds. The control of weeds and protection of native flora and fauna should be undertaken in accordance with the management strategies outlined within 'Priority Threat Management for Pilbara Species of Conservation Significance' (CSIRO, 2014).

Low-lying coastal areas within major settlements are more vulnerable to coastal processes. Several existing developed areas within Karratha, Dampier, Roebourne and Point Samson are subject to coastal inundation during 100-year and/ or 500-year ARI storm events. Climate change projections suggest increased occurrence and severity of tropical cyclones within the northwest region into the future. These changes are expected to further increase coastal vulnerability over the long term. Future planning and development needs to adopt coastal hazard risk management and adaptation planning measures as outlined within the City of Karratha's Coastal Hazard Risk Management Adaptation Planning, SPP2.6 and its supporting guidelines.

#### 8.4. MANAGEMENT OF SUSTAINABLE COASTAL RECREATION

Recreation pursuits by local residents and tourists in the Pilbara are largely centred within the coastal environment. Local residents frequently undertake a range of activities within the coastal foreshore and offshore environments including, four-wheel-driving, camping and boat related activities. In addition, the ongoing diversification of the region through increased tourism is placing increased pressure on coastal recreation and camping nodes. There are a variety of considerations that need to be incorporated into the management of recreational use of the coastal environment. Recreational management needs to balance a range of factors including:

- Quality coastal nodes which attract public recreation;
- Convenient access to the coastal nodes;
- Control over off-road vehicle access along the coast;
- Recreation and customary fishing; and

- Protection of Aboriginal Heritage sites.

### Provision of Foreshore Nodes for Public Access and Recreation

Many sites along the coastline attract recreational pursuits and/or provide access through to offshore islands. Population forecasts for the City predict a growing middle age, working population which increases the number of people with the available finances and motivation for recreational pursuits. This growth will place increased pressure upon available coastal recreational sites. As a result, coastal nodes need to be managed and developed for the intensification of active usage. The protection and management of these areas will require the provision of adequate access to selected sites and an appropriate range of recreational facilities commensurate with the Pilbara Cities' vision. This CMS identifies ten coastal nodes where recreational activity is to be initially directed and managed through Foreshore Management Plans. By focussing suitable coastal recreational development in coastal nodes will help alleviate pressures on the wider coastal environment. The location of each coastal node is identified within Figure No.9.

### Foreshore Management Plans

Foreshore Management Plans (FMP's) provide guidance for the ongoing use and management of foreshore areas. FMPs are at a site specific scale and comprise of on-ground actions. However, FMP's are still strategic in nature and the implementation of actions may require future detailed planning and engineering. Figure No.14 outlines the hierarchy of coastal management documents, with the CMS being the overarching strategic document.

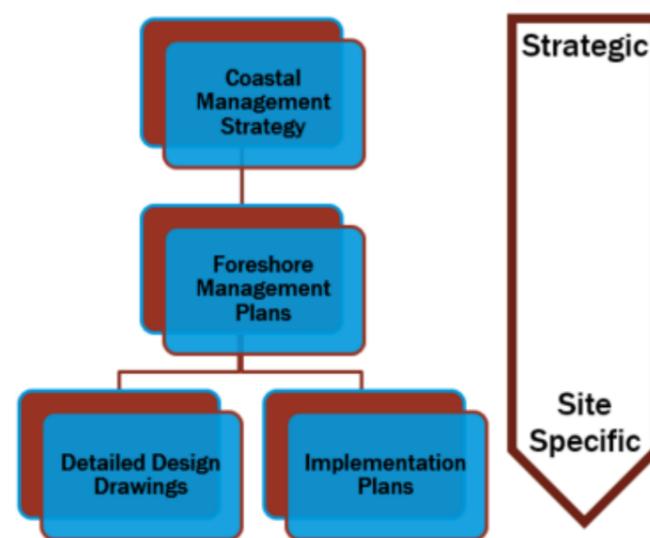


Figure 14 – Hierarchy of Management Documents

The City has already undertaken foreshore management planning for a number of coastal nodes. Table No. 9 details which FMPs have been completed, outlining the threatening processes and strategic actions arising from these plans. In general FMPs are designed to consider the impacts of use and development within coastal nodes and determine mitigating actions that ensure the long term protection of the natural assets. Potential impacts from development include the obstruction of views or vistas and the clearance of vegetation to position roads, buildings, structures, camping areas and signage. Balancing the recreational assets and infrastructure needs for each coastal node against the fundamental requirement for landform stability and ecological health is the key consideration for FMPs.

The construction of BBQs, shelters, seating, bollards, access ways and fencing are acceptable works within reserves for recreation, camping, conservation and coastal management. However, larger scale developments, including residential buildings, need further consideration in relation to coastal hazard risk management and adaptation planning.



Figure 15 – Coastal Infrastructure at the Karratha Coastal Node.

