SHIRE OF IRWIN
DONGARA-PORT DENISON
A BRILLIANT BLEND

COASTAL MANAGEMENT PLAN

SHIRE OF IRWIN



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Seashore Engineering

Shire of Irwin Coastal Management Plan

Prepared for the
Shire of Irwin

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table of contents

1.0 INTRODUCTION 10
1.1 BACKGROUND 10
1.2 PURPOSE 10
1.3 STUDY AREA 10
1.4 DOCUMENT STRUCTURE 10
1.5 CONSULTATION MECHANISMS 14
2.0 MANAGEMENT CONSIDERATIONS 22
2.1 COASTAL TENURE AND OWNERSHIP 22
2.2 COASTAL HAZARDS 22
2.3 ENVIRONMENTAL MANAGEMENT 22
2.4 ACCESS 23
2.5 4WDS AND OFF-ROAD VEHICLES 23
2.6 POPULATION GROWTH AND DEMAND 24
2.7 PROVISION OF FACILITIES 24
2.8 COASTAL SHACKS 24
2.9 RUBBISH AND WASTE 24
2.10 MANAGEMENT OF CAMPING NODES 25
2.11 HERITAGE 25
2.12 COMMUNITY INVOLVEMENT 25
3.0 STRATEGIC VISION AND OBJECTIVES 26
4.0 LAND MANAGEMENT AND TENURE 27
4.1 LOCAL PLANNING SCHEME 27
4.2 RESERVES 31
4.3 UNALLOCATED CROWN LAND 35
4.4 ACTIONS – LAND MANAGEMENT & TENURE 35
5.0 HERITAGE 36
5.1 ABORIGINAL CULTURAL HERITAGE SITES 36
5.2 HERITAGE PLACES 38
5.3 ACTIONS – HERITAGE 44
6.0 COMMUNITY INVOLVEMENT 45
6.1 COASTAL EDUCATION AND AWARENESS 45
6.2 COASTAL INFORMATION 45
6.3 ACTIONS – COMMUNITY INVOLVEMENT 46
7.0 ENVIRONMENT AND LANDSCAPE 47
7.1 CONTEXT 47
7.2 GEOLOGY AND SOILS 47
7.3 LANDSCAPE 49
7.4 CLIMATIC SUMMARY 49
7.5 VEGETATION AND FLORA 51
7.6 FAUNA AND HABITAT 54
7.7 DIEBACK 56
7.8 HYDROLOGY 56
7.9 BUSHFIRE 57
7.10 ACTIONS – ENVIRONMENT & LANDSCAPE 59
8.0 COASTAL PROCESSES 61
8.1 METEOROLOGICAL AND OCEANOGRAPHIC DATASETS 62
8.2 COASTAL DYNAMICS 66
8.3 DUNE DYNAMICS 70
8.4 SEDIMENT CELLS AND GEOMORPHIC FRAMEWORKS 71
8.5 ACTIONS – COASTAL PROCESSES 75
9.0 SECTOR 1 – NORTHERN BEACHES 76
9.1 DESCRIPTION 76
9.2 COASTAL PROCESSES 78
9.3 SOCIAL, RECREATIONAL AND LAND USE 80
9.4 ENVIRONMENT 80
9.5 SECTOR 1 – ISSUES AND OPPORTUNITIES 81
9.6 SECTOR 1 – RECOMMENDED ACTIONS 83
10.0 SECTOR 2 – DONGARA/PORT DENISON 86
10.1 DESCRIPTION 86
10.2 COASTAL PROCESSES 90
10.3 COASTAL PROCESSES AND MANAGEMENT SPECIFIC TO GRANNIES BEACH 93
10.4 SOCIAL, RECREATION AND LAND USE 99
10.5 ENVIRONMENT 101
10.6 SECTOR 2 – ISSUES AND OPPORTUNITIES 102
10.7 SECTOR 2 – RECOMMENDED ACTIONS 105
11.0 SECTOR 3 – SOUTHERN NODES 113
11.1 DESCRIPTION 113
11.2 COASTAL PROCESSES 115
11.3 SOCIAL, RECREATION AND LAND USE 118
11.4 SECTOR 3 – ISSUES AND OPPORTUNITIES 119
11.5 SECTOR 3 – RECOMMENDED ACTIONS 121
12.0 IMPLEMENTATION 130
12.1 INTRODUCTION 130
12.2 PRIORITIES 130

12.3 RESPONSIBILITIES 130
12.4 MONITORING & REVIEW 130
12.5 FUNDING SOURCES 130
12.6 ACTIONS 131
13.0 REFERENCES 132

TABLES

TABLE 1.1– QUESTIONNAIRE SUMMARY 8

TABLE 4.1 - LOCAL PLANNING SCHEME SUMMARY 21

TABLE 4.2 - SPECIAL USE ZONES 22

TABLE 4.3 - RESERVES 24

TABLE 5.1 - REGISTERED HERITAGES SITES 29

TABLE 5.2 - OTHER HERITAGE PLACES\ 29

TABLE 5.3 - HISTORIC HERITAGE PLACES 30

TABLE 8.1 - STATE PLANNING POLICY 2 RESPONSE TO OBJECTIVES 40

TABLE 8.2 – PRE-EUROPEAN VEGETATION SYSTEM ASSOCIATIONS 45

TABLE 8.3 – VEGETATION CONDITION CRITERIA 47

TABLE 9.1 – SHIRE OF IRWIN SEDIMENT CELLS 69

TABLE 9.2 – GENERALISED MORPHOLOGY FOR EACH TERTIARY SEDIMENT CELL 71

TABLE 10.1 – SECTOR 1 ZONING 74

TABLE 10.2 – SECTOR 1 RESERVE DETAILS 75

TABLE 10.3 – SECTOR 1 ISSUES AND OPPORTUNITIES 78

TABLE 10.4 – SECTOR 1 ACTIONS 80

TABLE 11.1 – SECTOR 2 ZONING 81

TABLE 11.2 – SECTOR 2 RESERVES 82

TABLE 11.3 - SECTOR 2 ISSUES AND OPPORTUNITIES 97

TABLE 11.4 – SECTOR 2 ACTIONS 100

TABLE 12.1 – SECTOR 2 ZONING 102

TABLE 12.2 – SECTOR 3 RESERVES 103

FIGURES

FIGURE 1.1 – CMP REVIEW PROCESS 6

FIGURE 7.1 – GERALDTON AIRPORT AWS WIND DISTRIBUTION (2011-2018) 43

FIGURE 7.2 – WIND ROSES 44

FIGURE 8.1 – REGIONAL BATHYMETRY 56

FIGURE 8.2 – GERALDTON AIRPORT AWS WIND DISTRIBUTION (2011-2018) 58

FIGURE 8.3 – GERALDTON SEASONAL WAVE VARIATION 59

FIGURE 8.4 – GERALDTON WATER LEVEL CASCADE 60

FIGURE 8.5 – GERALDTON EXTREME WATER LEVELS (1966-2018) 61

FIGURE 8.6 – BEACH COMPONENTS 63

FIGURE 8.7 – GERALDTON MEAN SEA LEVEL (1966-2018) 63

FIGURE 8.8 – PROXY INFLUENCES FOR DIFFERENT BEACH MEASUREMENTS (DAMARA 2015) 64

FIGURE 8.9 – COMPARISON OF SHORELINE AND VEGETATION LINE POSITIONS FOR DONGARA BEACH 65

FIGURE 8.10 – SHORELINE POSITION NORTH OF KINGY BAY (SHORELINE MONITOR) 65

FIGURE 8.11 – VEGETATION LINE POSITION SOUTH OF SEASPRAY CARAVAN PARK RELATIVE TO 1944 66

FIGURE 8.12 – SCHEMATIC OF BEACH-DUNE SEDIMENT TRANSFER MODEL 67

FIGURE 8.13 – SIMPLIFIED MODEL OF ONSHORE SAND TRANSPORT 68

FIGURE 8.14 – PRIMARY AND SECONDARY SEDIMENT CELLS FOR THE MIDWEST (STUL ET AL. 2014). 70

FIGURE 9.1 – NORTH SHIRE OF IRWIN COAST 76

FIGURE 9.2 – SHORELINE POSITION SOUTH OF SEVEN MILE BEACH (FROM SHORELINE MONITOR) 77

FIGURE 10.1 – NORTH CENTRAL SHIRE OF IRWIN COAST 84

FIGURE 10.2 – SHORELINE POSITION NEAR DENISON AIRSTRIP (FROM SHORELINE MONITOR) 85

FIGURE 10.3 – LOCALISED BATHYMETRIC FEATURES IN THE VICINITY OF DONGARA-PORT DENISON 85

FIGURE 10.4 – SHORELINE POSITION AT WHITE POINT (FROM SHORELINE MONITOR) 86

FIGURE 10.5 – EXTRACT FROM HIGH RESOLUTION BATHYMETRY 87

FIGURE 10.6 – EXPECTED BEACH RESPONSE TO PORT DENISON BREAKWATERS 88

FIGURE 10.7 – ORIGINAL CONTROLS FOR ARURINE BAY AND SUBSEQUENT MODIFICATIONS 89

FIGURE 10.8 – CONCEPTUAL MODEL OF BEACH DYNAMICS 90

FIGURE 10.9 – VEGETATION LINE TIME SERIES FOR GRANNIES BEACH 91

FIGURE 10.10 – GENERALISED COASTAL ENGINEERING OPTIONS WITH BEACH AMENITY 92

FIGURE 10.11 – RELOCATION AND UPDRIFT CONTROL OPTIONS

FIGURE 10.12 – RENOURISHMENT AND DOWNDRIFT CONTROL OPTIONS

FIGURE 10.13 – REVETMENT AND GROYNES OPTION 93

FIGURE 11.1 – SHORELINE POSITION AT FRESHWATER BAY (FROM SHORELINE MONITOR) 104

FIGURE 11.2 – SOUTH CENTRAL SHIRE OF IRWIN COAST 104

FIGURE 11.3 – SOUTH SHIRE OF IRWIN COAST 105

PLANS

PLAN 1.1 – SHIRE CONTEXT
PLAN 1.2 – SHIRE OVERVIEW
PLAN 1.3 – COASTAL SECTORS
PLAN 4.1 – LOCAL PLANNING SCHEME
PLAN 4.2 – LOCAL PLANNING SCHEME DONGARA/DENISON
PLAN 4.3 – RESERVES OVERVIEW
PLAN 5.1 – HERITAGE OVERVIEW
PLAN 7.1 – GEOLOGY OVERVIEW
PLAN 7.2 – PRE-EUROPEAN VEGETATION (COMPLEXES)
PLAN 7.3 – BUSHFIRE PRONE AREAS
PLAN 9.1 – SECTOR 1 OVERVIEW
PLAN 9.2 – MCKENZIES
PLAN 9.3 – SEVEN MILE BEACH
PLAN 10.1 – SECTOR 2 OVERVIEW
PLAN 10.2 – KING BAY/SUNSET COVE
PLAN 10.3 – DONGARA
PLAN 10.4 – GRANNIES BEACH
PLAN 10.5 – BOAT HARBOUR
PLAN 10.5 – DENISON SOUTH
PLAN 10.6 – SOUTH BEACH
PLAN 11.1 – SECTOR 3 OVERVIEW
PLAN 11.2 – CONCEPT; CLIFF HEAD OVERVIEW
PLAN 11.3 – CONCEPT; CLIFF HEAD NORTH
PLAN 11.4 – CONCEPT; CLIFF HEAD CENTRAL
PLAN 11.5 – CONCEPT; CLIFF HEAD SOUTH
PLAN 11.6 – CONCEPT; FRESHWATER POINT
PLAN 11.7 – CONCEPT; FRESHWATER POINT DETAIL
PLAN 11.8 – KNOBBY HEAD

APPENDICES

APPENDIX A – COMMUNITY MEETING OUTCOMES REPORT
APPENDIX B – OTHER MINOR SITES

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The preparation of this report was a collaborative process which included input from the Shire of Irwin, the Steering Group and members of the community who gave up their time to provide comments, attend meetings and to show project team various sites.

The recommendations and background information from the Shire of Irwin Coastal Development Strategy 2000 (Shire of Irwin and Landvision, 2000) provided valuable input into this report as well as other resources prepared by the Shire of Irwin, Department of Planning, Lands and Heritage, NACC and various other agencies.

definitions and abbreviations

DEFINITIONS

Amenity – those factors which combine to form the present character and likely future character of an area.

Biodiversity – the variety of life: the different plants, animals and microorganisms and the ecosystems of which they are a part.

Coastal foreshore reserve – the area of land on the coast set aside in public ownership to allow for coastal processes and provide protection of ecological values, landscape, visual landscape, indigenous and cultural heritage, and public access, recreation and safety.

Conservation – the protection, management, sustainable use and enhancement of the natural environment.

Development – any change to land use, including housing, any demolition, erection, construction, alteration of or addition to any building or structure on the land and any excavation or other works.

Dieback – the common name given to the pathogen Phytophthora cinnamomi which is a soil borne water mould that invades and destroys the root systems of many native flora species in WA.

Ecological linkage – a series of (both contiguous and non-contiguous) natural areas that, within a landscape context, connect larger natural areas by forming stepping stones of habitat that allow the movement of organisms and genetic material between these larger natural areas.

Ecology – study of the relationships of animals and plants, particularly of animal and plant communities, to their surroundings, living and non-living.

Ecosystem – a term used to describe a specific environment to include all the biological, chemical and physical resources and the inter-relationships and dependencies that occur between those resources.

Landscape values – natural and/or cultural landscape features that are highly valued, as defined by documented research.

Off-road vehicle – an un-registered vehicle that has the ability to be used off road (e.g. quad bike, dune buggy, trail bike).

Remnant vegetation – stands of remaining native vegetation indigenous to a locality.

Reserves – may be either land classified in local planning schemes for public purposes or areas of Crown land reserved for public purposes as determined by the Land Act 1933 and the Land Administration Act 1997.

Road Registered Vehicle – A licensed, road registered vehicle that has the ability to be used off road (e.g. 4WD, motor bike, licensed quad bike).

Sustainability – meeting the needs of current and future generations through the integration of environmental protection, social advancement and economic prosperity.

Threatened Ecological Community – communities which consist of native vegetation which are poorly represented and in danger of extinction and protected under the Biodiversity Conservation Act 2016.

Threatened Flora – Rare and priority flora protected under the Biodiversity Conservation Act 2016.

Threatened Fauna – Fauna protected under the Biodiversity Conservation Act 2016.

Vehicle – A vehicle is propelled by an engine or other mechanical source of power.

ABBREVIATIONS

2WD	Two Wheel Drive
4WD	Four Wheel Drive
CMP	Coastal Management Plan
CHRMAP	Coastal Hazard Risk Management and Adaptation Plan
DBCA	Department of Biodiversity, Conservation and Attractions
DoAWE	Department of Agriculture, Water and the Environment
DPLH	Department of Planning, Lands and Heritage
DPIRD	Department of Primary Industries and Regional Development
DoT	Department of Transport
DWER	Department of Water and Environmental Regulation
EPBC	Environmental Protection and Biodiversity Conservation
NACC	Northern Agricultural Catchments Council
ORV	Off Road Vehicle
RRV	Road Registered Vehicle
SoI	Shire of Irwin
SPP	State Planning Policy
LPS	Local Planning Scheme
UCL	Unallocated Crown Land
WAPC	Western Australian Planning Commission
WONS	Weeds of National Significance
YMAC	Yamatji Marpla Aboriginal Corporation

Priorities have been classified as follows:

- S: Short term – within the next 2 financial years
- M: Medium term – within the next 5 years
- L: Long term – 5+ years
- O: Ongoing – as required

1.0 introduction

1.1 BACKGROUND

The Shire of Irwin Coastal Development Strategy was prepared in 2000 (Shire of Irwin and Landvision). Coastal strategies and plans are typically reviewed every 10 years to address new issues and changing social, economic and environmental factors within an area. There is a need to review and update the 2000 Strategy to reflect current State and Local policies, environmental changes (such as coastal hazards) and changing social and economic pressures. The updated Coastal Management Plan will also be expanded to not only include the sites south of Port Denison (as the 2000 Strategy did) but to include the entire Shire coastline (excluding Beekeepers Nature Reserve).

The Coastal Management Plan focuses on existing coastal sites used for recreation. The areas between the sites are largely undisturbed. Future use and development should utilise existing sites and tracks to conserve areas of undisturbed coast.

1.2 PURPOSE

This document presents the Coastal Management Plan (CMP) for the Shire of Irwin coastline. The CMP will provide actions for the management of the Shire's coastal areas for the next 10 years, with a focus on areas with issues such as coastal hazards and land use pressures. The preparation of the CMP involved consultation with the community and stakeholders, a review of new State and Local policies, a review of relevant literature and site assessments to determine relevant actions.

The following broad steps were taken during the preparation of this document:

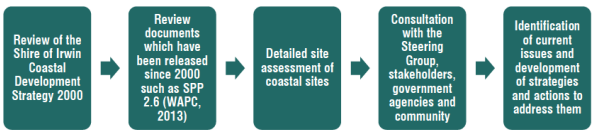


Figure 1.1 - CMP Review Process

This CMP identifies the specific actions needed, as well as their timing and responsibilities, to ensure the various assets and values identified by the community and stakeholders of this highly valued coastline are secured for the long term. The implementation section of this report provides further details regarding responsibilities, monitoring, timeframes and funding options.

1.3 STUDY AREA

The study area includes the entire Shire of Irwin coastline, excluding the Beekeepers Nature Reserve. The length of the study area is approximately 75 kilometres. The study area extends inland as required at each site to include the areas most commonly used for recreational pursuits along the coastline. A context plan is provided at Plan 1.1 and the extent of the study area is provided at Plan 1.2. Tenure along the study area is a mixture of freehold, Unallocated Crown Land (UCL) and reserves.

1.4 DOCUMENT STRUCTURE

The document provides actions addressing a range of coastal management issues, followed by more focused consideration of coastal sites located within one of three sectors:

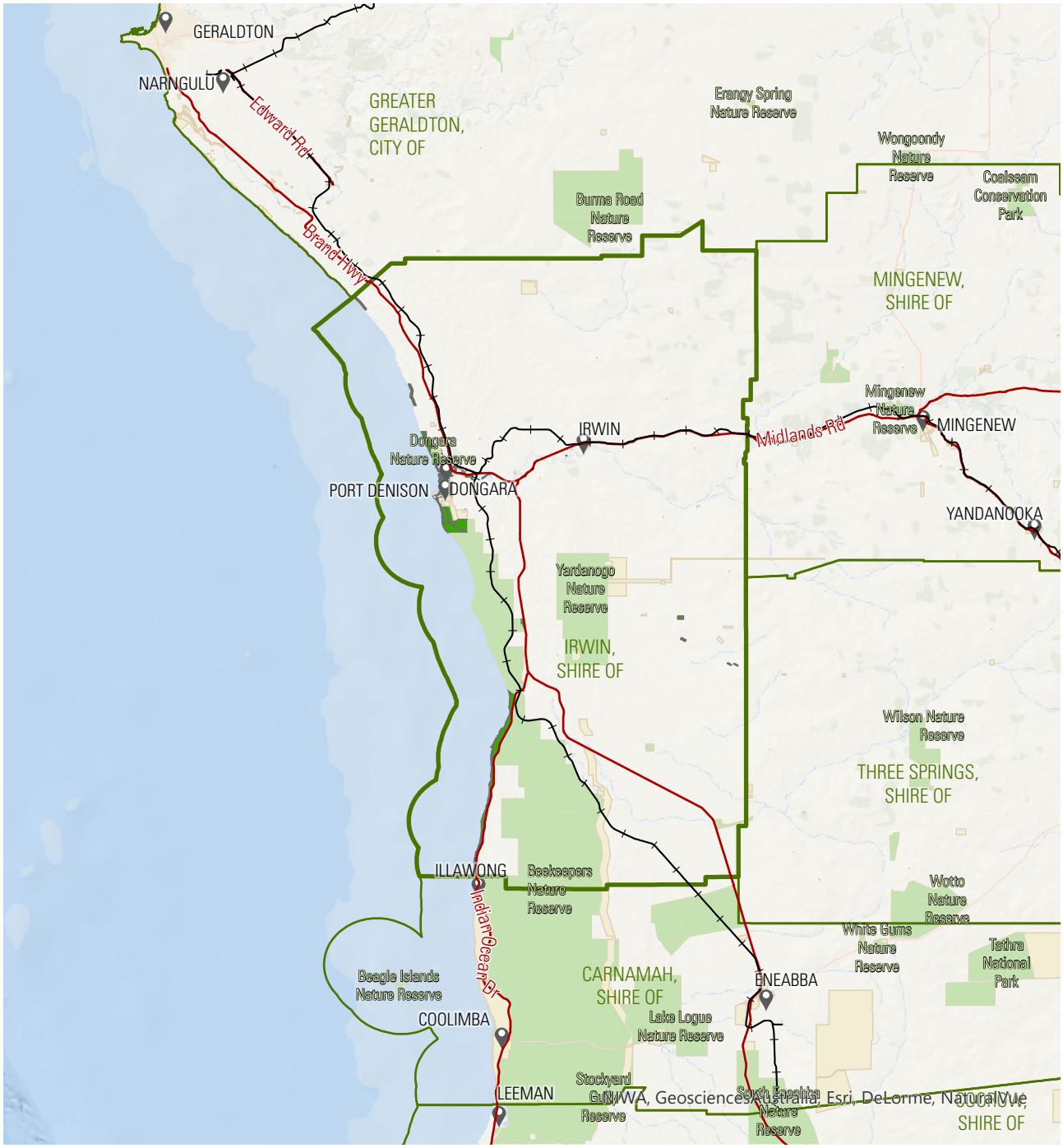
- Sector 1 – The northern coastline from the Shire's northern boundary to Reserve no. 43544 north of Dongara (includes the coastal sites of Bookara Beach and Seven Mile Beach).
- Sector 2 – The Dongara and Port Denison coastline from north of the Dongara townsite (Reserve no. 43544 north of Sunset Cove) to the south of Port Denison (south of South Beach and Reserve no. 137) (includes the coastal sites of Sunset Cove, Seaspray Beach, Irwin River Mouth, Nuns Pool, Surf Beach, Grannies Beach, Port Denison Foreshore and South Beach).
- Sector 3 – From Reserve No. 137 to the southern boundary of the Shire (includes North Cliff Head, Cliff Head, South Cliff Head, Bee Hollow, Freshwater Point, Little Freshwater, North Knobby Head, Knobby Head, South Knobby Head and Little Mexico).

The sectors are shown on Plan 1.3. A list of actions is provided for each sector, focussing on the coastal sites listed above. Each action is provided with a number (for easy reference and identification on the plan) as well as an indication of responsibility and priority. Further information on implementation, including a discussion on responsibilities, priorities and funding, is provided in Chapter 6.

There is additional focus on certain camping nodes in the southern portion of the Shire. A Concept Plan is provided for each of these sites which is a diagrammatic representation of proposed actions. Priority sites comprise the following:

- Knobby Head
- Freshwater Point
- South Cliff Head/Cliff Head/North Cliff Head.

Recommendations are formulated after considering the range of issues at each site, community feedback, stakeholder comments, future demand analysis and Shire resources.



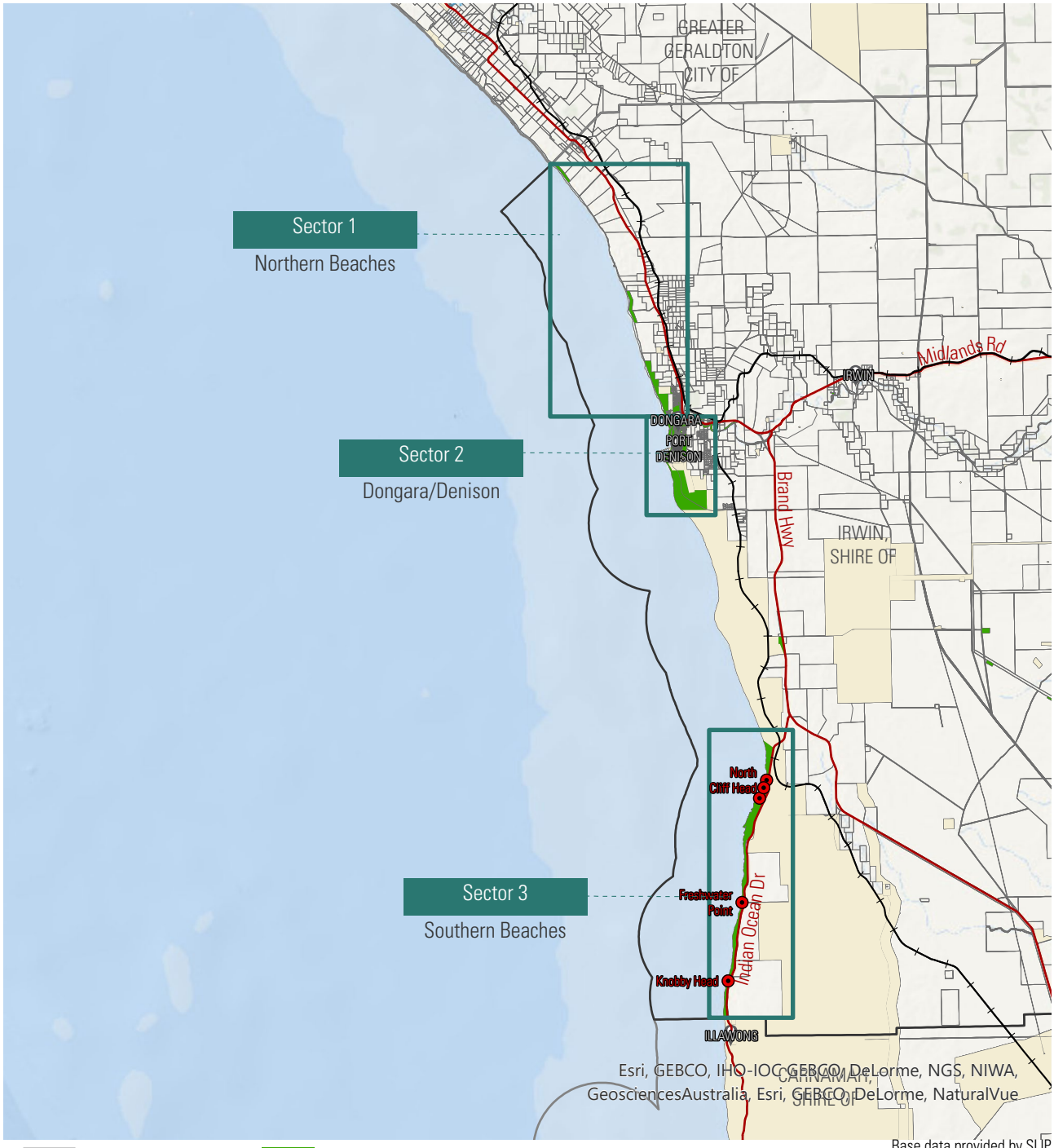
DWA, Geoscience Australia, Esri, DeLorme, NaturalVue

Base data provided by SLIP

Plan 1.1: Shire Context



Plan 1.2: Shire Overview



Plan 1.3: Coastal Sectors & Priority Sites

1.5 CONSULTATION MECHANISMS

A consultation program has been undertaken in mid 2019 to ascertain the views of coastal users and to seek comment from relevant Government agencies, based on a Stakeholder and Community Engagement Plan previously endorsed by Council. Specific consultation periods included:

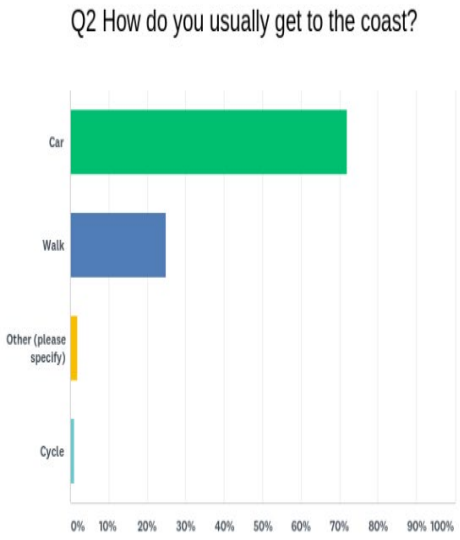
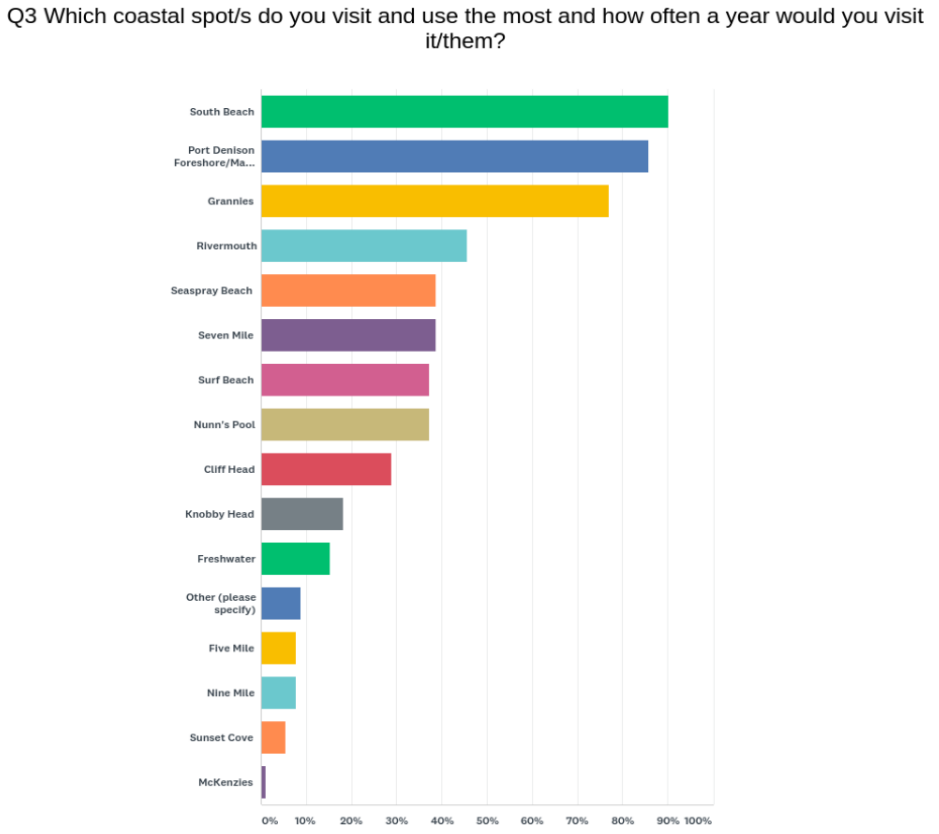
- Beach-user questionnaire and invitation to provide written comments at the commencement of the project
- Seeking comments and input relevant Government agencies and community groups to assist in identifying relevant issues and policy implications
- Advertising the commencement of the Study, the availability of a beach-user questionnaire and an invitation to the community workshop locally and online
- A community workshop held in October 2019 at Dongara to obtain input to the coastal management plan
- Release of the draft plan for public comment
- A community information evening at Dongara where the community could seek clarification on the plan prior to making a formal submission or comment.

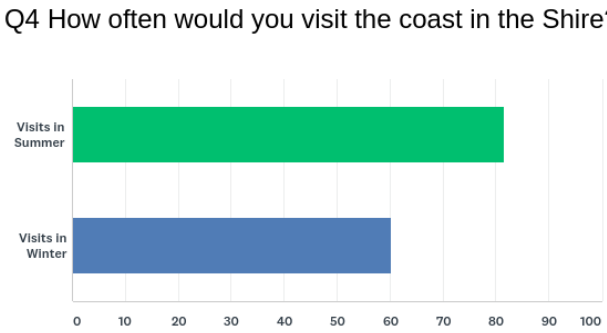
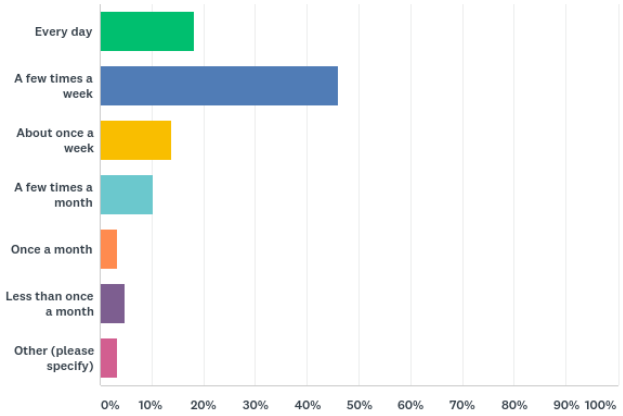
QUESTIONNAIRE

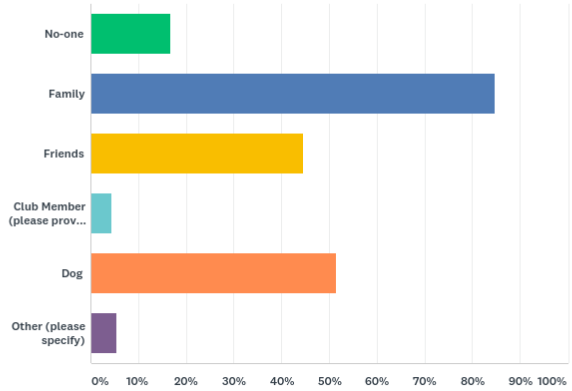
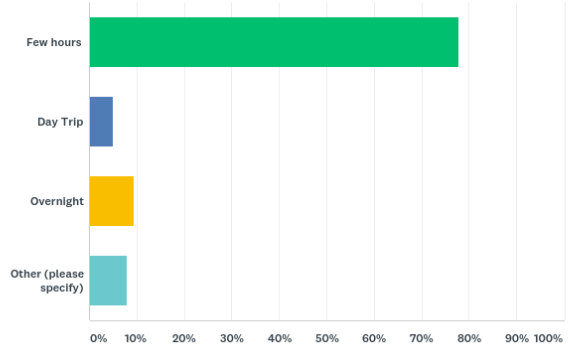
A coastal user survey was prepared and provided in both hard-copy paper form, and online. Over 200 responses were returned online, with approximately another 50 hard copies returned. A summary of responses received are provided in Table 1.1.

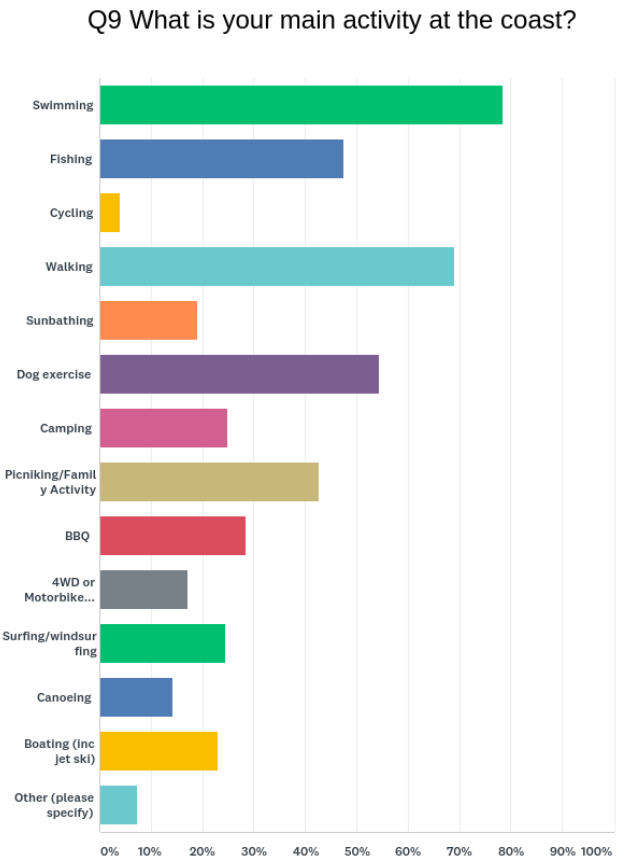
Table 1.1– Questionnaire summary

Question	Summary of Responses
Q1 What is the locality in which you permanently live?	

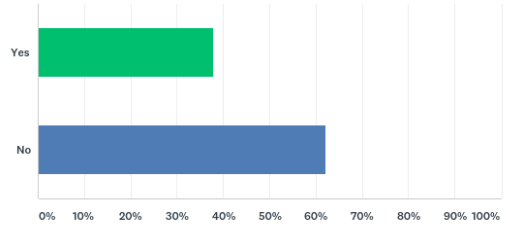
Question	Summary of Responses
Q2 How do you usually get to the coast?	
Q3 Which coastal spot/s do you visit and use the most?	

Question	Summary of Responses
Q4 How often would you visit the coast in the Shire?	
Q5 What are your preferred coastal spots (list up to 5, with the first coastal spot being the most preferred)?	
Q6 How often would you visit your preferred coastal spot??	

Question	Summary of Responses
Q7 Do you normally visit the coast with?	Q7 Do you normally visit the coast with: 
Q8 How long would you normally stay at your preferred coastal spot??	Q8 How long would you normally stay at your preferred coastal spot? 

Question	Summary of Responses
Q9 What is your main activity at the coast?	
Q10 What do you like about your preferred coastal spot? (i.e. why do you choose this spot over others?)?	

Question	Summary of Responses
Q11 What do you dislike about your preferred coastal spot?	
Q12 Is there anything you'd like to change about your preferred coastal spot?	
Q13 Are you concerned about the changing coastline in Dongara and Port Denison? If so, what are your main concerns? What would you do to manage your concerns?	The majority of responses to this question were concerned about the changing coastline, with a major focus on managing erosion. Suggestions included reviewing the impact of the groyne, and investigating further engineering options such as artificial reefs and additional groynes etc. To a lesser extent, concern was also raised regarding coastal management and inappropriate access to areas of the beach, and ensuring this is managed appropriately.

Question	Summary of Responses
Q14 Are you aware that the Shire has already prepared a Coastal Hazard Risk Management and Adaptation Plan?	Q14 Are you aware that the Shire has already prepared a Coastal Hazard Risk Management and Adaptation Plan? 
Q15 Dongara and Port Denison attract visitors throughout the year. Do you have any suggestions to make tourism along the coast a more positive experience?	A range of suggestions were made with a focus on improving access to coastal locations, improving low-key recreational facilities (such as trails, playgrounds, shelters, toilets and parking). Several respondents also suggested the use of planned activities to draw visitors to the coast - such as (for example) annual fishing competitions, market days, developing a fishing platform and the development of kayak/ snokelling trails). Futher advertising of the Shire's coastal assets should also be considered.
Q16 Do you have any other suggestions or ideas for improving coastal management within the Shire?	Several suggestions were made, with key themes being improving environmental management, improving and managing facilities (including the provision of new facilities for the community and visitors along the coast), managing ongoing erosion, and ensuring that the existing coastal values within the Shire are maintained.
Q17 Do you have any comments about any other coastal spots in the Shire?	Several suggestions were made, with key themes largely reflecting matters already addressed - including ongoing environmental management, management of tourism to the Shire (particularly caravan users at some coastal nodes), provision of facilities. It should be noted here that many respondents advised that, overall, the Shire of Irwin were doing a good job managing coastal areas.

COMMUNITY WORKSHOP

The Community Workshop for the Shire of Irwin's Coastal Management Plan was held on 14 October 2019, with twenty participants working together to address four key questions.

A total of 299 comments were generated and these have been collated and analysed to identify the key themes to emerge from the responses to each question which are highlighted below.

A separate report was produced summarising the outcomes of the workshop. This is attached at Appendix A.

COMMUNITY AND GOVERNMENT

Community and Government organisations will be invited to provide input to the Plan during the public advertising period.

PUBLIC REVIEW AND INFORMATION EVENINGS

The draft Plan will be released for public review, with written comments invited. A public information evening will also be held during the public review period.





2.0 management considerations

Key management considerations relate to general matters which frequently apply to the entire Shire of Irwin coastline. They have been identified from comments received from community consultation, meetings with the Shire, a review of literature and from site visits. Consideration of these issues is addressed in more detail throughout the document and form the basis for the development of management responses.