Foreshore Management Plan / Objective for Management	Threatening Processes	Strategic Actions
<p><b>Point Samson Management Plan and Foreshore Works Plan:</b></p> <ul style="list-style-type: none"> <li>- A designated coastal tourism node, the management plan describes environmental, cultural, and recreational and resource values and makes recommendations regarding future management of impacts.</li> </ul>	<ul style="list-style-type: none"> <li>- Unauthorised access from off-road vehicles and informal walkways.</li> <li>- Use conflict, with conservation and recreational land uses in close proximity to industrial areas.</li> <li>- Excessive litter on some foreshore areas.</li> <li>- Aging signage infrastructure</li> <li>- Impact on rocky reefs from high visitor numbers.</li> <li>- Weeds within dune vegetation</li> </ul>	<ul style="list-style-type: none"> <li>- Joint management between the City, the community and the Native Title Holders (the Ngarluma people).</li> <li>- Rehabilitation of dune areas with fencing and vegetation.</li> <li>- Fenced pedestrian access ways.</li> <li>- Walk trails between bays.</li> <li>- Provision of low maintenance amenity such as shade, seating and BBQ's.</li> </ul>
<p><b>Dampier Town Site and Foreshore Enhancement Plan and Implementation Works.</b></p>	<p>N/A (Implementation Plan not a FMP)</p>	<ul style="list-style-type: none"> <li>- The Foreshore Enhancement Plan was designed to plan a local recreational node that linked the town and the foreshore and incorporated a coastal tourism focus.</li> </ul>
<p><b>Karratha Foreshore Management Plan:</b></p> <ul style="list-style-type: none"> <li>- Karratha is the key regional centre in the municipality, the management plan describes foreshore values and details actions to mitigate impacts.</li> </ul>	<ul style="list-style-type: none"> <li>- Unauthorised access from off-road vehicles.</li> <li>- Excessive litter.</li> <li>- Removal of vegetation for firewood</li> <li>- Conflict of uses</li> <li>- Weeds.</li> </ul>	<ul style="list-style-type: none"> <li>- Joint management between City and Ngarluma;</li> <li>- A dual use path.</li> <li>- Walk trails through conservation area and between Off-Road Vehicle areas.</li> <li>- Car parks.</li> <li>- Shelters and seating.</li> <li>- Signage to control access and activity;</li> </ul>
<p><b>Wickham Boat Beach:</b></p> <ul style="list-style-type: none"> <li>- An important community hub, a focus for coastal activities and an ecological hotspot, the Wickham FMP provides a framework that guides ongoing use and management of the foreshore area.</li> </ul>	<ul style="list-style-type: none"> <li>- Unauthorised and uncontrolled access to the foreshore area.</li> <li>- Lack of amenity leading to unregulated recreational pursuits.</li> <li>- No signage uniformity or education on appropriate coastal uses.</li> <li>- Vulnerable cultural and ecological areas in need of protection.</li> <li>- Lack of governance model for management.</li> </ul>	<ul style="list-style-type: none"> <li>- Formalise 4WD access to work towards one entry and one exit point to the beach.</li> <li>- Revegetate and rehabilitate degraded and eroded fore dune areas.</li> <li>- Formalise parking amenity and pedestrian access.</li> <li>- Install fencing and signage.</li> <li>- Low key and low maintenance amenity such as shade structures.</li> <li>- Determine shared management opportunities.</li> </ul>
<p><b>Hearson Cove FMP:</b></p> <ul style="list-style-type: none"> <li>- The purpose of the Hearson Cove Foreshore Management Plan is to provide a framework that guides the ongoing use and management of this significant foreshore area.</li> </ul>	<ul style="list-style-type: none"> <li>- Unauthorised and uncontrolled access to the foreshore area.</li> <li>- Lack of amenity leading to unregulated recreational pursuits.</li> <li>- No signage uniformity or education on appropriate coastal uses.</li> <li>- Vulnerable cultural and ecological areas in need of protection.</li> <li>- Lack of governance model for management.</li> </ul>	<ul style="list-style-type: none"> <li>- Formalise 4WD access to work towards one entry and one exit point to the beach.</li> <li>- Revegetate and rehabilitate degraded and eroded fore dune areas.</li> <li>- Formalise parking amenity and pedestrian access.</li> <li>- Install fencing and signage.</li> <li>- Low key and low maintenance amenity such as shade structures.</li> <li>- Determine shared management opportunities.</li> </ul>
<p><b>Cleaverville FMP:</b></p> <ul style="list-style-type: none"> <li>- Cleaverville is the closest and most popular coastal camping location to the Karratha town site. The preparation of a Foreshore Management Plan for the Cleaverville Area was commenced in 2005 but has not been completed.</li> </ul>	<ul style="list-style-type: none"> <li>- Vehicles and foot traffic traversing the primary dune to create camping and parking areas</li> <li>- Vehicles driving on the beaches and foreshore areas in some locations are endangering the few remaining turtle nesting sites.</li> <li>- The removal of fuel for fires.</li> <li>- Souveniring of shells and benthic species such as octopus and clam are having an unknown impact.</li> <li>- Weeds species within the dunes</li> </ul>	<ul style="list-style-type: none"> <li>- Provision of educational and information signage.</li> <li>- Monitored and documenting human impacts to establish visitor impacts, servicing, provision of utilities and environmental consequences.</li> <li>- An investigation into the equity of access for people with disabilities and address accordingly where future infrastructure planning is undertaken.</li> <li>- Consideration of marine based tourism ventures.</li> <li>- The need for the installation of remote composting toilets.</li> <li>- The provision and ongoing maintenance of new shelters and picnic facilities for future day visitor areas.</li> </ul>
<p><b>Gnoorea (Forty Mile) Point FMP</b></p> <ul style="list-style-type: none"> <li>- A popular remote fishing and camping destination for northwest visitors and locals. The Foreshore Management Plan provides guidance for the management of the foreshore reserve.</li> </ul>	<ul style="list-style-type: none"> <li>- Erosion of dune areas and destruction of dune vegetation.</li> <li>- Uncontrolled camping and four-wheel drive access.</li> <li>- Litter.</li> <li>- Hydrocarbon, asbestos and heavy metal contamination resulting from inappropriate handling, storage and disposal of hazardous material by campers.</li> <li>- Lack of effective nature-based camp ground management.</li> <li>- The removal of shells and coral.</li> <li>- Localised over-fishing.</li> <li>- The removal of vegetation for fires.</li> <li>- Weeds</li> </ul>	<ul style="list-style-type: none"> <li>- Delineate camping areas and provides for short and long term stays</li> <li>- Indicate car parks and designated day use areas.</li> <li>- Identify Indigenous culture and business opportunities.</li> <li>- Investigate the use of dry composting toilets.</li> <li>- Provide separate pedestrian beach access.</li> <li>- Recommends closure of undesirable tracks.</li> </ul>

Table 8 –Key Outcomes of Current Foreshore Mangement Plans

## Off Road Vehicle Management

The majority of the City's coastline comprises of Crown Reserves with coastal access via a network of informal tracks through pastoral stations and along beaches. The culture of informal off road vehicle access to beaches and remote locations gives little or no regard to environmental values, has negative impacts on nesting fauna, encourages the erosion of primary dune structures and the infiltration of colonising species.

Difficult terrain and often sandy tracks generally require four-wheel-drive vehicles to access remote areas, particularly after rain or during high tides. Four-wheel-driving is a popular recreational activity across the Pilbara as it facilitates a range of activities including camping, fishing, boat launching and exploring undiscovered areas. However, the City recognises the need to address damage to coastal areas caused by off-road vehicle use. Uncontrolled vehicle access across sensitive areas, such as dune systems and beaches is a very destructive activity effecting coastal and hinterland areas. The loss of stabilising dune vegetation through uncontrolled activities has resulted in blowouts and dune erosion at several sites along the coastline including Settlers Beach of Cossack, Wickham Boat Beach, Cleaverville and Karratha Back Beach.

The report on Off Road Vehicles, by Trail Bike Management, was commissioned by the City in response to community concerns regarding off-road vehicle use. The report details the impacts, assesses the current situation and makes recommendations. A key recommendation in the report is the development of the Millars Road Off Road Vehicle Area, which is already gazetted under the *Control of Vehicle (Offroad Areas) Act 1978*, consistent with the WA State Trail Bike Strategy. The progression of the Millars Road Off Road Vehicle Area is dependent on being able to undertake a heritage survey and the results of that heritage survey allowing for expansion of the ORV area.

The *Control of Vehicles (Off-road Areas) Act 1978* provides opportunity for the City to enforce controls over ORV use within the municipality. The Act includes provisions to prohibit the use of vehicles in certain places and to make provisions where off road vehicles are permitted. The City does not plan to prohibit off road vehicle use nor the recreational activities it facilitates, rather the City is focused on consolidating access and recreation areas to ensure the protection of the environment and associated ecosystems. In addition to physical works and the remediation of damaged areas, the City is focused on educating off road vehicle users to ensure they are equally vested in the management and protection of the City's unique coastal environment.

## Access to the Coast

Conflict has also been identified at some locations where pastoral leases effectively prevent public access to the coast. Access is often restricted due to visitors damaging vegetation through efforts to create new tracks, leaving gates open, leaving rubbish, damaging or stealing property and/or generally causing degradation of roads and foreshore areas.

Provision of Public Access Routes (PAR) through pastoral lands is a mechanism that can be used to legalise access to important visitor attractions for both tour groups and self-drive travellers (Tourism WA). It is understood that there are approximately four hundred informal recreation/tourist locations across the municipality.

Prior to formalising access routes, the City needs to undertake further investigation to understand the usage (traffic volume and locations) of existing informal tracks. The Pilbara Regional Council (PRC) commissioned the Coastal Access in the Pilbara Local Government Toolkit in 2014. The toolkit provides a clearly defined approach to formalising coastal access. The City will adopt these recommendations in consideration of developing a plan for coastal access with a priority to identify the highest used coastal nodes.

Access roads and car parking areas providing access to the coast, have brought about significant environmental disturbance. Increased access brings not only increased disturbance, but also increased management responsibility. Access to coastal areas must be designed to reduce the potential for off track access where possible, and discourage drivers and walkers from leaving formed tracks.

## Recreational and Customary Fishing Impacts

The Department of Fisheries (DoF) commissioned Research Report 249, An Integrated System to Survey Boat-Based Recreational Fishing in Western Australia 2011/12 (DoF, 2013), shows that there are over 6,000 Recreational Fishing from Boat Licences (RFBL) in the Pilbara. The report also shows that on average, licence holders in the Pilbara spent more time fishing than in any other area of the State. While the economic value of recreational fishing to the City's economy remains unknown, it is a popular activity in Western Australia that brings significant benefits to regional economies.

Aboriginal people have customary rights to fishing. In addition to fishing as a customary activity, there is a significant dependence on fishing for access to food. A study undertaken by Wright and O'Neil (2013) found that more than 40% of Aboriginal people interviewed participate in customary fishing more than once a week, 45% participate in customary fishing more than once a month and only

14% participate less than once a month. Customary fishing, as defined in the *Fish Resource Management Act 1994*, has a complex relationship with commercial and recreational fishing. The significant and fast growing development of iron ore shipping and offshore gas development has consumed much of the coastal environment, which historically was used as fishing grounds for Aboriginal people.

## Protection of Aboriginal Heritage sites

Vandalism and removal of stone engravings from various sites in the Pilbara is of serious concern. The Burrup Peninsula and Dampier Archipelago are sites within the municipality that are of international significance. In addition, coastal dunes were often used by the Ngarluma people and other Traditional Owners for burial purposes. Recreational off-road vehicle use over sand dunes can lead to the desecration of burial sites, bringing about significant emotional angst to descendants, as well as environmental degradation through loss of vegetation.

Surveying for Aboriginal Heritage sites is an ongoing process and continues to date, particularly where development is proposed. Particular care needs to be taken where development is located adjacent to any Aboriginal heritage sites. The potential to enhance the protection of Aboriginal heritage sites could be assisted through implementation of an Aboriginal Ranger program. The City provides Ranger Services to coastal nodes but remains open to considering opportunities for Aboriginal Rangers along City coastlines. In addition, awareness of the impact recreational activities have on Aboriginal heritage site can be encouraged through community education.



Figure 16: View from the Murujuga National Park.

## 9. MANAGEMENT OBJECTIVES

The City's management of coastal reserves needs to be coordinated with the management of coastal areas by other agencies such as; the Murujuga National Park Rangers, Department of Parks and Wildlife, Pilbara Ports Authority, Department of Fisheries, Department of Mines and Petroleum and other private lease holders.

### 9.1. THE NEED TO MANAGE

The coastal zone is amenable to a variety of land uses which support industrial, urban, pastoral and recreational activities. These various uses compete for coastal locations, and by their nature, impact on the heritage and environmental values of the coastal environment. Effective and sustainable management of the competing interests requires careful consideration of social, economic, environmental and governance factors.

Aboriginal people are thought to have inhabited the region for up to 40,000 years (Pilbara RDA, 2012). As such, a rich cultural and historical Indigenous heritage exists in the region, particularly within the natural features such as rivers, hills and rock formations. Following European settlement of the Roebourne area, whaling and pearling industries were established along the coast. The pastoral industry proved to be the mainstay of the regional economy until the 1960s, which has since been overtaken by the resource and energy industries, led by the iron ore industry.

Salt, oil and gas production and fisheries now contribute to the economic diversification of the Pilbara and have led to the introduction of major infrastructure including ports and urban centres across the City's coastal environment. This has increased pressure on the coastal environment, requires effective management to conserve the coastline for future generations.

The Department of Planning, Status of Coastal Planning in Western Australia Report, highlights key coastal considerations for management of coastal planning in the Pilbara, including:

- *Conservation of coastal biodiversity:*
  - o *Degeneration of the natural environment including fishing*
- *Provision of land and access for Industrial Development:*
  - o *Resource development plans and vessel movements in the Pilbara*

- o *Heavy industry impacting on the coastal and marine environment, through both existing and proposed expansions*
- *Protection of residential, community, cultural and heritage assets in a changing climate.*
  - o *Safety and liability issues across different land tenures.*
- *Management of sustainable coastal recreation:*
  - o *Increases in unrestricted access by recreational users on coastal resources.*

These coastal considerations arise from the interaction of uses within the coastal environment. The City's coastal environment is in a state of constant change and is subject to myriad of processes that affect stability of the land and sea interface and the health of the underlying ecosystem. In light of all of the above, it is important that coastal resources are managed and effectively utilised. This CMS aims to achieve an appropriate balance by applying a quadruple bottom line consideration.

### 9.2. MANAGEMENT OF THREATS

The scope of works undertaken to support this CMS, reviewed and collated the findings of a wide range of studies completed over the past decade. This past investigation into coastal processes and developments, identifies that threatening processes have occurred from the construction of development and infrastructure. Management of these threats are the responsibility of a wide range of authorities. The direct responsibility for decision-making and management of a large proportion of coastal developments and subsequent impacts lie with various State Government agencies and/ or land managers, rather than solely on the City itself.

Accordingly, this CMS identifies management strategies and actions where the City has authority, and outlines opportunities to support and/or form partnerships with agencies who have control over other adjacent areas of the coastal environment. Implementation of the strategies and actions will be primarily through the City's core functions associated with development control, strategic planning, asset maintenance, waste management, and community engagement and ranger services.

### 9.3. COMMUNITY INPUT

The consultation undertaken to inform this CMS defined key influencing factors to guide the development and priority for management strategies and actions. The community has a very close connection to the coastal environment with the vast majority using the coastal environment at least once per week for a variety

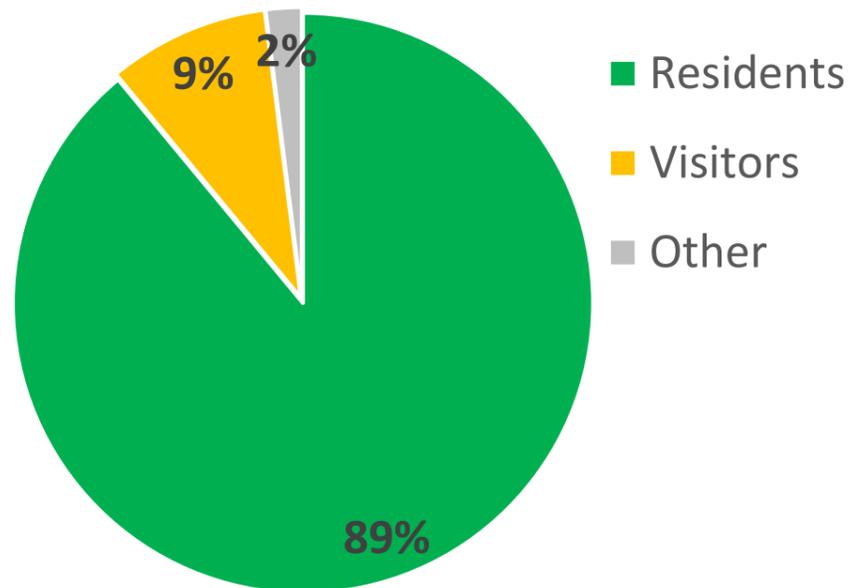


of recreation and leisure activities. While there are a number of specific recreational nodes along the coastline, the consultation identified that the level and type of use varies at each location. While there are specific concerns at each location (e.g. specific areas where water quality or risk to flora and fauna may be higher), there is consistency between the responses to outline recommended priority actions for the Shire. The most significant recommendations outlined for future management of the coastal environment are improvements to the following areas:

- Amenity and waste management of popular coastal nodes, including improvements to:
  - o Parking, lighting, ablution facilities, parkland areas, BBQ/ picnic areas (including tables, chairs, shade, etc.) signage, fishing platforms and bins.
- Balance of four-wheel-drive access onto and within the coastal environment, including:
  - o Developing specific controlled access and preserving areas to maintain environmental value.
- Control of the spread of weeds and the enhancement of local flora species.
- Stability and restoration of dune structures and habitats for local fauna.