2.1 COASTAL TENURE AND OWNERSHIP

Fragmented land ownership can result in difficulties in achieving coastal management objectives and actions. While there are significant areas of the coast located within Shire-managed reserves, there are also significant areas of UCL and freehold land, interspersed with Reserves managed by State Government agencies. Fragmented and varied ownership can make coastal management difficult without agreement and cohesive decision making between all parties.

2.2 COASTAL HAZARDS

State Planning Policy 2.6 – State Coastal Planning Policy (WAPC, 2013) has been prepared since the 2000 Strategy and the Shire's CHRMAP was prepared in 2016, identifying sites with high risk coastal inundation and erosion and priority actions. Coastal sites which have been identified in the CHRMAP as high risk include Grannies Beach, Surf Beach and South Beach.

The CMP will include a framework to guide implementation of future on-ground management options at Grannies Beach and Surf Beach, including maintenance regimes and potential modification of assets to help achieve priority actions from the CHRMAP. The coastal hazard assessment will also review the flood modelling for the Irwin River and consider potential future risks at the Irwin River mouth.

2.3 ENVIRONMENTAL MANAGEMENT

Coastal environments are fragile and susceptible to damage from uncontrolled use. Degradation to the environment spoils the natural beauty valued by the community in these areas. It is important to ensure appropriate management of recreational land uses to reduce and mitigate environmental degradation. This is a particular issue if coastal use increases over time due to population growth and increased visitation.

Environmental degradation through uncontrolled access and vegetation destruction is not a significant issue within the Shire. Nevertheless, uncontrolled access, dune degradation and removal of vegetation should be discouraged and prevented where possible.

Coastal Erosion north of Grannies Beach

Photo by Land Insights, May 2019



2.4 ACCESS

Coastal access includes provision and maintenance of both vehicle and pedestrian access. It is important that access to the coast is provided (where appropriate) for professional and recreational pursuits. However, this needs to be balanced with the environmental protection of dunes and vegetation. Having more than one access track leading to and from the same site can lead to unnecessary disturbance to dunes, which can eventually lead to erosion and dune blowouts. This can be a particular issue during peak/busy times. One example is the informal dune access north of South Beach which provides access from Kailis Drive/George Street to White Tops Drive, essentially duplicating the bitumen road access already provided at this site.

Most vehicle access tracks along the Shire's coastline are well established and it doesn't appear that the duplicate or additional tracks are a particular issue (with the exception of the dune access track north of South Beach). Uncontrolled access and duplicate tracks should be discouraged where possible.

Pedestrian access to the coast is provided at the coastal sites within the town sites. Access at the low-key coastal sites north and south of the towns is provided through dedicated pedestrian and/or vehicle access tracks to the beach.

2.5 4WDS AND OFF-ROAD VEHICLES

There are two types of vehicles that drive on the beach, Road Registered Vehicles (RRV) and Off-Road Vehicles (ORV). RRVs are licensed vehicles which have the ability to be used off road. ORVs are unlicensed vehicles which can be used off road (such as quad bikes, dune buggies etc.). The Control of Vehicles (Off Road Areas) Act 1978 applies to land owned by the State of WA and areas designated by Local Government Local Laws for off road vehicles (unregistered) only. Registered Road Vehicles are managed under the Road Traffic Act 1978 and Local Government Local Laws. There are no official 'off-road areas' located in the Shire. This was investigated by the NACC and the findings are located in Off-Road Vehicle Areas in the Northern Agricultural Region of WA Feasibility Study). No off-road vehicle areas were identified in the Shire of Irwin.

Environmental damage occurs when vehicles are driven over the dunes and through vegetation without following designated or existing tracks. This leads to erosion and dune blowouts. The issue is exacerbated when multiple tracks are created and drivers leave their tyres at full pressure. It is a significant challenge managing vehicle use within coastal areas, particularly when driver behaviour differs. Other issues include the spread of dieback, disturbance to heritage sites and safety risks where other beach users are present. It is important that tracks are rationalised, drivers are educated and vehicle tracks avoid Aboriginal cultural heritage sites and historic heritage places.

ORV use does not seem to be a particular issue in the Shire of Irwin. Many of the ORV tracks are well established and uncontrolled access is not common. In addition, there are no mobile dunes within the study area, which are usually common locations for ORV use. The only dunes are located within Beekeepers Nature Reserve and this area is not included in this CMP study area.

Beach Access at Seaspray Beach

Photo by Land Insights, May 2019



2.6 POPULATION GROWTH AND DEMAND

Population growth and improved access to coastal sites can lead to increased visitor numbers and overnight stays. This in turn leads to greater demand for facilities and for management of impacts.

Population growth in the Mid-west region has intensified the demand for accessible coastal opportunities and leads to further growth in demand for recreational experiences. The construction of the Indian Ocean Drive helped to make much of the Irwin coastline (especially south of town) readily accessible to the general public. Anticipated pressures will be from recreational activities and overnight stays such as camping. In addition, the Shire is in close proximity to Geraldton and provides a regional escape without having to drive long distances.

2.7 PROVISION OF FACILITIES

Facilities can be provided at coastal sites where demand or management pressure warrants it. The types of facilities depend on the land use, but they generally relate to camping/caravanning and day use. Facilities such as shelters, picnic benches, BBQ areas, toilets, rubbish bins, wastewater dump points, etc. are common at coastal sites, depending on the level of use and demand.

Camping/caravanning is a popular activity in the Shire, particularly during peak holiday periods. The formal camping areas are located at North Knobby Head, Little Freshwater and South Cliff Head/Cliff Head/North Cliff Head. Day use sites are more common around the Port Denison and Dongara townsites. It is also noted that the Shire manages overflow camping at the Town Oval during peak periods when the caravan parks are full.

Some facilities are already provided at these locations. This will be reviewed as part of the CMP recommendations.

2.8 COASTAL SHACKS

Coastal shacks were once relatively common along the WA coastline. They largely served as accommodation for professional fishermen and were also constructed and used by people for recreational use. Coastal shacks still remain along the Irwin coastline south of Port Denison.

The State Government Squatter Policy, adopted in 1989, recognised that squatter shacks had been established in various (mainly coastal) locations around Western Australia. In summary, the policy:

- prevented the development of new illegal squatter shacks on reserved or Vacant Crown Land0F
- provided a 6-year grace period for existing shack owners/users to remain prior to their removal
- recognised that professional fishers would largely be exempt from the policy.

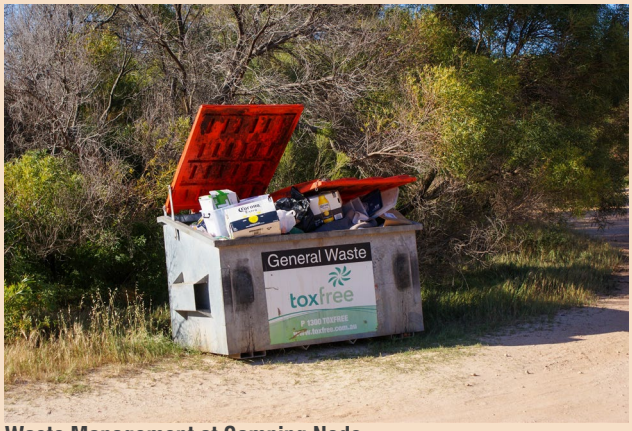
It was estimated that there were up to 130 coastal shacks across the Shire, whereas now only approximately 37 coastal shacks remain along Irwin's southern coastline (note that this number changes as shacks fall into disrepair or fall into the sea). These are used by professional fishermen.

Issues relating to coastal shacks include Shire liability (as they are located on Shire-manage reserves), clean up responsibility and costs (which also lie with the Shire) and equality of use (as they are located on publicly reserved land). It is the Shire's intention to have shacks removed in the longer term. Recommendations to this effect are provided in this CMP.

2.9 RUBBISH AND WASTE

Rubbish and waste (including human waste) is a common problem along the coast. If rubbish bins are not provided it is expected that coastal users take rubbish home with them and if bins are provided that they are used. Human waste is also an issue, especially where camping occurs, and no toilets are provided.

The Shire provides rubbish bins at popular coastal sites south of the towns and toilet facilities are also located at a number of sites. Coastal sites within the townsite are also equipped with rubbish bins and toilet facilities. The disposal of rubbish from bins is an ongoing cost to Council. Further provision of rubbish bins and toilets is considered as part of this CMP.



Waste Management at Camping Node

Photo by Land Insights, May 2019

2.10 MANAGEMENT OF CAMPING NODES

Camp managers can help ensure that vehicles remain on access tracks, manage where people camp, how many nights people stay, collection of fees (where required), control rubbish and creation of campfires (especially during prohibited periods).

There is an increasing requirement for camp managers at popular coastal sites around the State, especially in recent years after completion of the Indian Ocean Drive and the increasing population of the Mid-west. Currently the coastal camping sites south of town are managed by the Shire Community Ranger who visits these sites on an occasional basis. The Shire has also recently advertised for EOI for Patrol Officers.

2.11 HERITAGE

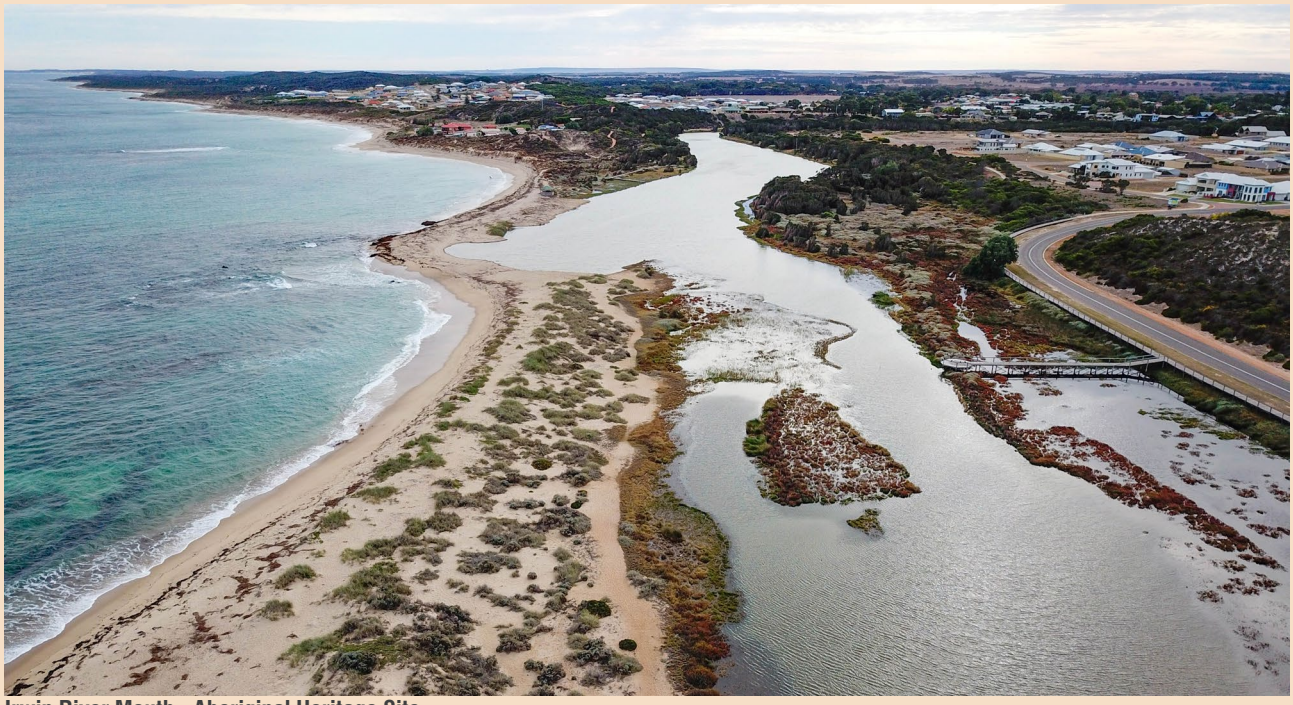
Coastal management will need to have regard for Aboriginal Cultural Heritage Sites and Historic Heritage Places identified by the Department of Planning, Lands and Heritage.

Registered Aboriginal Heritage Sites have been identified at the Irwin River. Other Heritage Sites have been located south of the Shire from the southern boundary to Cliff Head. There may be other non-registered Aboriginal Heritage Sites in the study area which can be identified through an Aboriginal heritage survey (if required).

2.12 COMMUNITY INVOLVEMENT

There is a need to continue and enhance community involvement in coastal management, particularly coastal landowners as well as user groups and community groups with an interest in coastal management issues. Involvement of the local community in coastal management will help lead to a greater sense of ownership and care of the coast. There are opportunities to create community coastal care groups and ways to involve the community more in its management.

While there are currently no active community groups or friends of groups dedicated to coastal management in the Shire, there is an opportunity to create groups, if the interest exists. There may be an opportunity to work with regional groups (such as NACC) in this regard.



Irwin River Mouth - Aboriginal Heritage Site

Photo by Land Insights, May 2019

3.0 strategic vision and objectives

The strategic vision for the study area is as follows:

> ***To manage the unique social, environmental and economic resources of the study area taking into account risk from coastal hazards, sea levels, bushfire and land use degradation.***

The objectives of the Coastal Management Plan are below. These have been developed through consideration of issues, opportunities, values and trends derived from consultation and the literature review.

- **Objective 1 – Identify current land uses, values and issues of the Shire's coastal land which may impact upon coastal management for the next 10 years.**
- **Objective 2 – To manage the environmental and recreational values of the coastline in order to retain the broad range of recreational opportunities, environmental values and sense of isolation unique to the area.**
- **Objective 3 – Consider risks, actions and recommendations from existing Shire plans and strategies.**
- **Objective 4 – To ensure management and protection of the Shire's coastline is undertaken in a sustainable manner.**
- **Objective 5 – To ensure adequate consideration of coastal hazards is undertaken and ensure management is undertaken in accordance with SPP 2.6 and associated guidelines.**
- **Objective 6 – To adequately consider future urban growth and tourism and the effects (both positive and negative) this may have on recreational use of the study area).**
- **Objective 7 – To retain, protect and enhance areas of historic value, places of cultural heritage significance within the study area.**
- **Objective 8 – To increase community awareness and participation in coastal management and maintain successful relationships between stakeholders and coastal users.**
- **Objective 9 – Provide an implementation plan that identifies management actions and sets priorities.**

4.0 land management and tenure

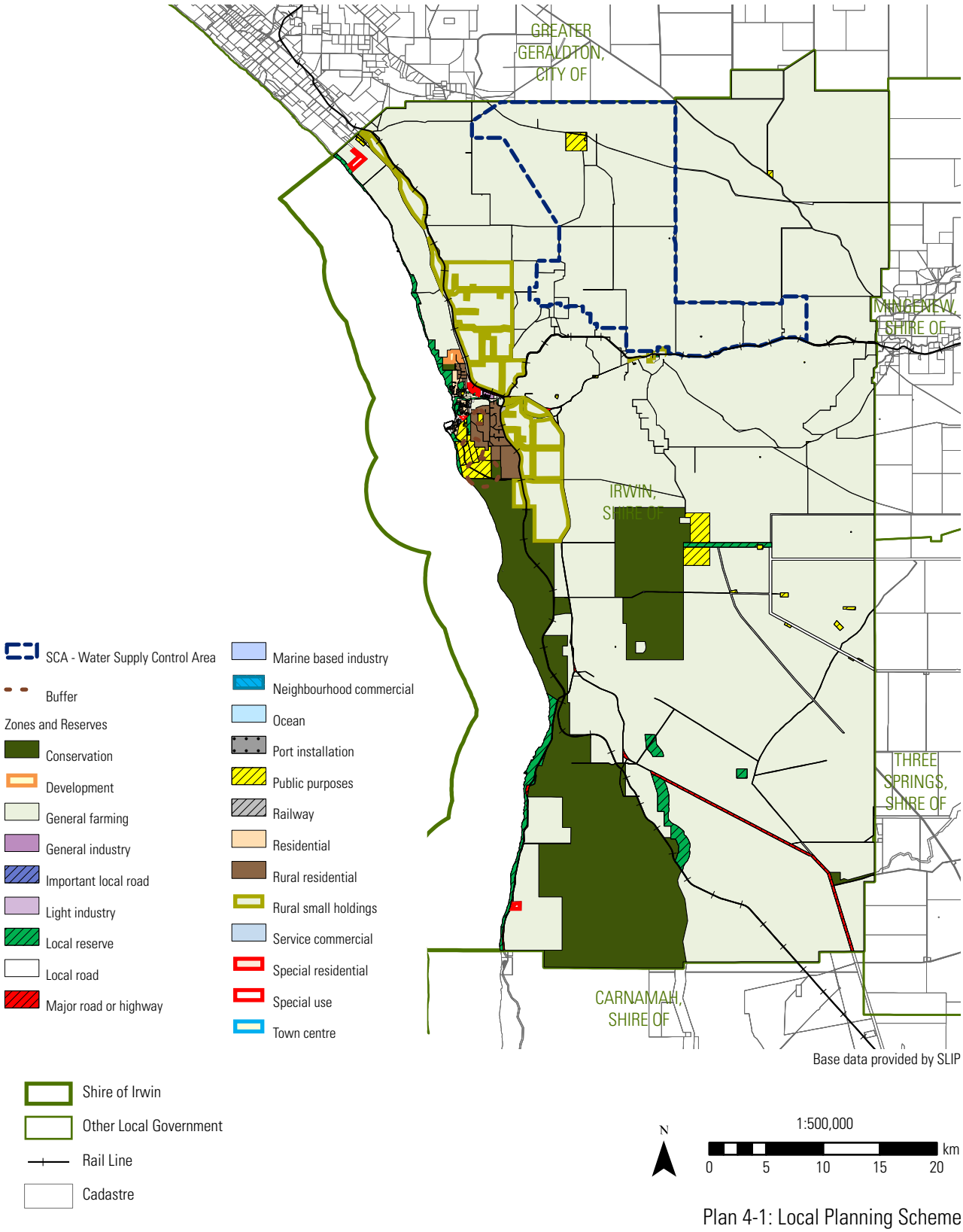
4.1 LOCAL PLANNING SCHEME

The Shire of Irwin Local Planning Scheme No. 5 (WAPC, 2008) identifies the following zones and reserves along the Shire's coastal areas.

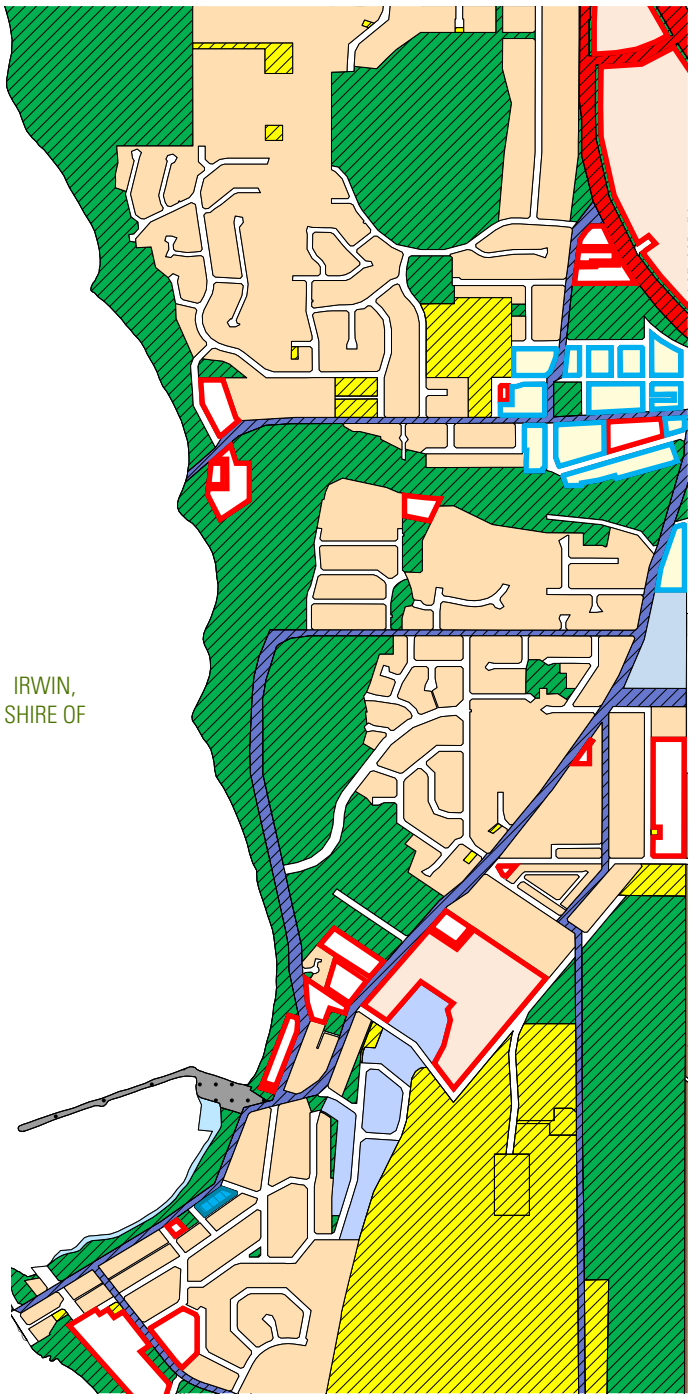
Table 4.1 - Local Planning Scheme summary

LOCATION	ZONE/RESERVE
Northern boundary to the Dongara townsite.	Coastal area is reserved as Local Reserve. Inland from the reserve the land is zoned General Farming.
Dongara and Port Denison townsite	Coastal area is reserved as Local Reserve. Directly south of Port Denison the coastal area is reserved as Local Reserve. Inland from the Local Reserve the land is reserved for Public Purposes (Airport and Common).
South of Port Denison to North Cliff Head	Reserved as Conservation for Beekeepers Nature Reserve.
North Cliff Head to the Shire's southern boundary	Coastal area is reserved as Local Reserve.

In addition to the above zones and reserves, the Scheme also designates some *Special Use* zones adjacent to the coastal areas which can impact on future use and management. These are listed in the table below. There are several areas zoned *Special Use* which allows for holiday accommodation and tourist uses and developments. Many are located in the Dongara and Port Denison townsite and two (SU1 and SU29) are located north and south along the coast respectively. It is noted that many of the *Special Use* zones will transition to *Tourism* zones as the new Local Planning Scheme is prepared.



Plan 4-1: Local Planning Scheme



Zones and Reserves

- General farming
- Important local road
- Local reserve
- Local road
- Major road or highway
- Marine based industry
- Neighbourhood commercial
- Ocean
- Port installation
- Public purposes
- Railway
- Residential
- Rural residential
- Rural small holdings
- Service commercial
- Special residential
- Special use
- Town centre
- Shire of Irwin
- Other Local Government
- Rail Line
- Cadastre

Base data provided by SLIP

N

1:25,000

0 0.25 0.5 0.75 1 km

Plan 4.2: Local Planning Scheme; Dongara/Pt Denison

Table 4.2 – Special Use Zones

LOCATION	NUMBER	SPECIAL USE PERMITTED USES
Wakeford Road, Bookara. Adjoining the northern boundary of the Shire.	Special Use 1	• Tourism and Recreation Resort compromising: • Resort Centre/Hotel/ Motel Accommodation (Licensed) • Clubhouse • Mediterranean (Seaside) Villas • Holiday Villas and Lake • Resort Shopping • Camping Area • Caravan Park • Horse Riding Farm • Dormitories • Function and Convention Centre • Resort Community Facilities • 18-hole Golf Course • Model Tourist Farm • Rural Pursuits • Incidental uses to the permitted uses.
Strata Lot 1, Church Street, Dongara	Special Use 6	• Caravan/Chalet Park • Camping Ground • Holiday Accommodation • Incidental uses to the permitted uses.
Lot 94 (reserve No. 25412) Church Street, Dongara	Special Use 7	• Holiday Accommodation • Incidental uses to the permitted uses.
Pt Sub Lot 48, Point Leander Drive, Port Denison	Special Use 12	• Public Restaurant • Holiday Accommodation • Tavern: provided it is incidental to the other permitted uses • Incidental uses to the permitted uses
Pt Sub Lot 49, Point Leander Drive, Port Denison	Special Use 13	• Caravan/Chalet Park • Incidental uses to the permitted uses.
Lot 915, (reserve no. 37184), Ocean Drive and Point Leander Drive, Port Denison	Special Use 14	• Aged persons village
Lot 946 (reserve no. 25826), Ocean Drive, Port Denison	Special Use 15	• Caravan/Chalet Park • Camping Ground • Incidental uses to the permitted uses.
Lot 947, Hampton Street, Port Denison	Special Use 16	• Eating House • Incidental uses to the permitted uses.
Lot 3000 (reserve no. 32182) Corner George and Carnarvon Street, Port Denison	Special Use 17	• Caravan/Chalet Park • Camping Ground • Incidental uses to the permitted uses
Lot 742, Corner Fletcher and George Street Port Denison	Special Use 18	• Aged persons village
Lots 53 and 54, Point Leander Drive, Port Denison	Special Use 28	• Hotel • Motel • Restaurant • Eating House
Portion of Lot 55, Indian Ocean Drive, Arrowsmith. Opposite North Knobby head, inland on Indian Ocean Drive	Special Use SU29	• Tourist Site, comprising: • Caravan Park • Chalet Park • Camping Area • Single House • Workforce Accommodation • Convenience Store • Restaurant • Incidental uses to the permitted uses

4.2 RESERVES

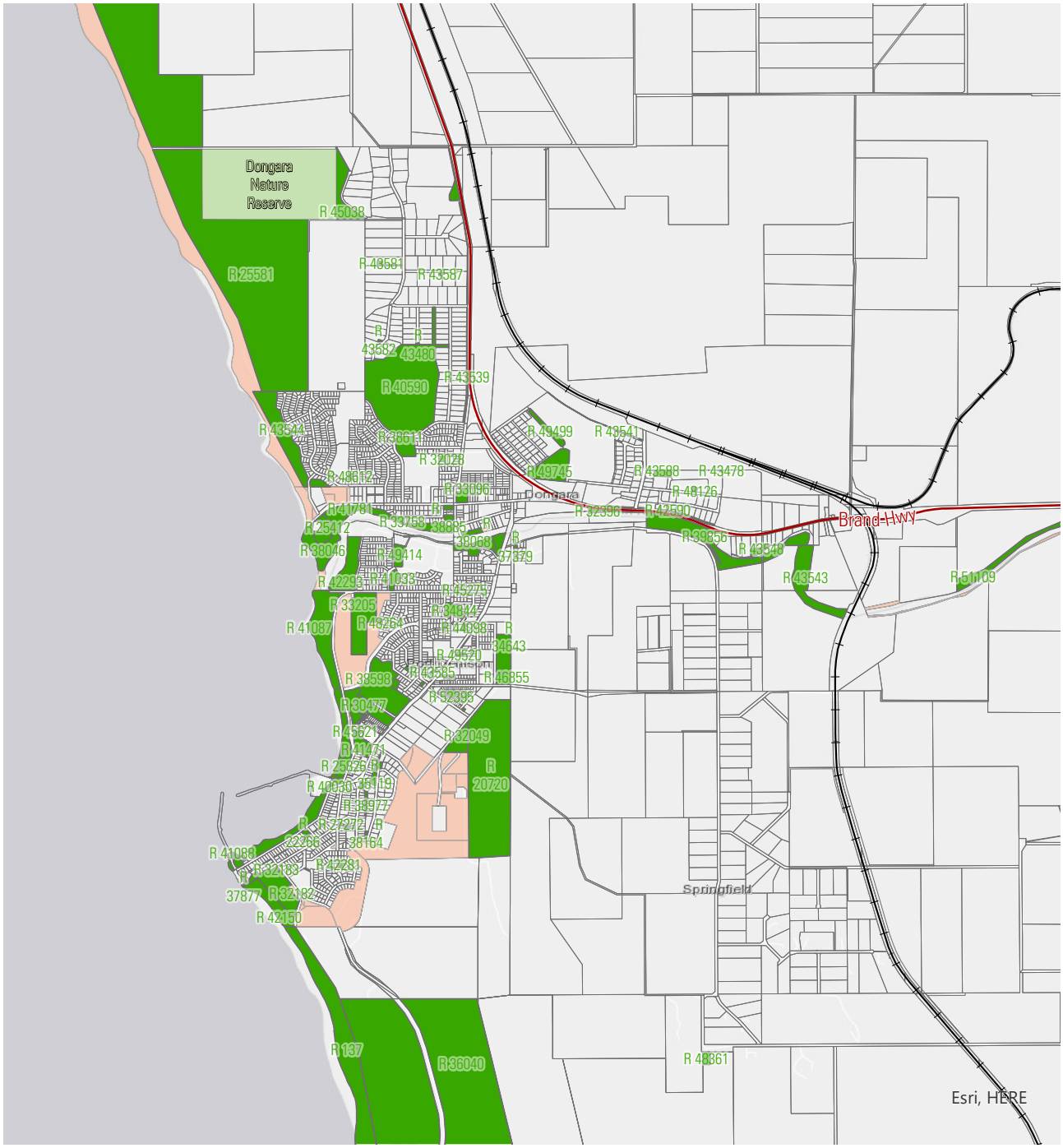
A reserve is Crown land that has been set aside for a public purpose as identified in a local planning scheme or reserved for public purposes as determined by the Land Act 1933 and the Land Administration Act 1997. It is a form of tenure of Crown land and is not an interest in land[1].

A description of all reserves along the coast is provided in the table below and a summary depicted on Plan 4.3. These are distant and separate from land reserved in the Shire's Local Planning Scheme as outlined in the previous section.

The Management Order attached to a reserve identifies the entity responsible for its management.



1 https://www0.landgate.wa.gov.au/for-individuals/Land-Transactions-toolkit/land-titles-registration-policy-and-procedure-guides/practice-manual/crown-land/res-01-crown-reserves



Base data provided by SLIP

State Road
Rail Line
UCL
DBCA Managed Land
Shire of Irwin Reserve
Cadastre

N

1:50,000

0 0.5 1 1.5 2 km

Plan 4.3: Reserves Overview - Dongara/Pt Denison

Table 43 - Reserves

RESERVE NO.	LOT NO.	PLAN NO.	LOCATION	PURPOSE	MANAGEMENT ORDER
43078	11982	P243167	Little Mexico to North Cliff Head	Parkland recreation and the letting of cottages existing thereon on 14/2/1994 ().	Shire of Irwin
39270	11560	187025	South of Freshwater Point	Navigation Beacon Site	Minister for Transport
24496	12174	P039607	Beekeepers Reserve	Protection of Flora	National Parks and Nature Conservation Authority
137	650	P401935	South of Port Denison	Common	Shire of Irwin
36040	12126	P219524	South of Port Denison – inland	Aerial landing ground (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands).	Shire of Irwin
42150	924	P190555	Port Denison	Recreation	Shire of Irwin
32182	3000	P46591	Port Denison	Camping and caravan park (with power to lease for any term not exceeding 50 years subject to the consent of the Minister for Lands).	Shire of Irwin
37877	917	P189498	Port Denison	Dune Protection	Shire of Irwin
41089	546	P216836	Port Denison – jetty	Harbour Purposes	Minister for Transport
41088	305	P042170	Port Denison	Recreation (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands).	Shire of Irwin
41088	307	P042170	Port Denison		Shire of Irwin
40029	581	P186882	Port Denison	Navigation Beacon Site	Minister for Transport
41088	306	P042170	Port Denison	Recreation (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands).	Shire of Irwin
41088	954	P036803	Port Denison		
41088	945	P221338	Port Denison		
41089	953	P036803	Port Denison	Harbour Purposes	Minister for Transport
40030	950	P221338	Port Denison	Foreshore Management	Shire of Irwin
40030	949	P221338	Port Denison		

RESERVE NO.	LOT NO.	PLAN NO.	LOCATION	PURPOSE	MANAGEMENT ORDER
46561	948	P221338	Port Denison	Recreation (with power to lease for any term not exceeding 5 years subject to the consent of the Minister for Lands).	Shire of Irwin
46561	947	P221338	Port Denison		
25826	946	P122138	Port Denison	Recreation camping and caravan park (with power to lease for any term not exceeding 30 years subject to the consent of the Minister for Lands).	Shire of Irwin
41087	590	P216835	Port Denison	Foreshore Management	Shire of Irwin
38046	300	P050241	Dongara	Recreation and foreshore management	Shire of Irwin
25412	94	P191394	Dongara	Caravan park (with power to lease for any term not exceeding 30 years subject to the consent of the Minister for Lands).	Shire of Irwin
43544	12053	P018271	Dongara	Public recreation	Shire of Irwin
43544	12053	P018955	Dongara		
43544	12361	P023156	Dongara		
43544	12815	P039794	Dongara		
43544	619	P053786	Dongara		
25581	2838	P109847	Dongara	Recreation	Shire of Irwin
25581	2838	P109847	North of Dongara		
25581	5949	P082780	North of Dongara		
39959	11735	P105495	Southern side of 7 Mile Beach	Public recreation	Shire of Irwin
39959	11735	P015495	Northern side of 7 Mile Beach		
34675	11222	D047687	Northern boundary of the Shire.	Public recreation	Shire of Irwin

4.3 UNALLOCATED CROWN LAND

Unallocated Crown land is not subject to any interest (apart from Native Title). It is not reserved and the Shire of Irwin (or other agencies) would hold a Management Order for the land.

There are large areas of Unallocated Crown Land (UCL) within the Shire. For the purposes of the Coastal Management Plan, the majority of this UCL is located in and around the coastal areas of Dongara and extends north along the beach to the Shire's boundary. The inclusion of beaches, often to a designated high-water mark, is common in Western Australia. Within the Shire, however, there are some areas where the UCL extends further inland over coastal dunes, and within Dongara there are several parcels of land that are within UCL.

There are a few parcels of UCL north of Seaspray Beach which will be committed under the Yamatji Nation Agreement to the Yamatji Land Estate. This process will take place over the next five years.

It should be noted that DBCA is responsible for the management (limited to fire, weeds and ferals) of unallocated Crown Land and un-managed reserves outside of gazetted townsites.

4.4 ACTIONS – LAND MANAGEMENT & TENURE

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
Relevant Objectives: • **Objective 1 – Identify current land uses, values and issues of the Shire's coastal land which may impact upon future coastal management for the next 10 years.** • **Objective 3 - Consider risks, actions and recommendations from existing Shire plans and strategies** • **Objective 6 – To adequately consider future urban growth and tourism and the effects this may have on recreational use of the study area**			
LMT1	Consider acquiring management orders for portions of UCL currently being used for recreation, such as the UCL at Seven Mile Beach (discussed in Chapter 9) and a portion of UCL at the Irwin River mouth (discussed in more detail in Chapter 10).	S-M	Shire of Irwin
LMT2	Undertake a Land Rationalisation Strategy to review freehold (Shire-owned), reserved land (Shire Management Order) and UCL to ensure appropriate land is set aside for coastal reserves, with appropriate purposes and options for leasing as required.	M-L	Shire of Irwin
LMT3	Update the Shire's Local Planning Framework to reflect contemporary coastal management requirements, ensuring that public access to beach/foreshores is maintained, appropriate coastal setbacks are implemented, and appropriate development controls are in place.	O	Shire of Irwin
LM4	Investigate opportunities for more formal disabled access when facilities are provided. Ensure universal access and inclusion planning is considered when designing and implementing the actions recommended in this Strategy and that the Shire's Access and Inclusion Plan (2012-2017) is referred to.	O	Shire of Irwin

5.0 heritage

5.1 ABORIGINAL CULTURAL HERITAGE SITES

The Irwin area boasts natural resource assets that are of high cultural and environmental value to Aboriginal people. These values must be recognised and appreciated for the effective management of the country. The aspirations, issues and needs of indigenous people for managing sea and country need to be considered. These vary between cultural groups in accordance with traditional Aboriginal lore and customs and therefore all relevant groups must be effectively engaged in any works arising from this plan.

Land use or development that may impact upon a heritage site is required to obtain the consent of the Minister under section 18 of the Aboriginal Heritage Act 1972. The Section 18 process involves giving notice to the Aboriginal Cultural Material Committee (ACMC) accompanied by the information as to the intended use of the land and Sites on the land. The Aboriginal Heritage Directorate recommends that developers undertaking activities within the study area take into consideration the DPLH's Aboriginal Heritage Due Diligence Guidelines (DPLH, 2013) when planning. The guidelines have been developed to assist proponents to identify any risks to Aboriginal heritage and to mitigate risks where heritage sites may be present. Due diligence may involve one or more of the following actions (note that the below list is an excerpt from the Due Diligence Guidelines):

a) *assessing the landscape where an activity is to take place*
b) *assessing the proposed activity and the potential impact on the landscape*
c) *searching the Register of Aboriginal Sites and the Aboriginal Heritage Inquiry System*
d) *consulting with the relevant Aboriginal people*
e) *agreeing to an Aboriginal heritage survey*
f) *other heritage management strategies.*

A search was undertaken of the Aboriginal Heritage Inquiry System for Registered Heritage Sites, Other Heritage Sites and Heritage Surveys throughout the study area (DPLH, 2019a). No Registered Aboriginal Sites are listed north or south of Port Denison/Dongara. Three Registered Heritage Sites are mapped along the Dongara coast. The details are provided in the table below. Heritage sites in Dongara/Port Denison are shown on Plan 5.1.

Table 5.1 - Registered Heritages Sites

SITE NAME	ID	SITE TYPE	LOCATION
Leander Point Denison	5280	Artefacts/scatter, midden/scatter	Southern side of the Irwin River, adjacent to Grannies Beach and Surf Beach.
Dongara	5632	Man-made structure	Northern side of the Irwin River – not located along the coast.
Irwin River (SC04)	18907	Historical, mythological, camp, natural feature, water source	Irwin River and surrounds.

A search was also undertaken for Other Heritage Places along the Irwin coast. Other Heritage Places in the Shire are listed in the table below.

Table 5.2 – Other Heritage Places

SITE NAME	ID	SITE TYPE	LOCATION
Irwin River	5918	Skeletal Material/ Burial	Along the Irwin River, inland from the coast.
Cliff Head	5574	Skeletal Material/ Burial	South of Cliff Head
Eneabba West	15297	Ceremonial, fish trap, camp, water source, other: track	Includes the coastal area from Cliff Head to the Leeman (south of the Shire).

The Other Heritage Place 15297 (Eneabba West) acknowledges the opportunity for Aboriginal heritage to be found along this stretch of the coast. Any development within this part of the coastline will need to undertake further investigations and consultation in accordance with the *Aboriginal Heritage Act 1972*.

NATIVE TITLE CLAIMS

It is also noted that the study area is subject to Native Title claims with the *Southern Yamatji* claim was registered with the National Native Title Tribunal in October 2017. The Yamatji Nation Agreement will establish a Yamatji Land Estate, which will consist primarily of existing unallocated Crown land (UCL) and unmanaged reserves that will be transferred to the Yamatji people over approximately the next five years. The Shire of Irwin is wholly within the Yamatji Nation Agreement Area. It should be noted that in February 2020, the Federal Court made a determination of Native Title. The Yamatji Nation Agreement outlines how Native Title rights and interests will be dealt within the Agreement Area. The determination will take effect upon the conclusive registration of the Yamatji Nation Agreement which will occur in the near future. The effect of the determination is that native title will be recognised and then surrendered over the majority of the Agreement Area.

It will be necessary to consult with relevant Native Title claim groups and their representative body (YMAC) to ensure appropriate consideration is given to the rights and interests of Traditional Custodians, including heritage matters. Compliance with the procedural obligations of the Native Title Act 1993 (Commonwealth) shall be required.

The implications of the Agreement on the Shire's Coast are still being reviewed and will be considered by the Shire as further information becomes available.



State Heritage Register: Two Obelisks and Commemorative Plaques

Photo by Land Insights, May 2019

5.2 HERITAGE PLACES

A search of the Heritage Places database was undertaken and the results are listed in the table below (DPLH, 2019b). Some sites are outside of the study area but located in close proximity to coastal areas. A majority of the historic heritage places are located within Dongara and Port Denison. No historic heritage places are listed along the remainder of the coastline, except for a few farmhouses located further inland.