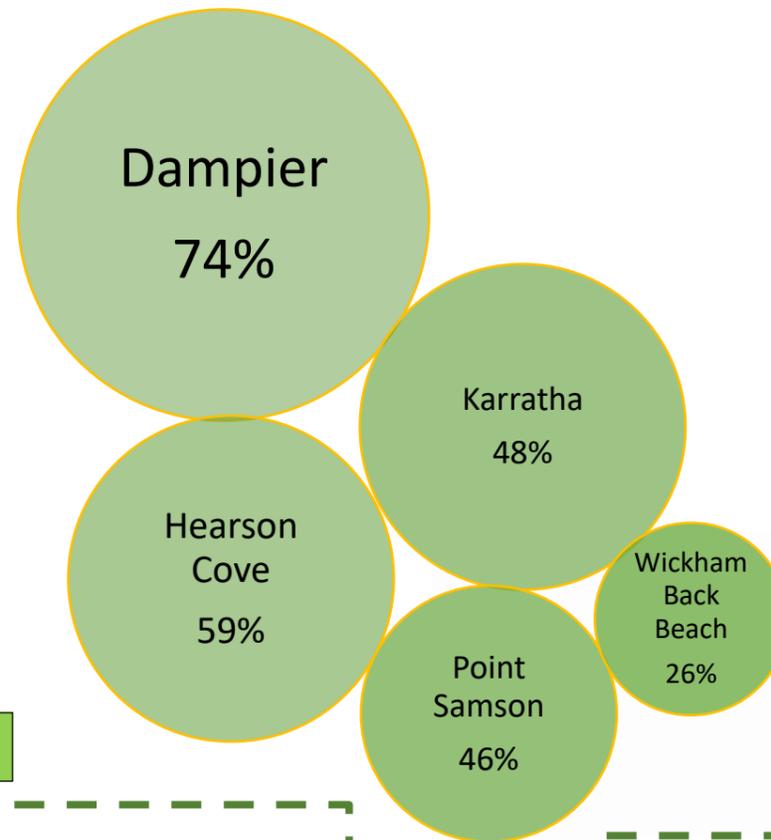
## Key Community Comments

Who provided input into the consultation



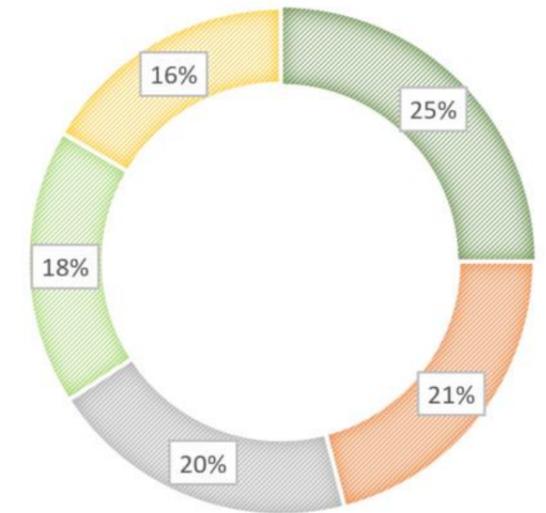
**81% OF RESPONDENTS LIVE IN KARRATHA.**

Top Locations for people to visit



Concerns people have about the coastal environment

■ Damage to Vegetation 
 ■ Damage to Native Fauna 
 ■ Loss of Access 
 ■ Impacts on Fishing Stock 
 ■ Impacts on Water Quality



How frequently are people enjoying the coastal environment:

Over **80%** of people visited the coastal environment at least once per week.

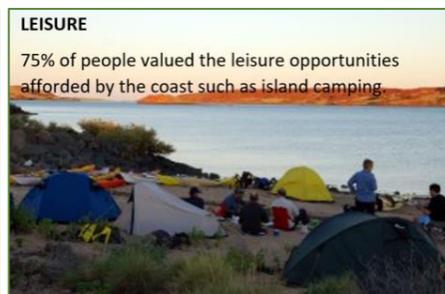
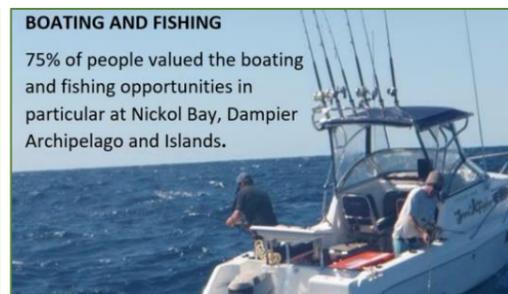
About **50%** of people specifically visited the Dampier Archipelago at least once per fortnight.

Concerns people have about the coastal environment

**Where is water quality more at risk:** Dampier Area, Karratha Back Beach, Point Samson Area.

**Where is flora and fauna more at risk:** Cleaverville, Karratha Back Beach, Hearson Cove.

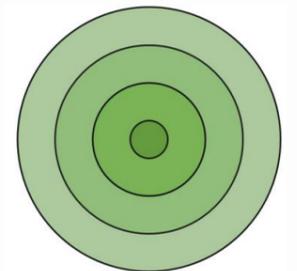
Top activities within the coastal environment



Priority areas for future management

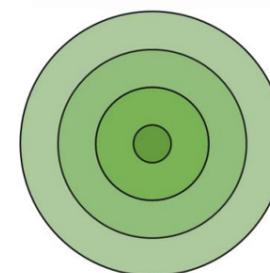
**Top priority areas:** Karratha Back Beach, Dampier Area and Hearson Cove.

**Next level of priority areas:** Cleaverville, Wickham Boat Beach and Point Samson.



What actions should be prioritised

- 1 Improvements to the amenity and waste management of coastal nodes.
- 2 Balancing the control of four-wheel-drive access.
- 3 Control the spread of weeds and enhancements to flora.
- 4 Restoring dunes and habitats for local fauna.



# 10. MANAGEMENT OPPORTUNITIES

## 10.1. ABORIGINAL JOINT MANAGEMENT

Opportunities exist to support specific culturally related activities and industries through the implementation of coastal management in consultation and collaboration with Traditional Owners. Participation in initiatives to engage Native Title Holders to care for and manage land within coastal foreshore nodes and/or along larger stretches of the City's coastline sends a positive message about caring for country. As practiced in other local government areas, such initiatives have enabled strengthening of traditional culture and responsibilities under Aboriginal law, while addressing more contemporary needs such as training and employment.

## 10.2. VOLUNTEER PROGRAM

Organisations such as Conservation Volunteers Australia already undertake land management programs in the Pilbara and are often looking for projects to engage volunteers. Local community organisations and facilitating bodies such as Rangelands NRM are also able to help facilitate opportunities to utilise volunteers or increase knowledge of funding opportunities for coastal management.



## 10.3. COMMUNITY EDUCATION AND AWARENESS

Encouraging change in the behaviour of coastal users will significantly reduce the extent of negative impacts from uncontrolled off-road vehicle use and irresponsible camping within the coastal environment. The City's Ranger Services already educate and inform the community regarding a number of these issues, as well as promoting environmentally responsible management of coastal campgrounds and flora and fauna protection. Installation of increased educational signage along with the development of information brochures and community awareness campaigns will continue to increase awareness and reduce negative impacts over time.

## 10.4. FUNDING OPPORTUNITIES

Implementation of this CMS will require funds to support the preparation, planning, construction, communication and monitoring of the proposed actions.

A variety of external funding sources have been successfully applied by the City to coastal works (including state and commonwealth programs and industry contributions). The City will ensure that all opportunities to secure support funding are explored and capitalised on to deliver maximum benefit in the most cost effective way.

## 10.5. MONITORING AND EVALUATION PROGRAM

The City will aim to undertake a review and evaluation of the strategies and actions within this CMS on an annual basis. The City intends for monitoring and evaluation to be:

- Useful and usable for all coastal stakeholders;
- Simple, cost-effective and practical;
- Developed with a range of timescales, as some action may take time to achieve results; and
- Meaningful and easy to interpret.

The ongoing cost of monitoring needs consideration as part of the implementation of the CMS recommendations. The City will seek to achieve the most appropriate balance between planning, works, community engagement and monitoring. In order to build a collaborative approach to coastal management across the municipality, the proposed monitoring framework aligns with the Pilbara Bioregion Conservation Action Plan (Rangelands NRM, 2015).

# 11. MANGEMENT STRATEGIES

Management Opportunities						
Theme	Strategies	Actions	Timeframe			Internal Service
			1 – 2 Years	2 – 5 Years	5 – 10 Years	
1. Strategic and Statutory Alignment	Align strategies and actions outlined within the CMS with local and regional research, planning and management.	1.1 Implement actions in coordination with existing initiatives, programs and strategies. 1.2 Collect, consolidate and disseminate research and survey data undertaken by external agencies and organisations. 1.3 Develop key performance indicators to implement actions from the CMS. 1.4 Undertake annual review of CMS outcomes to confirm effective implementation and ensure consistency with other local and regional strategies.	✓ ✓ ✓ ✓	✓   ✓	✓   ✓	Planning Services
2. Management	Develop partnerships with other authorities and stakeholders to increase the capacity and effectiveness of managing the coastal environment.	2.1 Undertake land tenure audit to clarify the extent and range of ownership/ management of all land within the City's coastal environment. 2.2 Develop suitable partnership(s)/ agreement(s) with various land managers to clarify the extent of responsibilities and opportunities to share resources to improve management and enforcement across the coastal environment. 2.3 Develop and implement a beach monitoring program, which firstly defines the holistic assessment area and outlines a range of success criteria determined on the type of land tenure and responsibility. 2.4 Investigate and define opportunities for an Aboriginal Rangers Program on City managed reserves through partnership(s) with relevant Native Title groups and Aboriginal Corporations. 2.5 Support programs and initiatives that actively engage the local community in managing the City managed reserves (e.g. school programs, clean-up days, etc.).	✓ ✓ ✓ ✓	   ✓	   ✓	Planning Services
3. Funding	Identify and secure funding to support the planning and management of the coastal environment.	3.1 Develop a Funding Attraction Strategy which links the defined coastal management objectives to the priority areas of funding agencies and vested stakeholders. The strategy should outline an approach to secure existing coastal specific funding and identify opportunities from wider funding programs (e.g. investigate availability of Indigenous specific funding to support development of an Aboriginal Ranger Program). 3.2 As a priority seek funding to complete Foreshore Management Plans for the priority coastal node locations. 3.3 Advocate for longer term support and consistent funding to ensure that longer term strategies can be achieved. 3.4 Encourage and support community groups and research organisation to obtain funding to investigate biodiversity protection and management within the City's coastal environment.	✓  ✓ ✓	   ✓	    	Planning Services and Community Engagement
4. Education	Increase community awareness and ownership of the coastal environment.	4.1 Develop a Coastal Education Program to ensure ongoing public education and engagement programs (e.g. developing coastal signage) to encourage biodiversity conversation. This needs to demonstrate the environmental loss and management challenges from inappropriate use and development of the coast. 4.2 Investigate opportunities to incorporate Aboriginal heritage awareness within coastal education initiatives. 4.3 Ensure the cost of implementing public education and engagement programs are defined and incorporated into funding submissions and the City's long term financial planning. 4.4 Continue to undertake community and visitor surveys to understand the effectiveness of coastal management strategies.	✓   ✓	   ✓ ✓ ✓	    ✓	Planning Services and Community Engagement

Conservation of Coastal Biodiversity						
Theme	Strategies	Actions	Timeframe			Internal Service
			1 – 2 Years	2 – 5 Years	5 – 10 Years	
5. Priority Locations	In collaboration with coastal land managers/ owners, identify priority locations for coastal biodiversity protection and enhancement.	5.1 Develop an inventory in ongoing collaboration with relevant agencies, (e.g. categories and priorities) of significant natural landscapes, flora and fauna, ecological communities, cultural heritage values and lookouts.	✓			Planning Services  Infrastructure Services
		5.2 Undertake gap analysis (in ongoing collaboration with relevant agencies) of flora and fauna surveys within the coastal environment and prioritise location requiring further investigation.		✓	✓	
		5.3 Define the significant importance of various coastal locations (in ongoing collaboration with relevant agencies), and incorporate these across relevant agency strategies (e.g. Foreshore Management Plans).		✓		
		5.4 Install interpretative signage in priority locations where important fauna, such as turtles and seabirds, are present.				
		5.5 Assess and modify existing beach access and coastal development (e.g. lighting) to avoid negative impacts on fauna habitats.	✓		✓	
6. Spread of Weeds	In collaboration with coastal land managers/ owners, identify and reduce the spread of invasive weed species.	6.1 Inspect, monitor and map locations of invasive weeds across City reserves. Where appropriate, ensure flora surveys are undertaken in the development of Foreshore Management Plans.		✓		Planning Services and Ranger Services
		6.2 Develop and implement a shared approach/ strategy for long-term weed control and flora rehabilitation in collaboration with relevant coastal managers and owners,.		✓		
7. Destructive and Feral Fauna	In collaboration with coastal land managers/ owners, develop feral fauna eradication program(s) and grazing controls.	7.1 Develop an inventory (e.g. categories and priorities) of native fauna populations and habitats (in ongoing collaboration with relevant agencies and coastal land managers/ owners).	✓			Planning Services and Ranger Services
		7.2 Develop a strategy which outlines how to share resources to eradicate feral fauna and protect native fauna (in ongoing collaboration with relevant agencies and coastal land managers/ owners).		✓	✓	
		7.3 Develop a strategy to protect native fauna habitats from cattle grazing, especially in regards to rare fauna (in ongoing collaboration with relevant agencies and coastal land managers/ owners).		✓		
8. Dune and Erosion Control	In collaboration with coastal land managers/ owners, identify vulnerable coastal dune systems and encourage improvement strategies.	8.1. Survey and identify low, medium and high risk erosion locations and conduct regular monitoring for signs of natural or man-made disturbance as they occur (e.g. informal tracks, loss of vegetation cover, etc.).	✓	✓		Planning Services and Ranger Services
		8.2. Identify physical mechanisms, including fencing, to control inappropriate beach access.	✓			
		8.3. Increase community responsibility and ownership of dune systems and the high priority for protection.	✓	✓	✓	
		8.4. Encourage revegetation of coastal dune systems.				
		8.5. Continue to undertake foreshore and dune works as identified within the City's Foreshore Works Plans, and look to include additional works as they are identified.		✓		
		8.6. Investigate the benefits of establishing a plant nursery for raising tube-stock for revegetation planting.		✓	✓	