Only one historic heritage place (the Obelisk and Commemorative Plaque) is listed on the State Register. The remainder of the places are listed on the Shire Local Heritage List. The Shire is currently in the process of reviewing the Local Heritage List. It is anticipated that this will be finalised in the near future. Heritage sites in Dongara/Port Denison are shown on Plan 5.1.

Table 5.3 - Historic Heritage Places

SITE NAME	PLACE NUMBER	DESCRIPTION	LISTING	LOCATION
Nhargo Farmhouse	01220	Nhargo Farmhouse has historic significance given its connection to the settlement of the Irwin District and the Waldeck family.	Register of National Estate Municipal Inventory – Category 2	South of Seven Mile Beach
M. G. Kailis Crayfish Factory	11831	The Kailis Crayfish processing plant was built in 1959-60 by Yama Pty Ltd. The original brick and asbestos building was demolished in 1996. The factory has several gable roofed buildings. The office is a single storey building, painted grey with fibro infill to the gable end and the corporate logo. The factory consists of two adjoining gable buildings with a loading dock to the north. Significant in contributing to local character.	Municipal Inventory – Category 5	4 Bradley Street, Dongara. East of Seaspray Beach.

SITE NAME	PLACE NUMBER	DESCRIPTION	LISTING	LOCATION
Irwin River Mouth	12480	Sited between the townsites of Dongara to the north and Port Denison to the south, the Irwin River Mouth is an attractive location. The Irwin River Mouth has high historic significance, given its connection to the establishment of the first port and harbourmaster's house dating from the early 1850's and the wreck of the Albatross. The area has high aesthetic significance, and as such makes a high contribution to the character of the area. The area has high social significance given its aesthetic qualities and the high use of the walk trails for recreation by the community.	Municipal Inventory – Category 1B	Irwin River and river mouth.
Arurine Bay	11866	Arurine Bay has high historic significance given it contains several shipwrecks. The place also has high aesthetic significance for its beaches, adjacent reserves and reefs. Its pristine condition and high biodiversity gives the place high scientific significance.	Municipal Inventory – Category 5	Port Denison harbour
Irwin District Recreation Centre	11876	The Irwin Recreation Centre has social significance given its role as a centre of sports and social activities in the district.	Municipal Inventory – Category 5	Adjacent to Surf Beach
Denison Bowling Club	11870	The Denison Bowling Club has social significance given its role as a centre of sport and entertainment in the district.	Municipal Inventory – Category 5	Adjacent to Surf Beach
Denison Caravan Park	11864	The Denison Caravan Park has social significance for its use as a holiday destination since 1961.	Municipal Inventory – Category 5	Adjacent to Grannies Beach
Fishing Boat Harbour	11863	The Port Denison Fishing Boat Harbour has high historic significance given its connection to the development of sea transport and the cray fishing industry. Further, the place has social significance given its use as a place of recreation and its recognition as a landmark. The place also has high scientific significance given its high biodiversity.	Municipal Inventory – Category 5	Port Denison Harbour

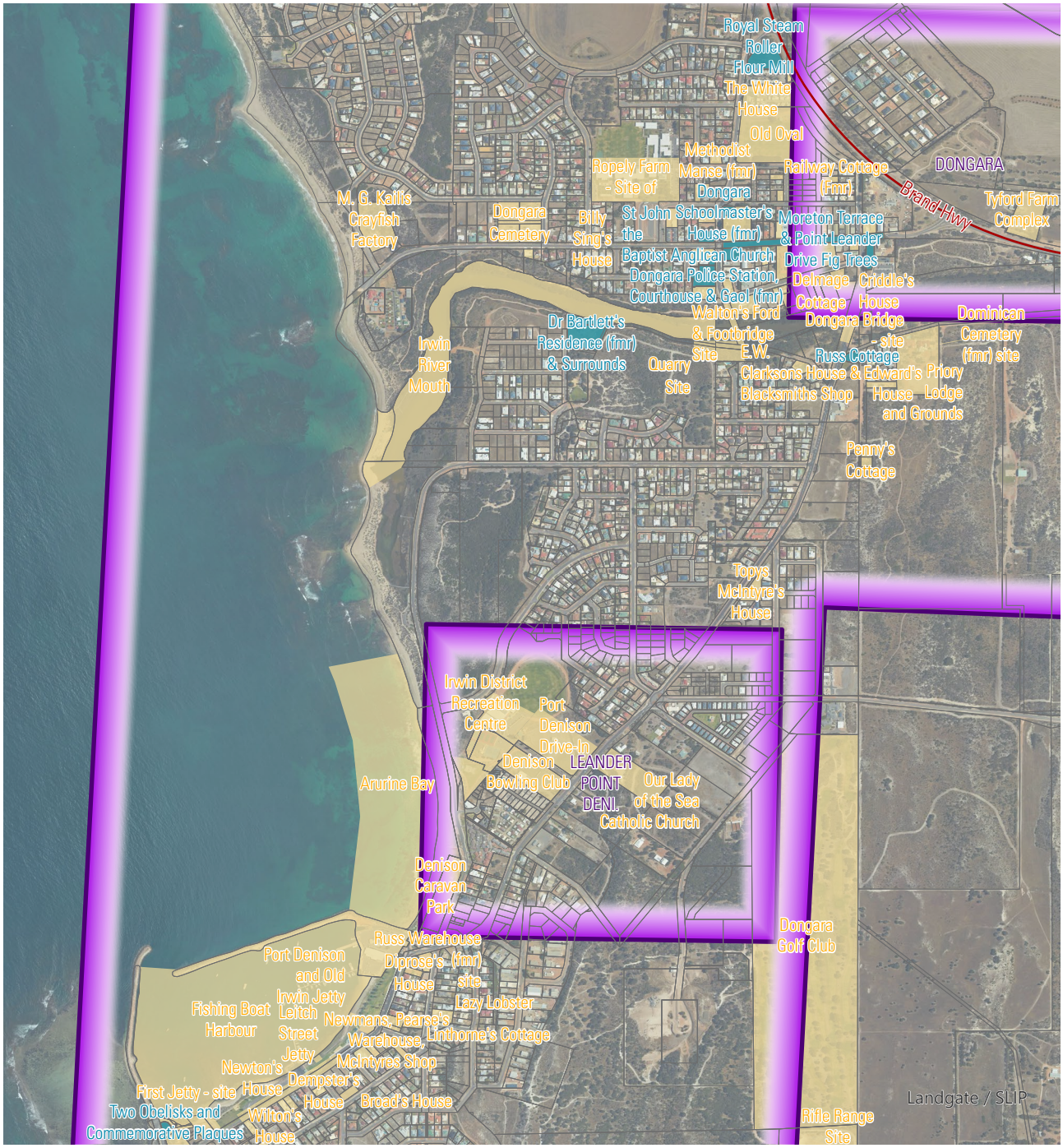
SITE NAME	PLACE NUMBER	DESCRIPTION	LISTING	LOCATION
Leitch Street Jetty	11858	This jetty was built in 1959 in conjunction with the opening of the first Dongara crayfish processing plant. The Leitch Street jetty had historic significance given its connection to the development of the cray fishing industry in the district and the other jetties.	Municipal Inventory – Category 4	Port Denison Harbour
Port Denison and Old Irwin Jetty	01241	The William Street jetty has historic significance given its connection to the development of sea transport in Port Denison and the other jetties. All that remains of this jetty are some pylons and cross members.	Register of National Estate Municipal Inventory – Category 2	Port Denison Harbour
Russ Warehouse	11842	A small cottage built in 1888. It was destroyed in the floods of 1971. The place has historic significance for its connection to the Absolom Russ a noted ship owner of the district.	Municipal Inventory – no category	Port Denison Harbour
Diprose's House	11843	This house was built by W. H. Linthorne in c.1920s for use as a holiday house. This house has historic significance for its connection to W. H. Linthorne, a local builder, however it has been considerably altered.	Municipal Inventory – Category 5	Port Denison Harbour
Lighthouse Keepers Cottage	11845	This house was built for the harbour master and lighthouse keeper, John Smyth just before his death in 1886. The site of the Lighthouse Keeper's Cottage has historic significance given its connection to the establishment of the harbour, and its association with harbourmaster Hughes and early sea transport in the Irwin District.	Municipal Inventory – Category 4	Port Denison Harbour
Site of the Fishermen's Hall	04046	The former Custom and Excise Shed (Bond Store) was built in 1894 of timber frame and corrugated iron cladding. The former Bond Store has historic significance given its connection to the development of sea transport in the district, especially the remnants of the nearby second jetty. It also has social significance for its connection to the Dongara Professional Fishermen's Association.	Municipal Inventory – Category 4	Port Denison Harbour

SITE NAME	PLACE NUMBER	DESCRIPTION	LISTING	LOCATION
Foster's House	11844	This cottage, which was known as "Linga Longa", was built by E. Fields in c.1930. The house known as Linga Longa has historic significance for its connection to the Fields family. It is a good example of a holiday house used in Port Denison prior to World War II.	Municipal Inventory – Category 4	Port Denison Harbour
Newmans, Pearse's Warehouse, McIntyres Shop	11846	Originally this was the site of Edward Newman's and Francis Pearse's Warehouse, a weather board and shingle building constructed in 1868. Has historic significance for its connection to the development of Port Denison as a port and later as a holiday destination.	Municipal Inventory – Category 4	Port Denison Harbour
Knowler's House	11848	This house was built in the 1930s by George Knowler. The house known as Knowler's has historic significance for its connection to the Knowler family who were well known in Port Denison and contributes to the local character.	Municipal Inventory – Category 5	Port Denison Harbour
The Port Store	11847	This large limestone building was built in 1868 as a warehouse for S. F. Moore. Has historic significance given its connection to Port Denison as a port and a later as a holiday destination.	Municipal Inventory – Category 4	Port Denison Harbour
Moreton Bay Fig Trees, site of Tennis Courts and Bush Shelter	18093	The eastern boundary of the harbour is lined with 14 Moreton Bay Fig trees. Has historic significance given the connection to the development of Port Denison as a holiday destination from the 1920s and the use of the area for public bathing from 1911.	Municipal Inventory – Category 3	Port Denison Harbour
Dempster's House	11851	Has historic significance for its connection to the Dempster family. The place was a good example of a simple fibro cottage of its era. Demolished in 2003.	Municipal Inventory – Category 4	Port Denison Harbour
Leitch's House	11852	Two semi-detached houses were built by Alec Leitch in the c.1930s for rental in the summer holidays.	Municipal Inventory – Category 5	Port Denison Harbour
Newton's House	11853	This cottage has been divided into two units. It was built c.1930s as a holiday home for Newtons, a farming family.	Municipal Inventory – Category 5	Port Denison Harbour
Money's House	11855	This house was built for Frank Money, fisherman, c.1930s of corrugated iron and cement brick.	Municipal Inventory – Category 5	Port Denison Harbour

SITE NAME	PLACE NUMBER	DESCRIPTION	LISTING	LOCATION
First Jetty – site	11857	The first jetty was built in 1865 by Ben Mason and was sited at the end of Herbert Street. Has historic significance given its connection to the development of sea transport in Port Denison and the later jetties.	Municipal Inventory – Category 4	Port Denison Harbour
Two Obelisks and Commemorative Plaques	01242	Situated on a small hill there is an obelisk of random rubble construction with a concrete render on a stone plinth, that together stands approximately 6.8 metres; four plaques fixed to the west, north and south sides of the obelisk; and, a plaque attached on a separate random limestone structure indicating the location of several ship wrecks. the site has historical significance for its association with the early development of sea transport at Port Denison and is a rare historical component dating from the early days of the settlement at the Irwin River (c.1860s)	Register of the National Estate. Municipal Inventory – Category 1A.	Port Denison Harbour
Dominican Retreat	11856	Built in the c.1930s as a coastal retreat for the Dominican Nuns who were working inland and in the Goldfields region. Has historic significance for its connection with the Dominican Order in Dongara.	Municipal Inventory – Category 5	Port Denison Harbour

The shacks located south of Dongara/Port Denison are not currently listed as historic sites. There may be an opportunity for the Shire to recognise the history of the coastal nodes at some point.

It is noted that the Shire is currently reviewing its herlitage list, which may result in changes to the content of Table 5.2 once adopoted.



Base data provided by SLIP

State Road

Registered Aboriginal Heritage Site

State Heritage Register

Cadastre

Municipal Inventory

N

1:20,000

m

0 250 500 750 1,000

Plan 5.1: Heritage Overview; Dongara & Pt Denison

5.3 ACTIONS – HERITAGE

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
Relevant Objective: • **Objective 1 – Identify current land uses, values and issues of the Shire's coastal land which may impact upon future coastal management for the next 10 years.** • **Objective 7 – To retain, protect and enhance areas of historic value and places of cultural heritage significance within the study area**			
H1	Continue to liaise with local Aboriginal representatives to ensure a culturally sensitive approach to recreational activities and the provision of visitor amenities within the study area.	O	Shire of Irwin, DPLH, YMAC, Native Title claim groups
H2	Encourage involvement of Aboriginal persons in coastal management through engagement, consultation and employment /volunteering where possible.	O	Shire of Irwin, DPLH, YMAC, Native Title claim groups
H3	Consult with relevant Native Title claim groups and the Yamatji Marpla Aboriginal Corporation to ensure appropriate recognition and protection is given to relevant heritage sites.	O	Shire of Irwin, DPLH, YMAC, Native Title claim groups
H4	Establish interpretative signage at culturally/historically significant sites. Consult with Native Title claim groups and the Yamatji Marpla Aboriginal Corporation in preparing informative information.		Shire of Irwin, DPLH, YMAC, Native Title claim groups
H5	Undertake Aboriginal heritage surveys and assessments as required under the Aboriginal Heritage Act 1972, including but not limited to Section 18 assessment where required.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)

6.0 community involvement

6.1 COASTAL EDUCATION AND AWARENESS

Community involvement in coastal issues and management is beneficial as it creates a sense of ownership and helps to achieve better management outcomes. The Shire should work with other coastal land managers and adjoining landowners to support and encourage greater involvement in coastal management. Involvement of the wider community can also help to increase community knowledge of the coastal environment, and achieve community level behavioural change, which can result in increased care for the environment and a reduction in harmful activities.

Options that may assist in raising public awareness of coastal issues include:

- Support programs that involve the community such as beach clean-up days and school participation programs.
- Coastal Community Support Program – encourage and support voluntary individuals and groups who manage coastal areas.
- Coastal Training Programs – run short courses on coastal management through training organisations to educate a number of interested people on coastal issues and management.

6.2 COASTAL INFORMATION

Increasing the information available on the coastal environment will be beneficial in determining the scale of impacts and what should be done to manage the coast. The information which can be gathered includes visitor numbers, activities undertaken and nights staying/camping along the coast. More valuable information can be gathered over a greater period of time as further monitoring and research is undertaken.

The demographics of people visiting coastal sites is important in order to determine the scale of use and how much management is required to reduce impacts. The Shire should continue to monitor visitor numbers at North Knobby Head, Little Freshwater and South Cliff Head/Cliff Head/ North Cliff Head. It can also be beneficial to provide surveys or questionnaires to coastal users to help determine their expectations and experiences. In due course, this will help the Shire and other land managers plan for expected visitor numbers, provide suitable facilities and make appropriate decisions regarding management of coastal sites.

6.3 ACTIONS – COMMUNITY INVOLVEMENT

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
Relevant Objectives: • **Objective 4 – To ensure management and protection of the Shire's coastline is undertaken in a sustainable manner** • **Objective 5 – To ensure adequate consideration of coastal hazards is undertaken and ensure management is undertaken in accordance with SPP 2.6 and associated Guidelines** • **Objective 8 – To increase community awareness and participation in coastal management and maintain successful relationships between stakeholders and coastal users**.			
CI1	Support programs that actively engage the local community in managing coastal reserves e.g. school education programs, beach clean-up days.	O	Shire of Irwin
CI2	Provide opportunities for the community to be involved in rehabilitation, monitoring, facility and access management etc.	O	Shire of Irwin
CI3	Assist and encourage the community with forming "Friends of" groups.	S	Shire of Irwin
CI4	Liaise with land managers in the study area, (including DPLH and Native Claim groups and private landholders) to discuss and determine a level of commitment towards community involvement and education.	O	Shire of Irwin, DPLH, Native Title claim groups
CI5	Support an off-road and 4WD driver education program that focuses on providing information relating to safe off-road driving.	M-L	Shire of Irwin
CI6	Provide surveys and continue to communicate with the public and visitors to the Shire's camping areas and day-use sites in order to gauge visitor expectations and to help plan for provision of facilities and services.	O	Shire of Irwin

7.0 environment and landscape

7.1 CONTEXT

Coastal environments are highly dynamic and valuable ecosystems. They have significant biological value for the unique environments they provide for a range of native species. They also have economic value in terms of residential, tourism and recreational land uses. From a social perspective, coastal areas act as meeting places for families and friends and provide an opportunity for a range of recreational activities. It is important that environmental values are protected to ultimately cater for biological, social and economic values of the coast.

This chapter includes a discussion and summary of the environmental features and values within the study area including climate, coastal geomorphology, coastal processes, water resources, vegetation and fauna. The information is sourced from a variety of references including (but not limited to) the Shire of Irwin Coastal Development Strategy (Shire of Irwin and Landvision, 2000), Irwin River Estuary Management Plan (Land Insights, 2014) and the Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) (Shire of Irwin, 2016).

This Strategy aims to address the requirements of State Planning Policy 2.0 (SPP2) Environmental and Natural Resource Policy (WAPC, 2003) through the recommendations and strategies included below. The objectives of SPP2 and how the Strategy aims to address these objectives is addressed in the table below.

Table 7.1 – State Planning Policy 2 Response to Objectives

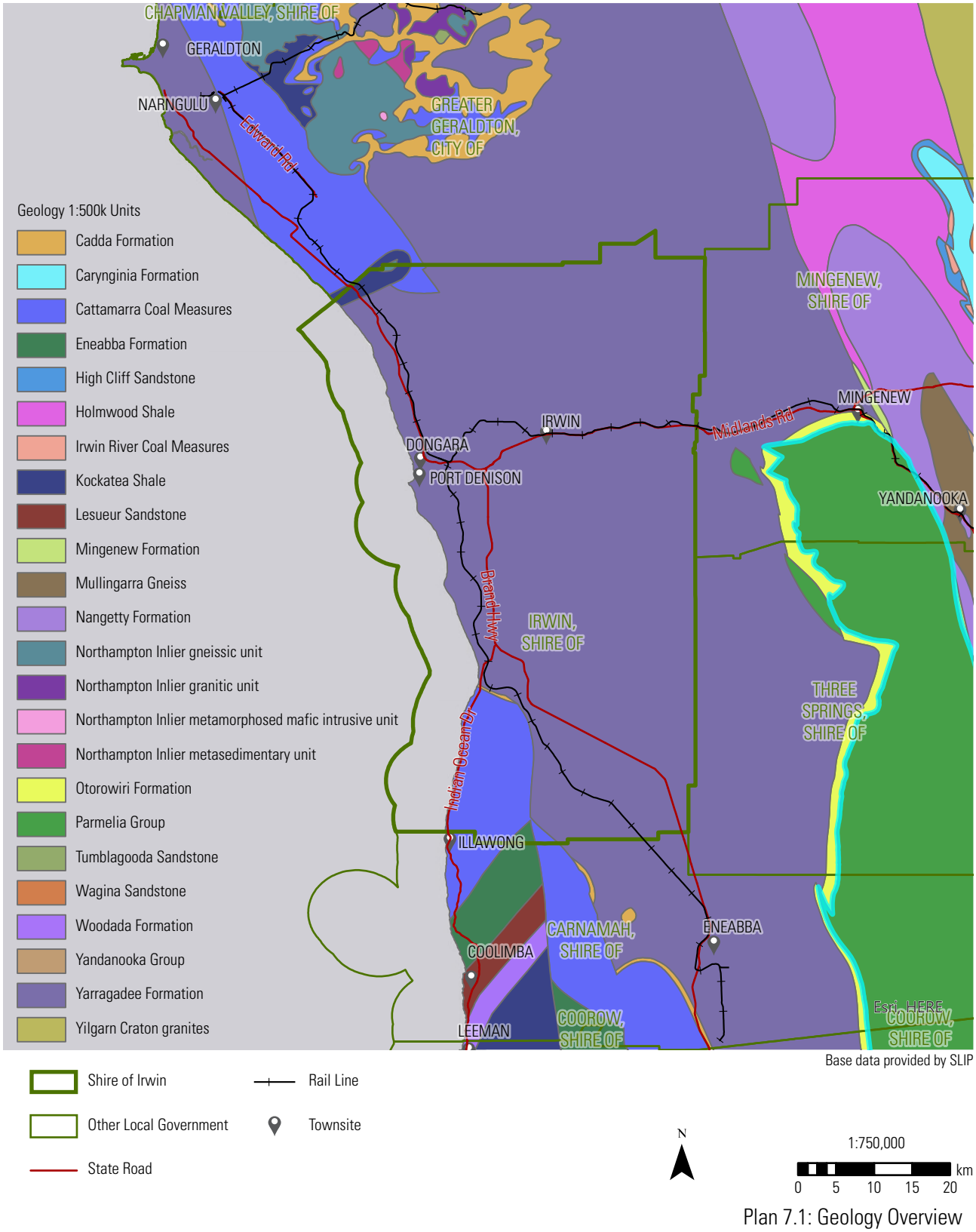
OBJECTIVE	RESPONSE
To integrate environment and natural resource management with broader land use planning and decision-making.	The strategies recommended in this Chapter consider protection, conservation and enhancement of the study area's natural resources and should be considered by decision-makers in future projects and actions along the coast.
To protect, conserve and enhance the natural environment.	The strategies recommended in this Chapter consider protection, conservation and enhancement of the study area's natural resources.
To promote and assist in the wise and sustainable use and management of natural resources.	Protection of the study area's natural resources through implementation of the strategies recommended in this chapter will assist with the sustainable use of the coast.

7.2 GEOLOGY AND SOILS

Tamala Limestone dominates the coast south of Cliff Head. The 1:2500000 state interpreted bedrock geology (DMIRS, 2019) describes the geology as *sandstone, minor siltstone and conglomerate; limestone in upper part; dominantly fluvial with marine transgression at top* (J-sz-PH). It is described by the 1:500 000 state interpreted bedrock geology (DMIRS, 2019) as *Cattamarra Coal Measures* (J-_cm-slh) *carbonaceous siltstone, shale, claystone, coal, sandstone* and a small area as Cadda Formation (J-_cd-sf) *grey shale, siltstone and sandstone; scattered carbonate lenses*.

The remainder of the coast is dominated by Quindalup sands which form extensive beach ridge deposits and fields of parabolic dunes which may overlie the beach ridges (Shire of Irwin and Landvision, 2000). The 1:2500000 state interpreted bedrock geology (DMIRS, 2019) describes the geology as *sandstone and siltstone, lesser limestone* (J-st-PH). It is described by the 1:500000 state interpreted bedrock geology (DMIRS, 2019) as *Yarragadee Formation* (J-_ya-st) *fine- to coarse-grained sandstone, thin shale interbeds*.

Geology is shown on Plan 7.1.



Plan 7.1: Geology Overview

7.3 LANDSCAPE

The natural landscape and topography enhance the natural beauty and contribute to the biological value of the coast. The landscape also provides an opportunity for recreational use and enjoyment of the coast. The varied landscape features along the coast include limestone hills and headlands, embayments and quiet low-lying sandy bays and parabolic dunes. The natural beauty of the coastline has encouraged access for day use activities and camping nodes.

Significant landscape features south of Beekeepers Nature Reserve include limestone hills and headlands (such as those at Knobby Head, Cliff Head and Freshwater Point) and embayments (such as those at Bee Hollow and Freshwater point). High parabolic dunes north of Cliff Head provide a striking landform feature (Shire of Irwin and Landvision, 2000).

The landscape and visual features of the coastline from north of Dongara to the northern boundary of the Shire is assessed as part of the *Dongara to Cape Burney Visual Landscape Assessment* prepared by Ecoscape in 2011. The study notes that the area lies within the *Geraldton Plain landscape character type* which is characterised by *rocky shorelines, exposed mobile dunes and shrub covered dunes across open alluvial flats and steep flat-topped ranges to the east.*

The dune system along the section of the coast from Dongara to Nine Mile Beach is described in the Assessment (Ecoscape, 2011) as having *no exposed sand areas on the dunes and a thick cover of coastal vegetation*. Some tracks and firebreaks are evident along fencelines of lots throughout the area. The coastal plain unit (inland from the dune system) from Wakeford Road to Dongara is described as generally being of rural character with some natural elements due to greater diversity in landform and natural vegetation. This section of the coast is within the Tamala South System which is *characterised by lowhills and rises with some limestone outcropping. As a result, the terrain of this landscape character unit is varied with several gently contoured basins or swales. These gentle swales are interspersed with areas that are undulating or contain low dunes and/or patches of remnant vegetation*.

7.4 CLIMATIC SUMMARY

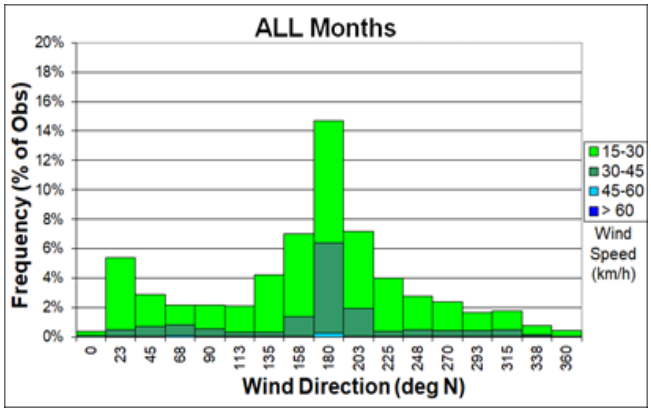
Information on climate was obtained from the Bureau of Meteorology from the nearest stations including Dongara (rainfall) and Geraldton Airport (temperature and winds). The average annual rainfall is 456.10 mm with most of the rainfall falling between May and August. Tropical cyclones occasionally bring heavy rains to the area. The average minimum and maximum temperatures throughout the year range from 13°C to 25.7°C. The coldest months are June to September and can reach 7.3°C and the warmest months are December to March and can reach 35.6°C (Bureau of Meteorology, 2019a).

Hot summers and extended periods of fine weather enhance the appeal of coastal living and recreation along the Irwin coastline. The mid-west coastline is also known for the intensity of sea breezes at this time of year..

The nearest automatic weather station from Geraldton airport (AWS 8315) has been used to provide an indication of winds (Figure 7.1). However, it is acknowledged that the station is located 8km inland, which will provide local modulation of regional winds. Specifically, inland stations tend to record lower peak wind speeds, with damping of onshore winds and typically a slight deviation of modal southwest and easterly wind directions. These biases vary within 30-60km of the coast, particularly due to the relative influence of land and sea breezes. e.g. from the coast to landward, the sea breeze declines within 5-15km, with the land breeze becoming increasingly dominant, but declining in strength further inland.

Without correction for the biases introduced by Geraldton Airport AWS's inland location, the wind record confirms a strongly southerly wind climate. This supports development of southwest wind waves and encourages northward wind-blown sand drift. The strongest observed winds typically occur from the west, associated with mid-latitude winter storms.

Figure 7.1 - Geraldton Airport AWS Wind Distribution (2011-2018)

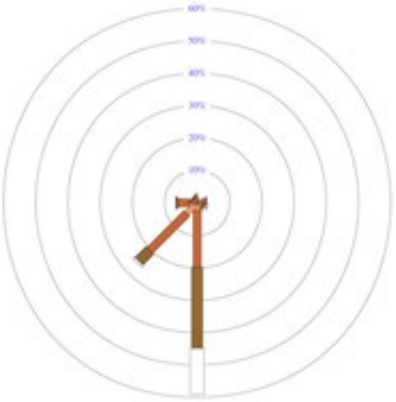


Wind roses for Geraldton Airport for summer and winter (am and pm) are provided below (Bureau of Meteorology, 2019b)

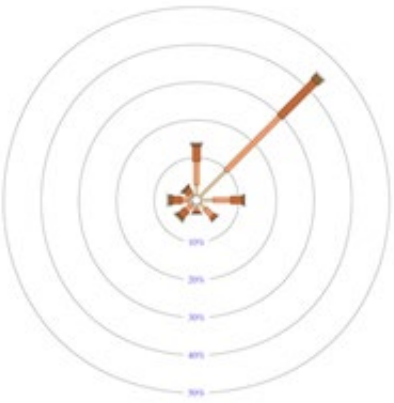
Figure 7.2 - Wind Roses



Geraldton - Summer am



Geraldton - Summer pm



Geraldton - Winter am



Geraldton - Winter pm

These wind roses have been constructed in the following way:

- The percentage of calm conditions is represented by the size of the centre circle - the bigger the circle, the higher is the frequency of calm conditions.
- Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Eight directions are used.
- The branches are divided into segments of different thickness and colour, which represent wind speed ranges from that direction. Speed ranges of 10km/h are used in these wind roses. The length of each segment within a branch is proportional to the frequency of winds blowing within the corresponding range of speeds from that direction.

(Source: http://www.bom.gov.au/climate/averages/wind/wind_rose.shtml)

7.5 VEGETATION AND FLORA

TERRESTRIAL VEGETATION

Coastal vegetation is an integral part of the coastal ecology and has an important biological function – it provides habitat for native fauna, stabilises dune and reduces erosion. Plant communities within the coastal environment are important as the vegetation reduces sand mobility and increases surface roughness, reducing wind velocities close to the ground and binding sand particles together (Peter Hammond and Associates, 2000). In general, a majority of the Shire coastline is well-vegetated and vegetation degradation is limited to areas of high use. At these sites, the focus of vegetation management is on reducing erosion and improving dune stability.

The vegetation and flora within the study area can be described from a variety of sources including the Shire of Irwin Coastal Development Strategy (Shire of Irwin and Landvision, 2000) and the Irwin River Estuary Coastal Management Plan (ATA Environmental and Shire of Irwin, 2005).

The Shire of Irwin coastline is located within the Geraldton Sandplains (GES) IBRA bioregion (Interim Biogeographic Regionalisation of Australia). The IBRA is a national planning framework used for spatial mapping of vegetation communities throughout the country. This bioregion is not listed as underrepresented in the National Reserve System (Department of Environment and Energy, 2019).

At a more local scale, pre-European vegetation mapping by Shepherd et al., 2002 (and mapped online by the DPIRD (2019)) shows a number of vegetation associations along the Irwin coastline as listed in the table below.

Table 7.2 – Pre-European vegetation system associations

LOCATION	NAME	STRUCTURE	DESCRIPTION
Beach areas south of North Cliff Head	Cliff Head_1026	Scrub-heath/ thicket	No description available.
Southern boundary to Freshwater Point	Cliff Head_432	Thicket	Wattle, casuarina and teatree Acacia-allocasuarina-Melaleuca alliance
Between Freshwater point and North Cliff Head	Cliff Head_255	Mallee	Eucalypt shrubland Eucalyptus eremophila, E. redunca, E. spp
North Cliff Head to Port Denison	Cliff Head_772	Heath	Low shrubs of mixed composition
Port Denison and Dongara	Greenough_17	Thicket	Wattle, casuarina and teatree Acacia-allocasuarina-Melaleuca alliance
North of Dongara to the northern boundary	Greenough_431	Scrub, open scrub or sparse scrub	Wattle, teatree and other species Acacia spp. Melaleuca spp.

Pre-European vegetation is shown on Plan 7.2.

Further detailed vegetation descriptions are provided in a number of other sources for certain areas along the coast. The vegetation along the southern coastal areas are described in the *Shire of Irwin Coastal Development Strategy* (Shire of Irwin and Landvision, 2000). The vegetation at the Irwin River Mouth is described by ATA Environmental and Shire of Irwin in the *Irwin River Estuary Coastal Management Plan* (2005).

SHIRE OF IRWIN COASTAL DEVELOPMENT STRATEGY

Vegetation between Little Mexico (southern end of the Shire) to North Cliff Head (south of Beekeepers Nature Reserve) is described in the Shire of Irwin Coastal Development Strategy (Shire of Irwin and Landvision, 2000). This description is below.

> *Vegetation communities can be broadly divided into three categories: strandline and foredune vegetation (growing immediately behind the beach), frontal dune and coastal heath of secondary dunes and the limestone ridge to the east.*
>
> *Vegetation of the foredune is dominated by the ephemeral species Cakile maritama and Salsola kali. These are the first species to colonise recently deposited sand at the back of the beach. These two species are found again on the frontal dune or the low beach ridge behind the foredune. Here, however, the perennials Spinifex longifolius, Tetragonia decumbens and Atriplex cinerea are generally dominant, with Nitraria billardieri also prominent in some locations. Other species noted here include Atriplex isatidea, Carpobrotus virescens, Spinifex hirsutus and Calocephalus brownii.*
>
> *Moving back into the western edge of the coastal heath, the shrubs Acacia rostellifera, Scaevola crassifolia and Olearia axillaris become prominent.*
>
> *Progressing further inland towards and onto secondary dunes and the limestone backslope, a wide range of secondary species are evident. This includes the species already mentioned together with the groundcovers and low-growing herbs Acanthocarpus preissii, Hemiandra pungens, Conostylis acculeata, Threlkeldia diffusa and Eremophila glabra, the shrubs Acacia cyclops, Anthcercis littorea, Myoporum insulare, Rhagodia baccata, Spyridium globulosum, Exocarpos sparteus, Melelauca huegelii, Melaleuca acerosa, Alyxia buxifolia and Templetonia retusa and the climbers Hardenbergia comptoniana, Clematis sp and Cassytha racemosa.*
>
> *On top of and immediately inland from the coastal escarpment from Bee Hollow northwards the endemic trees Eucalyptus obtusiflora and E. erythrocorys are prominent. These limestone endemics and their associated understorey are considered to be particularly significant, representing the only mallee formation outside of the mallee region of the south-east of the state.*
>
> *There are a number of introduced trees in the existing coastal sites. The most prominent are E. gomphocephala and Tamarix aphylla. E. platypus, E. camaldulensis, Callitris preissii and Olea europaea are also present.*
>
> *Between Cliff Head and Denison the vegetation of the foredune and frontal dune is similar to that to the south. Tetragonia decumbens, Cakile maritima and Salsola kali dominate the foredune while Spinifex longifolius, Tetragonia decumbens and Atriplex isatidea are prominent on the foredune.*

IRWIN RIVER ESTUARY COASTAL MANAGEMENT PLAN (IRECMP)

A Flora Survey was undertaken by ATA Environmental for the Irwin River Estuary Coastal Management Plan (ATA Environmental and Shire of Irwin, 2005). The Survey identified a number of different vegetation types along the river. Those located along the Irwin River mouth include the following:

- OaSILS – *Olearia axillaris and Spinifex longifolius (Beach Spinifex) Low Shrubland over Carpobrotus edulis with Tetragonia decumbens, Rhagodia baccata (Berry Saltbush) and Lycium ferocissimum (African Boxthorn) on sandy soils.*
- *AiHhLCS – Atriplex isatidea and Halosarcia halocnemoides (Shrubby Samphire) dominated Low Closed Shrubland on sandy soils.*
- *MPs – Persicaria decipiens over Sedgeland of Mesomelaena pseudostygia over Digitaria ciliaris (Summer grass) and Cynodon dactylon (Couch) with scattered Casuarina obesa (Swamp Sheoak) on clayey sandy soils.*
- *SuLCS – Suaeda australis Low Closed Shrubland with scattered Scaevola crassifolia, Tetragonia decumbens, Digitaria ciliaris (Summer grass) and Anthoceris littorea on sandy soils.*

The vegetation condition around the Irwin River Mouth was rated as 'Excellent' and 'Very Good' with an area on the southern side of the river classified as 'Degraded'. The reason for the degraded condition is due to the varying density of weeds throughout the area, which includes some of the more aggressive weeds such as African Boxthorn (ATA Environmental and Shire of Irwin, 2005).

Vegetation condition mapping is based on the criteria developed by Keighery (1994) and described in Bush Forever (Western Australian Planning Commission, 2000). The

descriptions are provided in the table below.

Table 7.3 - Vegetation condition criteria

CONDITION	DESCRIPTION
Pristine	No obvious signs of disturbance.
Excellent	Vegetation structure intact; disturbance affecting individual species and weeds are non-aggressive.
Very Good	Vegetation structure altered; obvious signs of disturbance.
Good	Vegetation structure significantly altered by obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration of vegetation structure, but not to a state approaching 'good' condition without intensive management.
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

IRWIN ESTUARY WEED MANAGEMENT PLAN (IEWMP)

The Irwin Estuary Weed Management Plan (IEWMP) (NACC, 2013) identifies the following vegetation communities at the Irwin River Mouth:

- Spinifex longifolius grassland
- Acacia rostellifera open heath
- Atriplex conerea and Tecticornia halocnemoides open low heath

The vegetation on the northern side of the river out is classified as 'Very Good' condition and the vegetation on the southern side of the river mouth as 'Excellent-Very Good' condition (refer to the Keighery vegetation condition table above).

The IEWMP identifies weed species and prevalence at the Irwin river mouth. South of Seaspray Caravan Park the plan identifies Pyp Grass, Wild Oats, Fountain Grass and Rhizomatous Grass. On the southern side of the river mouth the Plan identifies Rhizomatous Grass at a few locations along the estuary. These species are identified as high priority weeds and recommendations for removal are provided in the IEWMP.

MARINE VEGETATION

The Shire of Irwin Coastal Development Strategy (Shire of Irwin and Landvision, 2000) provides some comment on the marine vegetation. It states that in the near-shore waters adjoining the coast, there are a wide range of seagrass and marine algal communities which provide habitat and food resource for recreational and commercial fish stocks. Marine vegetation is also an integral part of the marine ecology and services an important biological function. Seagrass species include Possidonia sinuosa, P. australis, Amphibolus Antarctica, Eclonia radiata and Sargassum sp.

The following description is adapted from Peter Hammond and Associates, 2000 (Draft Irwin Coastal Plan Environmental Assessment and Management Recommendations).

There is a wide range of seagrass and macroaglal communities in the nearshore zone, ranging from stands of seagrass on sandy floor, through to mixed communities on rocky pavement interspread with sand patches, to algal communities on the reef. Seagrass meadows are protected by the offshore reef. Species along the Central Coast are listed below:

- Posidonia sinuosa
- Amphibolis spp
- Heterozostera tasmanic
- Ecklonia radiata
- Sargassum spp.

Seagrass meadows provide food and shelter for a variety of marine organisms including fish, crustacea and molluscs. They also provide a host for a variety of epiphytes and epizoa that are grazed extensively and are important for the protection they provide for juvenile fish and crustacea. This includes rock lobster which feeds and develops for approximately 4-5 years following hatching in seagrass and reef areas.

Detrital material from the macrophytes accumulates as drift rafts in the inshore waters and banks of wrack on the beaches. Wrack are found on many sheltered sandy beaches along the coast such as Cliff Head and south of Port Denison. It decays on the beach and can create an unpleasant smell for beach users. However, wrack has an important ecological role to play in the marine environment and in sustaining commercial and recreational fisheries. There is an important relationship between fish such as cobbler and the drifting rafts of macrophytes in the inshore waters. There is a direct correlation between the abundance of surf zone fishes and the volume of drift macrophytes in the inshore waters. Breakdown of wrack banks with changing tide and energy conditions triggers the release of nutrient and food to fish and other animals in the inshore waters.

Seagrass in the nearshore waters acts by slowing the water movement and trapping and binding sediments within the

seagrass meadows. Sediment trapping and growth of the seagrass banks thus contributes to wave attenuation and protects the shoreline.

THREATENED AND PRIORITY FLORA

The Biodiversity Conservation Act 2016 provides for species of native flora to be listed as Specially Protected, Threatened (Critically Endangered, Endangered or Vulnerable) or Extinct in Western Australia (DBCA, 2019a). The DBCA database currently records three occurrences of Priority 4 Flora along the Irwin coastline.

THREATENED COMMUNITIES

The DBCA (2019b) defines a Threatened Ecological Community (TEC) as an ecological community that is a naturally occurring group of plants, animals and other organisms interacting in a unique habitat. The Biodiversity Conservation Act 2016 provides for the listing of threatened ecological communities that need protection as Critically Endangered, Endangered, Vulnerable or Presumed Totally Destroyed in Western Australia (DBCA, 2019b). Additional ecological communities with insufficient information available to be considered a TEC, or which are rare but not currently threatened are placed on the Priority Ecological Community (PEC) list.