Balancing the Provision of Land and Access for Industrial Development						
Theme	Strategies	Actions	Timeframe			Internal Service
			1 – 2 Years	2 – 5 Years	5 – 10 Years	
9. Control of Industrial Emissions and Impacts	Support industrial and port development in a way that minimises and mitigates emissions, while protecting the surrounding biodiversity and sensitive land uses.	9.1 Establish ongoing discussions with industrial operators, or representative bodies, to align priorities and negotiate opportunities where industrial operations can offset impacts through contribute to biodiversity values (e.g. management funding, delineation of conservation estates, revegetation programs, etc.).	✓	✓	✓	Partnerships Planning Services.
		9.2 Progress and implement land use buffers around industrial areas and infrastructure within the City's Local Planning Scheme in accordance within State Planning Policy 4.1 – State Industrial Buffer.	✓	✓	✓	
		9.3 Ensure where development applications for industrial development within or adjacent to the coastal environment are submitted with the City, a multi-agency referral and consideration is undertaken.	✓	✓	✓	
10. Industrial Coastal Access	Define coastal access specific to industrial areas and ports while managing and maintaining community access to the coast.	10.1 Collate and disseminate information to the community and visitors on existing industrial, marine and land based, access routes to outline the location and purpose of restricted areas.	✓	✓	✓	Planning Services
		10.2 Ensure the community has the opportunity to provide comments when development applications are received which propose to restrict existing recreational coastal access.	✓	✓	✓	
11. Extraction of Basic Raw Materials	Ensure the extraction of basic raw materials is undertaken with respect to the natural environment and community interests.	11.1 Implement the City's Local Planning Policy DP26 – Basic Raw Materials Policy for applications on privately owned land.	✓	✓	✓	Planning Services
		11.2 Establish ongoing discussions with the Department of Mines and Petroleum (DMP) to discuss applications on Crown owned land to identify the City's priorities and concerns for basic raw materials, as outlined within DP26.	✓	✓	✓	
		11.3 Ensure responses to referrals from the DMP are made when they are received.	✓	✓	✓	

Protection of Existing and Future Residential, Community and Heritage Assets						
Theme	Strategies	Actions	Timeframe			Internal Service
			1 – 2 Years	2 – 5 Years	5 – 10 Years	
12. Settlements	Planning and development of coastal settlements is undertaken equitably across the coastal environment consistent with community use and values.	12.1 Ensure that development is focused within identified coastal nodes, and prior to further expansion of these coastal nodes, Foreshore Management Plan are prepared to address site specific considerations.	✓	✓	✓	Planning Services
		12.2 Investigate the opportunities for the Fortescue River and Balla Balla reserves being vested to the City for management, with the possibility of an Aboriginal Ranger Service having responsibility.		✓		
13. Coastal Hazard Risk	Development and use of land within the coastal environment is undertaken with consideration of coastal hazard risks.	13.1 Scheme Amendments, Subdivision and Development Applications should address the potential coastal hazard risk, including sea level rise, in accordance with State Planning Policy 2.6 – State Coastal Planning Policy.	✓	✓	✓	Planning Services
		13.2 Review the existing City of Karratha Coastal Hazard Risk Management Adaptation Plan in consideration of all existing coastal vulnerability studies and flood management plans.		✓		
14. Cultural Protection	Increase the awareness and protection of Aboriginal cultural heritage sites across the coastal environment.	14.1 Engage with Native Title Holders and Aboriginal Corporations to identify opportunities to increase the involvement Aboriginal people in coastal management.	✓			Community Engagement Planning Services
		14.2 Develop partnerships with Native Title Holders and Aboriginal Corporations to develop interpretive signage at historic and/ or cultural significance.		✓		
		14.3 Support the identification and protection of Aboriginal Heritage sites through appropriate registration and culturally sensitive approach to recreational activities and coastal development.	✓	✓		
15. Stormwater Runoff	Manage the physical interactions between stormwater catchment runoff and coastal processes.	15.1 Implement the actions as outlined within the City of Karratha Water Management Strategy, and the specific District and Urban Water Management Strategies.		✓	✓	Infrastructure Services All Staff
		15.2 Implement the actions as outlined within the City of Karratha Water Action Conservation Plan aimed at conserving water, improving onsite infiltration of storm water and removing pollutants from storm water runoff.	✓	✓	✓	

Management of Sustainable Coastal Recreation						
Theme	Strategies	Actions	Timeframe			Internal Service
			1 – 2 Years	2 – 5 Years	5 – 10 Years	
16. Recreation Coastal Access	Formalise and control public access onto and within the coastal environment.	16.1 Undertake coastal usage audit at coastal nodes and informal beach locations to define the type and frequency of access onto and within these locations, and identify any existing control mechanisms and signage. 16.2 Identify priority coastal nodes and locations and implement and maintain a range of control mechanisms including formal parking, access tracks, fencing and signage. This should be outlined within a separate Coastal Access Strategy and/ or included within the City's asset management planning. 16.3 Ensure community consultation is undertaken prior to any changes to coastal access being undertaken. 16.4 Continue to control informal camping within the City's coastal reserves.	✓	✓		Planning Services and Ranger Services
			✓	✓	✓	
17. Infrastructure Development	Recreation infrastructure is designed and constructed for use by the widest possible population, into the future and in consideration of whole of life costs.	17.1 Complete Foreshore Management Plans to identify recreational developments/ upgrades to sustainably meet population demands. 17.2 Prioritise new amenity infrastructure development across coastal nodes as outlined by the community and/ or as required to preserve biodiversity or prevent erosion. 17.3 Ensure that infrastructure is designed with consideration of coastal hazard risks over the asset life span. 17.4 Undertake a review of the City asset management and long term financial planning, as appropriate, to incorporate the cost of maintenance of existing infrastructure and the provision of new infrastructure. 17.5 Ensure disability inclusion principles are incorporated within the design and construction of new recreational infrastructure and amenities. 17.6 Undertake regular monitoring of recreational infrastructure.	✓	✓	✓	Asset Management Leisure Planning
			✓	✓	✓	
18. Recreational Fishing	Control the impact of recreational fishing through land use planning, community education and mitigation options.	18.1 Incorporate 'No Take Zone' controls for designated areas within community education programs. 18.2 Review facilities and practises for fish waste disposal at boat ramps, jetties and coastal nodes to determine if best practise are being undertaken, and look to establish partnerships to improve standards. 18.3 Assist agencies, organisation and community groups to increase awareness of recreational fishing on selected beaches within identified fauna nesting areas.	✓	✓	✓	Planning Services Community Engagement
			✓	✓	✓	
19. Vehicle Management	Balance the use and impacts of off-road-vehicle onto and within the coastal environment.	19.1 Enforce the provisions as outlined within the Control of Vehicle (Off-Road Areas) Act 1978 as outlined within the City's Off-Road Vehicle Information brochure. 19.2 Review community and visitor awareness of off-road access and safety within the coastal environment, and incorporate increased awareness within community education initiatives. 19.3 Implement the management recommendations within the Off Road Vehicle Report. 19.4 Require that signage is installed at select beaches to deter vehicle access during fauna nesting periods. 19.5 Investigate opportunities to provide additional off-road-vehicle areas to compensate use of the coastal environment should access be restricted at certain locations.	✓	✓	✓	Ranger Services Infrastructure Services Planning Services
			✓	✓	✓	
20. Waste Control	Maintain and improve the experience and responsibility of the community and visitors.	20.1 Require that adequate bins are provided across at identified coastal nodes, and incorporate signage at less formal coastal nodes to encourage the community and visitors to clean up and take rubbish with them. 20.2 Monitor the coastal environment to identify dumping areas for vegetation/ garden waste, industrial waste and other debris within the coastal environment. Where regular dumping is occurring, develop strategies to target illegal dumping.	✓	✓	✓	Ranger Services
			✓	✓	✓	

## Appendix One: Tenure Arrangements for Coastal Nodes



### KARRATHA BACK BEACH

- CURRENT TENURE**
-  Unallocated Crown Land
  -  Parks and Recreation (Vested with City of Karratha)  
Reserve No: 36708
- PROPOSED TENURE CHANGES**
-  Potential to incorporate coastal UCL fringe into adjacent reserve 36708 by way of a management order to the City.
- FUTURE TENURE CONSIDERATIONS**
- All Unallocated Crown Land subject to future act process under the Native Title Act 1993.