There are some TECs located along the Dongara coastline, at the Irwin River Mouth. A number of PECs are located along the northern coastline. No TECs or PECs are identified south of Port Denison.

7.6 FAUNA AND HABITAT

Peter Hammond and Associates (2000) states that there are 17 species of terrestrial mammals in the area including several species of Dunnart. The Western Grey Kangaroo, Honey Possum, Southern Bush Rat and Ash-Grey Mouse are all common. The bird life is rich and diverse. The heath vegetation provides habitats for fairy-wrens and honeyeaters. The salt lakes and wetlands are important summer refuge areas for waterbirds including Shelduck and the Banded Stilt. Reptiles in the area include tortoises, geckos, lizards, skinks and snakes.

In 1993 Griffin (Griffin, EA, 1993, Flora of the Quindalup dunes between Swan and Irwin Rivers, Western Australia. Unpublished report to the Coastal Planning Branch, Department of Planning and Urban Development and the Heritage Council of WA) undertook a study of the flora, formation and movement of coastal dunes in this region for the Department of Planning which remains very relevant today.

THREATENED FAUNA

The *Biodiversity Conservation Act 2016* provides for species, subspecies or populations of native fauna to be listed as Specially Protected, Threatened (Critically Endangered, Endangered or Vulnerable) or Extinct in Western Australia (DBCA, 2019c). The DBCA database records Threatened Fauna along the Irwin coastline as follows:

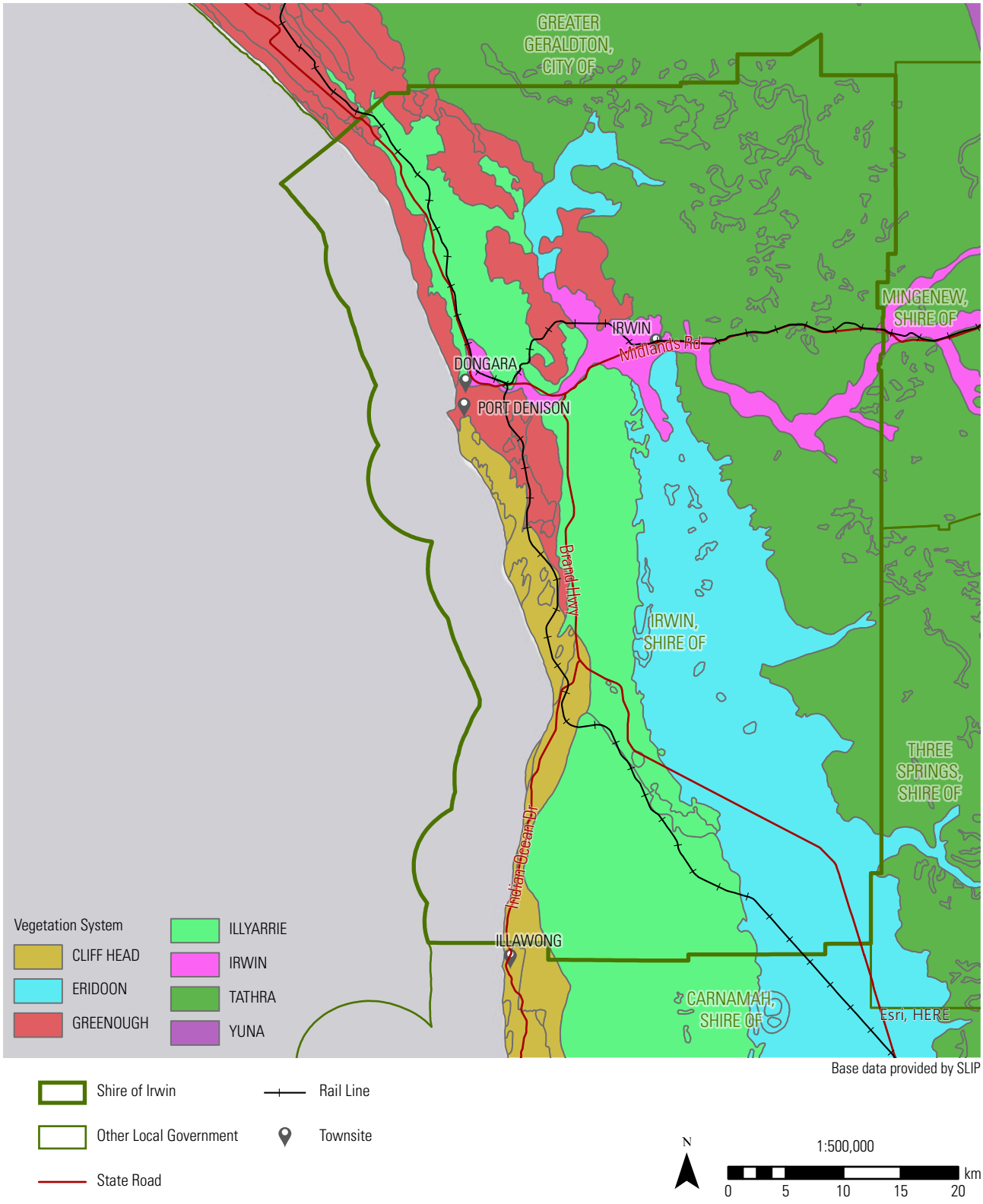
- Six records of *Threatened – Vulnerable*
- *Two records of Priority.*

Consideration of any potential impact on habitat will need to be considered if disturbing vegetation.

FERAL ANIMALS

Feral animals such as rabbits, foxes, goats and cats can cause general disturbance to coastal areas including dune erosion, destruction of native vegetation and the spread of weeds. They also compete with native fauna for habitat and resources. Control of rabbits, foxes, rats and feral cats can be achieved through baiting, trapping and poisoning. The Shire and other coastal landowners (particularly north of Dongara) should work with the Department of Primary Industries and Regional Development to undertake feral animal control where necessary.

Introduced honeybees can also be considered as a feral animal and may compete with native bees for pollen and nectar (Peter Hammond and Associates, 2000).



Plan 7.2: Pre European Vegetation Systems

7.7 DIEBACK

Dieback is the name given to a fungal disease that affects over 2300 native plant species. *Phytophthora cinnamomi* is the most common form of dieback. Vehicles, pedestrians and animals are the main transporters that spread the dieback fungi spores. Certain plant families such as Proteaceae and Epacridaceae are particularly susceptible.

While there is no evidence of dieback occurring within the study area, landowners and the Shire should be vigilant of this issue and should any signs of dieback occur appropriate action should be taken. Signs which should be looked for include browning and chlorosis of the leaves and branch death.

The Dieback Working Group has a number of publications available such as *Managing Phytophthora Dieback in Bushland* (2015) which can be referred to if signs of dieback become evident. The best course of action is to prevent the spread from infected areas to non-infected areas so they should be blocked from access if possible, to prevent the spread of soil particles and drainage managed appropriately to prevent its spread in water.

7.8 HYDROLOGY

GROUNDWATER

The Coastal Development Strategy (Shire of Irwin and Landvision, 2000) states that *shallow superficial aquifers are likely to be found in the Quindalup sands and the Tamala limestone immediately behind the foreshore*. According to the Strategy, superficial aquifers in the Quaternary strata may be potential sources of fresh water, although available quantities could be limited.

Deeper aquifers located further inland could have larger quantities of groundwater available. Sandstones within the Yaragadee Formation yield large quantities of groundwater that is often suitable for domestic use (Shire of Irwin and Landvision, 2000).

Groundwater salinity statewide mapping (SLIP, 2019) indicates that the salinity levels along the coast are between 3,000 – 7,000 mg/L of Total Dissolved Solids.

The entire coastal area is located within the 'Arrowsmith' Proclaimed Groundwater Area under the *Rights in Water and Irrigation Act 1914*. The coastal area is also entirely located within the 'Dongara' sub-area.

SURFACE WATER

Surface drainage in the Shire of Irwin is seasonal, with highly variable flows which are generally highest between July and August. The Irwin Drainage Basin dominates the surface hydrology in the Shire. It is bound by the Greenough River basin to the north and the Arrowsmith Basin to the south (Peter Hammond and Associates, 2000).

Surface water mapping for the Irwin coastline is summarised as follows:

- Hydrographic Catchment Basin – 'Greenough River' and south of Beekeepers Nature Reserve is 'Moore-Hill Rivers'
- Hydrographic Catchments – 'Coastal'
- Hydrographic Sub-catchments – 'Greenough River, Tributaries and Catchment' (northern), 'Irwin River' (central), 'Eneabba Coastal Tributaries' (southern)
- Surface water management area – 'Greenough River, Tributaries and Catchment' (northern), 'Irwin River' (central), 'Eneabba Coastal Tributaries' (southern)

The Irwin coastline is not located within a Proclaimed Surface Water Area under the *Rights in Water and Irrigation Act 1914*.

IRWIN RIVER

The Irwin River is the only drainage line that flows into the Indian Ocean. It originates near Mullewa and Tardun and flows in a south-westerly direction to the Shire of Irwin and eventually discharges into Arurine Bay when floods are sufficient to break through the sand bar at the river mouth. Flooding of the Irwin River has occurred at multiple times since European settlement. The river is approximately 140 kilometres long and has a catchment area of 6,145km^2 (Hydrologia, 2017). It is classified as a perennial water course and can experience flash flooding following rainfall within the catchment, although flows are typically low (ATA Environmental, 2005)).

Flooding from the Irwin River has a long and well-documented history since European settlement in the area in 1851. The following information is from Hydrologia (2017). The bridge connecting Dongara to Port Denison was first constructed in 1888-89 and was overtopped by floodwaters in 1889, 1917, 1945 and 1964. A new bridge was constructed in 1964 and was damaged in the 1999 flood. Flooding has also occurred in the following years: 1864, 1871, 1872, 1914, 1932, 1942, 1951, 1971, 1972, 1988, 1999. Significant flooding occurred during the 1971, 1988 and 1999 flood events.

The Irwin River Flood Study was commissioned by the Shire of Irwin and prepared by Hydrologia in 2017. The objective of the study was to provide updated hydraulic modelling and mapping to inform decision-making and mitigation strategies regarding use of flood prone land, with consideration of the effects of climate change. The purpose of this is to guide future land use planning and development decision making, emergency response planning and increase community awareness of flood risk. The Study provides outcomes of the hydraulic modelling and floodplain mapping for 1 in 10 AEP (Annual Exceedance Probability), 1 in 100 AEP, 1 in 2000 AEP and probable maximum flood. The study does not have a particular focus on the Irwin River Mouth or coastal area,

however it includes historical information and photographs from previous floods at the river mouth and the hydraulic modelling and floodplain mapping shows the areas potentially at risk. It is noted that the River mouth frequently breaks with rainfall events and high tides.

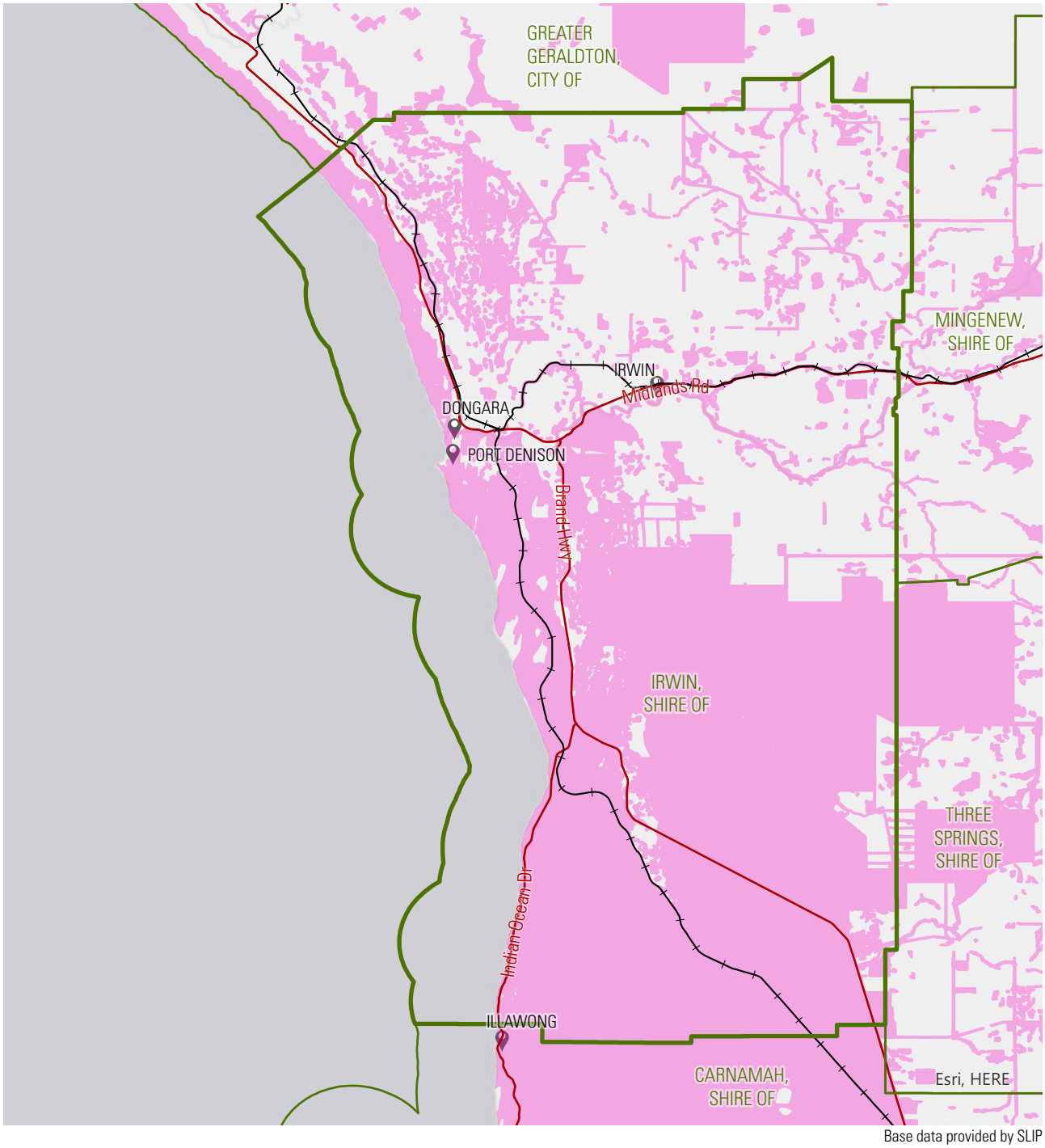
7.9 BUSHFIRE

Fire is a natural phenomenon in Australia which is largely caused or influenced by summer droughts, lightning storms, campfires or are deliberately lit. Bushfire management is important as a means to reduce risk to human lives and property and to reduce significant destruction to native vegetation. Fire management procedures in coastal reserves commonly include:

- Prescribed burning
- Strategic firebreaks
- Use of barbeques rather than open campfires
- Prohibited burning period
- Adequate signage at coastal sites
- Bushfire risk assessments
- Bushfire Management Plans.

It is essential that any new development proposals along the coast adequately consider fire management in accordance with the WAPC guidelines, specifically *SPP 3.7 Planning for Bushfire Management* (WAPC, 2015) and the *Australian Standards AS 3959* (Standards Australia, 2009). This is particularly important in areas recognised as having a significant or high bush fire risk. Responsible land managers along the coast should have appropriate fire management procedures in place. The Shire should have bushfire safety measures in place for their coastal reserves, including evacuation procedures.

Bushfire Prone Areas are shown on Plan 7.3.



Plan 7.3: Bushfire Prone Areas (2019)

7.10 ACTIONS – ENVIRONMENT & LANDSCAPE

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
Relevant Objectives: • **Objective 1 – Identify current land uses, values and issues of the Shire's coastal land which may impact upon future coastal management for the next 10 years.** • **Objective 2 – Manage the environmental and recreational values of the coastline in order to retain the broad range of recreational opportunities, environmental values and sense of isolation unique to the area.** • **Objective 4 – To ensure management and protection of the Shire's coastline is undertaken in a sustainable manner.**			
EL1	Visual Landscape Planning in WA: A manual for evaluation, assessment, siting and design, (WAPC, 2007) should be referred to during visual assessments and planning for recreational elements along the Shire's coastline.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
EL2	Design of new coastal car parks, roads and buildings should minimise the visual impact on the surrounding environment and to prevent impact from sand drift (e.g. avoid use of straight pathways, roads; take into account prevailing wind and sand movement etc).	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
EL3	Encourage access to the coast along formal tracks and pathways through the use of fencing and signage where dune degradation is an issue.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
EL4	Monitor dunes located around camping areas and high use sites for signs of degradation. Close and rehabilitate informal tracks as they occur and in accordance with the programme of works developed by the responsible landowner. Rehabilitation should be undertaken using the most appropriate means for the particular site which could include brushing, revegetation etc	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
EL5	Encourage local nurseries to grow coastal plants suitable for dune rehabilitation.	O	Shire of Irwin
EL6	Undertake seed collection to retain the local provenance of species, possibly as a community project.	M-L	Shire of Irwin
EL7	Should signs of dieback be detected in the study area, establish a dieback monitoring program to monitor and manage areas susceptible to the spread of dieback for signs of infection.	S	Shire of Irwin
EL8	Follow the Managing Pytophthora Dieback in Bushland by the Dieback Working Group (2015) in the event that dieback is detected.	O	Shire of Irwin

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
EL9	Support/work with the Midlands Recognised Biosecurity Group for the eradication of feral rabbits, foxes and cats from the study area. Encourage the eradication of rabbits, foxes and feral cats by private landholders.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
EL10	Ensure that good and responsible planning is undertaken with consideration of the principles and objectives of SPP2 and factor coastal planning requirements during preparation of the Shire's new Local Planning Scheme.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
EL11	Support efforts by the local community with weed control efforts (particularly African Boxthorn, Verbesina and other weeds along coastal areas), dune rehabilitation and rubbish clean ups.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
EL12	Prepare a Signage Strategy to provide a coordinated and consistent approach to providing and maintaining signage throughout the Shire's coastal area. The Strategy should also note where signs may need to be shifted annually due to sand drift.	M-L	Shire of Irwin
EL13	Ensure appropriate signs are provided at coastal sites, including hazard and warning signs identifying evacuation procedures in the event of inundation or fire, interpretative and historic information, educational, locational information, safety information, directions and identification of land use permissions and prohibitions.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
EL14	Encourage access to the coast along formal tracks and pathways through the use of fencing and signage where dune degradation is an issue.	O	Shire of Irwin
EL15	Ensure that designated areas of High Quality Agricultural Land (as determined by the Department of Primary Industries and Regional Development) are protected from land uses that are incopatible with the ongoing agricultural use of that land.	O	Shire of Irwin DPIRD

8.0 coastal processes

Regional descriptions of coastal morphology (Eliot et al. 2012) and coastal hazards (Land Insights & Damara WA 2015) are available. Information presented here provides more local description of coastal processes, specific to the Shire of Irwin.