### GNOOREA POINT

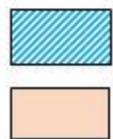
- CURRENT TENURE**
-  Unallocated Crown Land
  -  Recreation & Preservation of Coastal Environment (Vested with City of Karratha)
  -  Construction & Launching Facilities (Unvested)
  -  Area subject to the Yaburara & Mardudhunera Claim WC1996/089
  -  Cape Preston Marine Management Area, jurisdiction of Department of Parks and Wildlife (DPaW)
- PROPOSED TENURE CHANGE**
-  Inclusion of 'Camping' into the purpose of the reserve.
  -  Reserve originally created as part of an off shore pipe project. A change in purpose and issue of a Management Order to clarify responsibility.
  -  Any proposed use of this area will require a future act process under the Native Title Act
  -  Any proposals affecting these waters will require consultation with DPaW.



# DAMPIER



## Current Tenure



Reserves Vested with the City of Karratha.



Unvested Reserve (43294 – Drainage, 43295 – Recreation)



## Proposed Future Tenure

Land Transfer options with RTIO.

- LEGEND**
- RT TRANSFER MAINTENANCE OF PUBLIC PARKS & OPEN SPACE
  - RT TRANSFER SPORTING & RECREATION FACILITIES
  - RT KEEPING THESE FACILITIES
  - RT KEEPING VACANT LAND



# Fortescue River Mouth



## CURRENT TENURE

-  Unallocated Crown Land
-  Public Purposes (Unvested)
-  Access Easement
-  Cape Preston Marine Management Area (DPAW)
-  Area subject to Yaburara & Mardudhunera Claim

## Proposed Future Tenure

-  Reserve 380 should be vested in with the City through a management order. The purpose of this vesting should be changed from "Public Purpose" to reflect more appropriate land use such as: "Recreation and Camping."
-  UCL should also be vested with the City through a management order, with purpose to reflect preferred use of the reserve. Will require a future act process under the *Native Title Act 1993*.

# Cleaverville



## CURRENT TENURE



Recreation & Camping (Vested with City of Karratha)

## Future Tenure

The "Recreation and Camping" reserve is subject to the Ngarluma/Yindjibandi determination and therefore any change to use of the reserve will require a future act process under the NT Act.

# Wickham Boat Beach



## CURRENT TENURE

-  Unallocated Crown Land
-  Recreation (Vested with City of Karratha)
-  Harbour Purpose (Vested with Department of Transport)

## Future Tenure

Unallocated Crown Land is subject to the Ngarluma/Yindjibandi determination and therefore any change of use will require a future act process under the NT Act.

# Appendix Two: References

Author	Title	Date
Acil Tasman	FIFO and Regional Impact Assessments	Jan 2009
AEC Group	Pilbara Tourism Product Development Plan	2014
Astron Engineering	Cleaverille Beach – Existing Environment And Management Issues (Draft)	Dec 1998
Astron Engineering	Karratha Accommodation Study	May 1999
Bob O'Sullivan	Coastal Strategy Plan (Draft)	Nov 2008
BoM	Cape Lambert Storm Surge Study	April 1998
BoM	Climate Statistics for Australian Locations: Karratha Aero, Dampier Salt, Roebourne, Cossack and Roebourne Aero	March 2013
CARDNO	DRAFT Point Samson Structure Plan	2015
CBRE	Industrial Land Supply Analysis – Pilbara Region	2013
Chamber of Minerals & Energy and PWC	State Growth Outlook	2011
Chamber of Minerals and Energy of WA & PWC	WA State Growth Outlook 2011	April 2011
City of Karratha	Coastal Management Strategy, Stakeholder Engagement Plan.	2016
City of Karratha	Draft Local Planning Strategy	2016
City of Karratha	Storm Surge Risk Policy – DP19	2016
City of Karratha	Local Government Heritage Inventory	2014
City of Karratha	Coastal Hazard Risk Management Adaptation Plan	2016
City of Karratha	DRAFT Dampier Community Hub Management Plans	2014
City of Karratha	Operational Economic Development Strategy 2014-16	2014
CODA	Pilbara Vernacular Handbook	Dec 2011
CSRIO	Priority Threat Management for Pilbara Species of Conservation Significance	2014
CSIRO	Pilbara Regional Mining Climate Change Workshop Outcomes	Dec 2011
CSIRO	Priority Threat Management for Pilbara Species of Conservation Significance	2014
Dampier Port Authority	Dampier Port Authority – Development Guidelines	Dec 2006
Dampier Port Authority	Port of Dampier – Land Use and Infrastructure Plan 2014	2014
Dept of Agriculture	Salinity Investigations at Karratha	Sep 1975
Dept of Conservation and Land Management	Burru Peninsula Recreation and Tourism Masterplan	Feb 1999
Dept. Conservation and Land Management	The Biodiversity Audit for the Pilbara	2002
Dept of Conservation and Land Management	Indicative Management Plan for the Proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area	2005

Author	Title	Date
Dept of Conservation and Land Management	Dampier Archipelago Nature Reserves Management Plan	May 1990
Dept of Conversation and Land Management	Muruju National Park Management Plan	2013
Dept of Environment & Conversation	Biodiversity Conservation Strategy for WA (Draft)	2006
Dept of Environment and Conservation	Proposed Burrup Peninsula Conservation Reserve Management Plan (Draft)	2006
Dept. of Fisheries	An integrated system to survey boat-based recreational fishing in Western Australia 2011/12.	2013
Dept of Housing and Pilbara Development Commission	Pilbara Towns Housing Study	
Dept of Mineral & Petroleum Resources	King Bay – Hearson Cove Precinct Plan	Aug 2002
Dept. of Planning	Geology, Geomorphology and Vulnerability of the Pilbara Coast	2013.
Dept of Water	Pilbara Coast Water Study	Feb 2009
Dept of Water	Pilbara Groundwater Allocation Plan (Draft)	2012
Dept of Water	Pilbara Regional Water Plan	Nov 2008
Dept of Water	Pilbara Regional Water Plan	June 2010
Dept of Water	Pilbara Regional Water Plan (Draft)	Nov 2008
Dept of Water	State Water Plan	2007
Dept Regional Development and Lands	Pilbara Cities Vision	2012
EPA	Environmental Protection and Ecological Sustainability of the Rangelands in WA, Position Statement No. 4	2004
EPA	Guidance for the Assessment of Environmental Factors No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia	2004
EPA	Guidance for the Assessment of Environmental Factors No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia	2004
EPA	Guidance for the Assessment of Environmental Factors No. 3: Separation Distances Between Industrial and Sensitive Land Uses	2005
EPCAD Pty Ltd	Dampier Enhancement Initiative	2014
Essential Environmental	Pilbara Strategic Regional Land Use Plans (Draft)	Sep 2010
Essential Environmental/ RDA Pilbara	Pilbara State of the Environment Report	June 2013
Essential Environmental	Gnoorea (40 Mile) Foreshore Management Plan (Draft)	2013
Essential Environmental	Karratha Foreshore Management Plan (Draft)	2013

Author	Title	Date
Essential Environmental	Point Samson Foreshore Management Plan (Draft)	2013
Geographia & CCS Strategic Management	Karratha 2020 Vision and Accommodation Plan	Jan 2009
GHD	Burru Industrial Estate – Optimal Use of Sites	Jan 2010
GHD	Burru Support Industry Land Investigation	Aug 2007
GHD	Karratha Drainage Management Plan	Oct 2010
GHD	Pilbara Towns Water Supply Infrastructure Modelling and Planning Study	Oct 2008
Global Environment Monitoring Systems	West Pilbara Cyclone Surge Inundation Study	June 2009
Gresley Abas	DRAFT Dampier Hub Design Development Report	2014
Haig, T./ Dept of Water	The Pilbara Coast Water Study	2009
Hassell	Karratha Vernacular	2011
Heritage Council	Cossack – Conservation Policy	1996
Heuris Partners Ltd	Planning for Resources Growth in the Pilbara – Employment and Population Projections	Aug 2008
Heuris Partners Ltd	Planning for Resources Growth: Revised Employment and Population Projections	April 2010
JDA Consultant Hydrologists	Dampier Coastal Vulnerability Study	Mar 2012
JDA Consultant Hydrologists	Karratha Coastal Vulnerability Study	Aug 2012
JCY Architects	Karratha Cultural Precinct – Concept Design Report Vol. 1	Jan 2014
Landcorp	Karratha City Masterplan	2010
Landcorp	Karratha City of the North Town Revitalisation	May 2010
Landcorp	Karratha City Revitalisation Brochure	June 2010
Landcorp	Karratha Community Revitalisation Plan	May 2010
Landcorp	Karratha Implementation Plan	2010
Landcorp	Karratha Town Centre Revitalisation Project	Dec 2009
Loechel, B., Hodgkinson, J.H. and Moffat, K.	Pilbara Regional Mining Climate Change Adaptation Workshop: Report on Workshop Outcomes	2011
MacroPlan Dimassi	Karratha Homemaker Centre WA – Assessment of Market Potential	2014
Main Roads/ GHD	Karratha-Wickham Coastal Route Feasibility Study	2012
MetOcean Engineers Pty Ltd	Cyclic and Non-Cyclic Ocean Waves Study	April 2004
Murdoch University	Pilbara Regional Sustainability Strategy	June 2005
O'Brien Planning Consultants	Municipal Heritage Inventory Part 1 & 2	April 1996

# Appendix Two: References

Author	Title	Date
Pilbara Area Consultative Committee Inc	The Pilbara Plan	
Pilbara Development Commission	Pilbara Commercial Property and Land Snapshot	Dec. 2013
Pilbara Development Commission	Pilbara Housing And Land Snapshot	Oct. 2014
Pilbara Development Commission	Pilbara Infrastructure Needs Current & Future (Draft)	1998
Pilbara Development Commission	Pilbara Regional Priority Plan	Oct 2005
Pilbara Development Commission	Pilbara/Gascoyne Islands Ecotourism Management Strategy	1995
Pilbara Development Commission	Summary of Housing and Accommodation Initiatives in the Pilbara	July 2009
Pilbara Iron – Rio Tinto	Understanding the Pilbara Region and its Economy	
Pilbara Regional Council	Coastal Access in the Pilbara, Local Government Toolkit	2014
Rangelands NRM	Pilbara Bioregion Conservation Action Plan	2015
Regional Development Australia Pilbara	Pilbara Report Investment Prospectus 2012	2012
Regional Development Australia Pilbara	Regional Development Australia Strategic Plan 2011-2014	2010
Regional Development Australia Pilbara	Regional Development Policy Framework 2012-2017	2011
Rehbein Airport Consulting	Karratha Airport Masterplan (Draft)	Jan 2013
Riley Consulting	Supplementary Transport Paper for LPS	2014
Rio Tinto	Cape Lambert Port B Development	Mar 2009
Rio Tinto	Wickham Town Structure Plan	2011
Roberts Day Group	DRAFT Karratha Revitalisation Strategy	2015
RPS Group	Transient Worker Accommodation	April 2011
SGS Economics and planning for DPI	Karratha Primary Trade Area Retail and Commercial Strategy	Feb 2008
SGS Economics and planning for DPI	Karratha Primary Trade Area Retail and Commercial Strategy - Part B	July 2009
Shire of Roebourne	Cleaverville Area Foreshore Management Plan	2005
Shire of Roebourne	Coastal Management Strategy (Draft)	June 2005
Shire of Roebourne	Foreshore Management Plan (Draft)	July 2005
Shire of Roebourne	Karratha Open Space Strategy (Draft)	June 2008
Shire of Roebourne	Environmental Strategy	2013
Shire of Roebourne	Shire of Roebourne Major Land Transaction Business Plan (Draft)	2013
Shire of Roebourne	Strategic Community Plan 2011 - 2021	2011
Shire of Roebourne	Strategic Community Plan 2012 - 2022	2012

Author	Title	Date
Shire of Roebourne	Strategic Plan 2009 – 2013	2009
Syme Marmion and Co	Extractive Industry and Sustainable Regional Development	June 2010
Syme Marmion and Co	Industrial Land in the Eastern Corridor of the Shire of Roebourne	Aug 2013
Syme Marmion and Co	Shire of Roebourne Workforce Plan (Draft)	2012
Taylor Burrell Barnett	Wickham South Development Plan	Nov 2010
Taylor Burrell Barnett	Wickham Townsite Structure Plan	Jan 2011
Trail Bike Management Pty Ltd	Towards an effective Off Road Vehicle Strategy	2012
UDLA	Wickham Boat Beach Foreshore Management Plan	2016
UDLA	Hearson Cove Foreshore Management Plan	2016
UDLA	Roebourne Structure Plan	2014
UDLA	Cossack Visioning Document	2014
Urbis	Dampier Townsite Redevelopment and Revitalisation Strategy (Draft)	July 2013
WA Tropical Cyclone Industrial Liaison Committee	Karratha Storm Surge Inundation Study	Nov 1996
WAPC	Karratha Area Development Strategy	April 1998
WAPC	Karratha Land Development Program – Land Release Plan	April 1997
WAPC	Karratha Land Use Survey 1997	April 1997
WAPC	Karratha Regional Hotspots Land Supply Update	Dec 2010
WAPC	Local Planning Manual	Mar 2010
WAPC	Pilbara Framework Regional Profile + Appendices	Aug 2009
WAPC	Pilbara Infrastructure Priorities	June 2010
WAPC	Pilbara Planning and Infrastructure Framework	Jan 2012
WAPC	Planning Provisions for Affordable Housing Discussion Paper	Oct 2013
WAPC	State Coastal Planning Policy Guidelines	July 2013
WAPC	State Planning Strategy (Draft)	2012
WAPC	Status of Coastal Planning in WA	Jan 2010
WAPC	WA Tomorrow Forecast Summary – LGAs of WA	Feb 2012
WAPC	WA Tomorrow Forecast Summary – Roebourne	Feb 2012
Water Reform Implementation Committee	A blueprint for Water Reform in WA	Dec 2006
Wright and O'Neill	Ancient Traditions Carry On. FISH, June 2014 Vol. 22.	June 2014