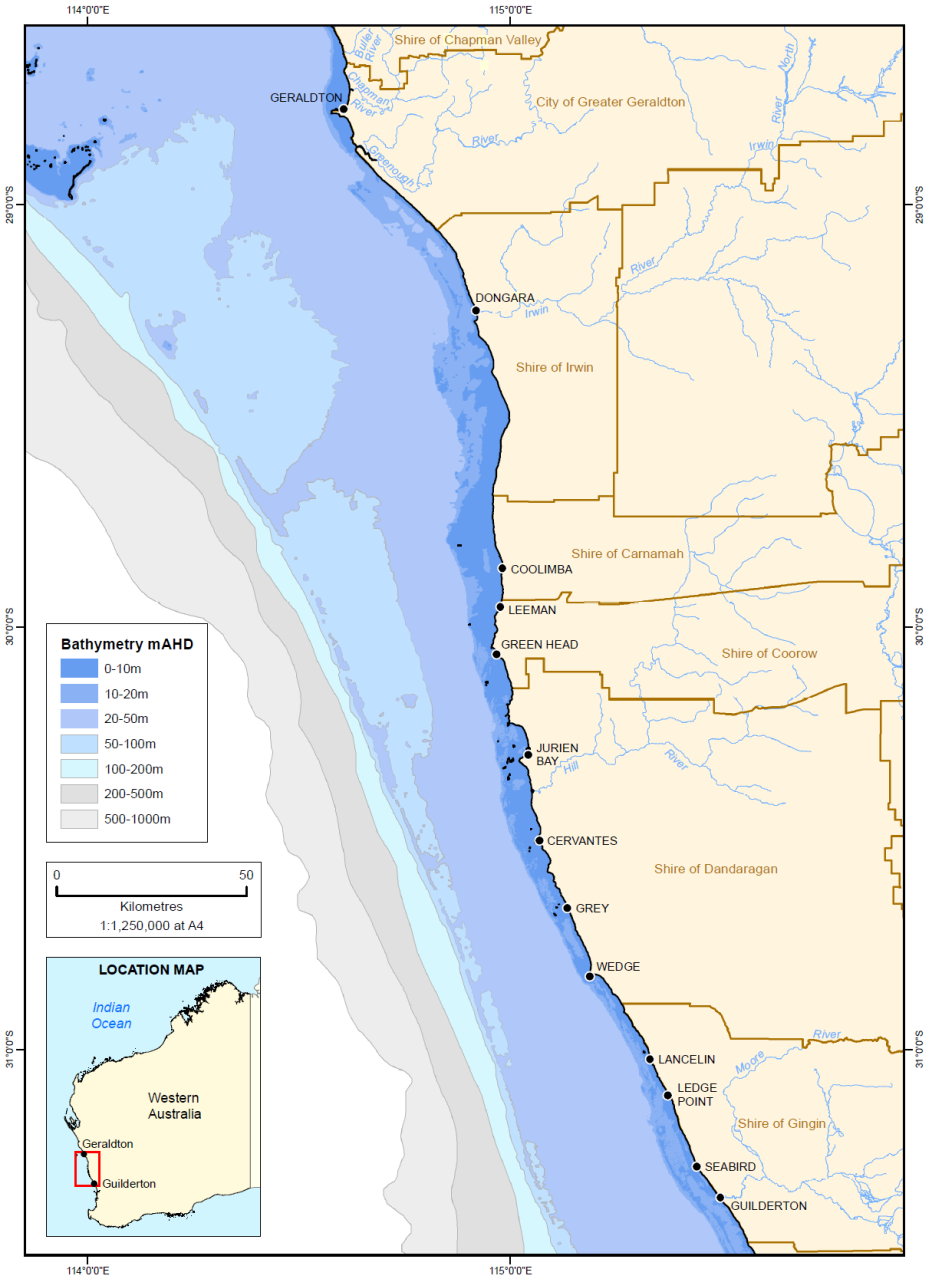


Figure 8.1: Regional Bathymetry

Extracts from the regional description (Land Insights & Damara WA 2015) relevant to the Shire include:

The Midwest is located towards the northern end of the temperate region, which means coastal hazards are predominantly associated with mid-latitude storm systems. Additionally, very rare tropical storms have provided severe conditions in the past, notably through southward travelling tropical cyclones. The region is subject to heat-driven winds, including regular strong sea-breezes, northerly thunderstorms and pre-frontal troughs.

Tides of the region are microtidal and mainly diurnal, which determines that storm surges and other water level phenomena such as those caused by the Leeuwin Current have a strong influence upon inundation. The largest surges measured along the coast have been associated with southward travelling cyclones, capable of producing surge and shelf waves simultaneously. However, the most severe conditions are more commonly associated with mid-latitude storms, as their frequency and persistence allows greater opportunity for interaction with high winter tide levels.

The coast is exposed to large Indian Ocean swell waves, although nearshore reef systems commonly present may provide considerable wave damping before they reach the shore. Wind waves occur frequently along the coast, and generally peak on a daily basis with strong afternoon sea breezes.

Coastal processes, including erosion and inundation hazards, are strongly influenced by the coastal morphology present along the Midwest coast. Along the whole coastline, rock features have important influences upon coastal behaviour, whether headlands acting as controls to beach position, reef systems providing wave sheltering or rock platforms providing a foundation for perched dunes. These natural structures typically influence present-day coastal mobility, but commonly increase coastal susceptibility to erosion associated with changing conditions (including sea level rise) or the transfer of erosive stress when efforts are made to stabilise a small section of coast. This highlights the need to consider the coastal system at a larger scale than any immediate coastal management issue.

Cliff Head to south of Geraldton has active dune fields along the majority of its coast, with furrows and sand sheets suggesting active mobility due to wind-blown sediment movement. Seaward of these dune fields, coastal dunes with shore parallel ridges are intermittently present, indicating some variation in coastal dynamics. Occasional rock features provide headland control between Cliff Head and Dongara. From Dongara to south of Geraldton, a semi-continuous limestone reef runs almost parallel to the existing coastline. This provides wave sheltering, except south of Greenough, where the rock forms a coastal platform. The coastal dune structure is loosely linked to rock headlands, with wider coastal dune fields often present on the northern side, suggesting either downdrift erosion, or gross coastal realignment in response to changing wave conditions over longer time scales. The coastal dunes are high and limit inundation hazard.

8.1 METEOROLOGICAL AND OCEANOGRAPHIC DATASETS

Meteorological and oceanographic conditions influencing coastal dynamics at Dongara include winds, waves and water levels, with rainfall runoff occasionally influencing the mouth of the Irwin River (Irwin Flood Study, 2017). There is limited available information directly available from Dongara, with the majority of relevant data sets being collected at Geraldton, as part of port and airport activities.

There is no long-term weather station at Dongara. Consequently, the nearest automatic weather station from Geraldton airport (AWS 8315) has been used to provide an indication of winds (Figure 8.2). However, it is acknowledged that the station is located 8km inland, which will provide local modulation of regional winds. Specifically, inland stations tend to record lower peak wind speeds, with damping of onshore winds and typically a slight deviation of modal southwest and easterly wind directions. These biases vary within 30-60km of the coast, particularly due to the relative influence of land and sea breezes. For example, from the coast to landward, the sea breeze declines within 5 – 15km, with the land breeze becoming increasingly dominant, but declining in strength further inland.

Without correction for the biases introduced by Geraldton Airport AWS's inland location, the wind record confirms a strongly southerly wind climate. This supports development of southwest wind waves and encourages northward wind-blown sand drift. The strongest observed winds typically occur from the west, associated with mid-latitude winter storms.

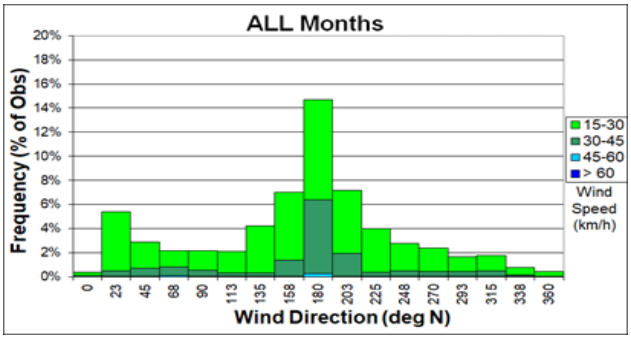


Figure 8.2: Geraldton Airport AWS Wind Distribution (2011-2018)

Midwest Ports undertake ongoing wave monitoring in the region, which provides a basis for description of the regional wave climate (Wandres et al. 2016). However, it is noted that the waverider buoy is located at a comparatively nearshore location, resulting in moderate peak wave heights.

There is highly seasonal variation in wave conditions (Figure 8.3). It is noted that local wave measurements were undertaken offshore from Leander Point in 1976-1977 (PWD 1976), however, this data set precedes the longer-term measurements and therefore cannot be correlated to provide a locally relevant characterisation of varying wave conditions.

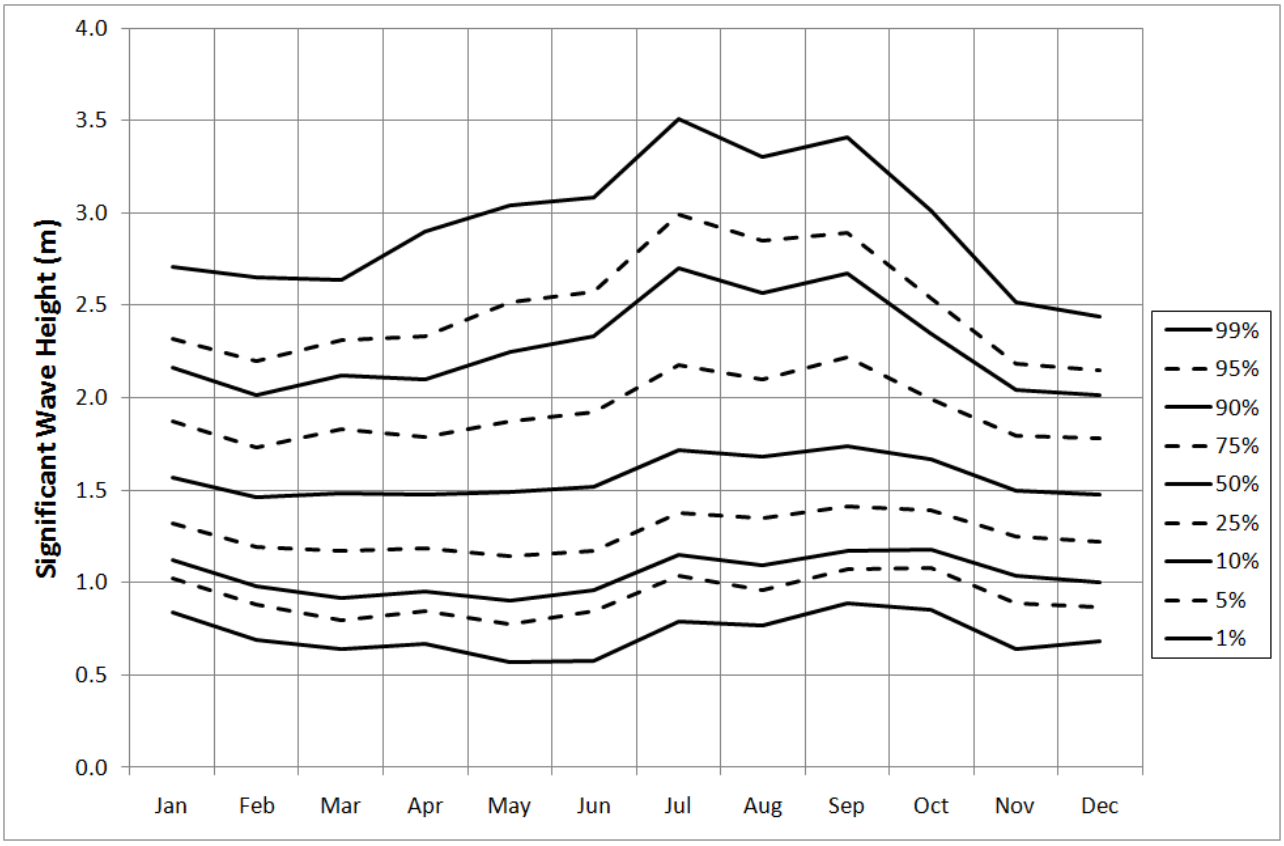


Figure 8.3: Geraldton Seasonal Wave Variation

Sea level variations are more directly relevant, as water level processes display a relatively high coherence along the Midwest coast, between Geraldton, Jurien and Fremantle permanent tide stations (Eliot, 2018). The region experiences microtidal, mainly diurnal conditions, which determines that there is greater influence from surges and mean sea level processes (Figure 8.4).

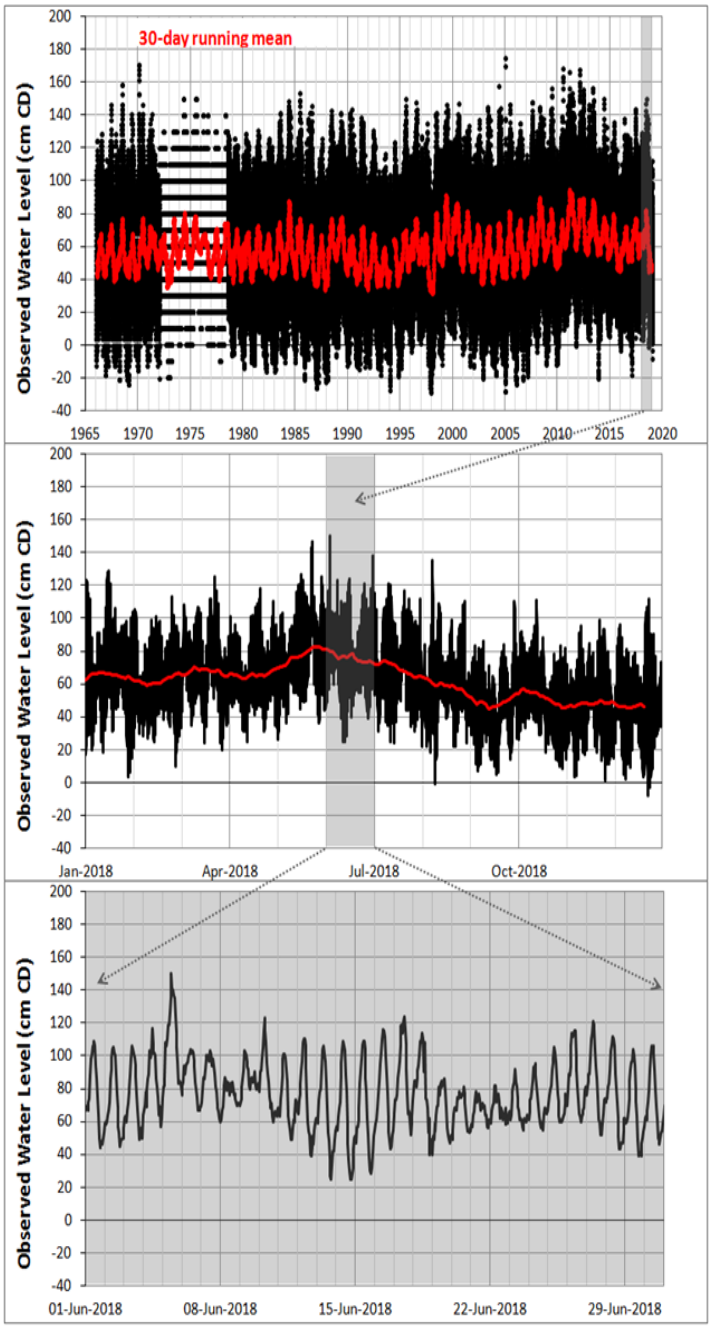


Figure 8.4: Geraldton Water Level Cascade

Evaluation of extreme water levels for Geraldton (Damara WA 2012) has previously identified that tropical cyclones are the most likely cause of extreme sea level events (above 20 year recurrence), although mid-latitude storms provide more frequent incidence of high water levels and will more commonly be the dominant cause of sea levels influencing coastal behaviour. Update of the tide gauge data set analysis has been undertaken (Figure 8.5), confirming a continuation of the previously reported behaviour. Small increases in the 100-year recurrence estimates are noted, which reflect the occurrence of high mean sea levels over the last decade.

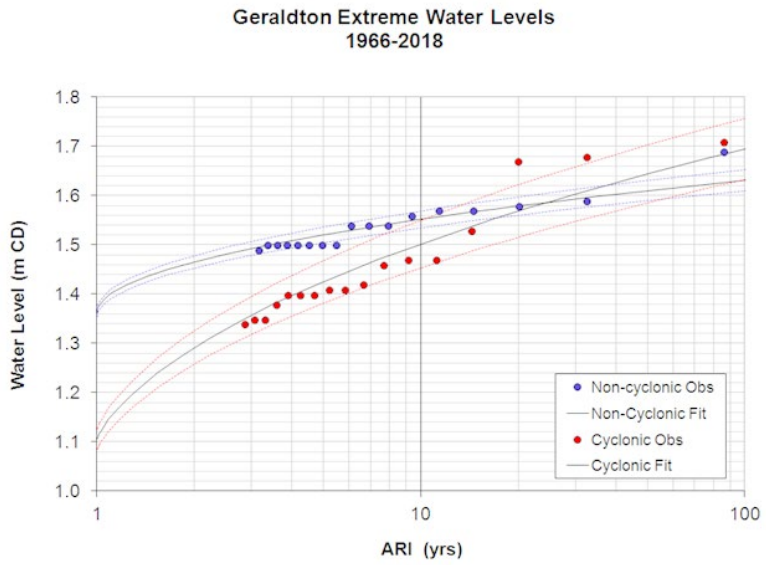


Figure 8.5: Geraldton Extreme Water Levels (1966-2018)

8.2 COASTAL DYNAMICS

Dongara lies in the northern part of the Geraldton-Bunbury region, which is characterised by a mainly west-facing coast, with moderate continental shelf width. Sediments are mostly calcareous, supporting development of limestone ridges through coastal lithification (Gozzard, 2011). These ridges buffer the effects of long-term fluctuations in sea level, whether acting as an erosion-resistant shore, or providing nearshore wave damping. Increased coastal stability enables dune development, with successive phases of dune deposition being identified (McArthur and Bettenay, 1974). Previous shorelines occur as limestone reefs, nearshore rock platforms or as ridges to landward, typically underlying modern dunes. The existing coastal dune structure is typically a large coastal barrier dune in the order of 200 – 300m width, with aeolian dunes to landward. With the notable exception of longitudinal dunes in Beekeeper's Reserve, the coastal dunes generally exhibit low mobility and can be consider relict structures, with formation during the late Holocene highstand, when mean sea level was approximately 1 – 2m higher than the present day (James et al., 2004).

The tidal regime of the Geraldton-Bunbury region is micro-tidal with mainly diurnal tides (Easton, 1970; NTF, 2000; Eliot, 2018). Wave conditions are generally energetic through the influence of frequent strong winds, as well as Indian Ocean swell (Lemm et al. 1999; Wandres et al. 2016). Storms are mainly winter mid-latitude depressions (20 – 40 years) associated with westerly onshore winds (Steedman & Associates 1982); with very occasional (1 – 2 decades) tropical cyclones passing close enough to produce gale force winds, the majority of which are experiencing extra-tropical transition (Hetzel et al. 2015). The diurnal land-sea breeze cycle is prevalent along the coastal margin, and particularly evident during summer months, with bimodal conditions developed through morning easterlies due to land breeze conditions and southerly afternoon winds due to sea breeze conditions.

The strong tendency for northwards sediment transport due to both waves and winds provide an almost unidirectional alongshore transfer of sediment. However, this is modified by shoreline orientation, as well as local effects of variations in elevation and discontinuities in the limestone reefs and platforms. This determines that each shoreline segment can respond slightly differently to either individual weather events, seasonal variation, or inter-annual fluctuations of meteorological and oceanographic drivers. As a consequence, alongshore sediment supply is typically sporadic, with erosion events providing 'slugs' of sediment to the adjacent (northern) coastal segment, which can propagate and distribute along the segment's beaches and are then either transferred further alongshore or into the coastal dunes. This process can contribute to cyclic behaviour, or be a mechanism for progressive accumulation of features, if there is an extended period between events causing coastal disturbance.

Formation of the beach and dune structure (Figure 8.6) is related to the relative balance of the processes of alongshore sediment supply and cross-shore sediment exchange between the beach and dune (Pye et al., 2007). Short-term beach movements are largely constrained to the beach face. Seasonal and event-driven fluctuations are largely contained within the beach flat, which can be supplied or supplemented by alongshore sediment transport. The dune position is generally developed through a balance of occasional storm erosion events and landward wind-blown transfer of sediments from the beach flat. The episodic nature of storm events and the interaction between dunes, vegetation and sediment transfer often develop impermanent foredune features seaward of the larger, primary dune.

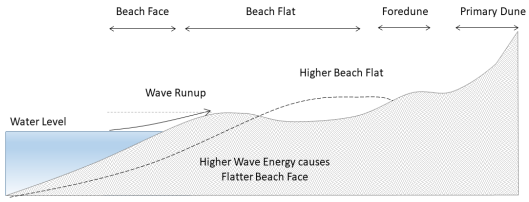


Figure 8.6: Beach Components

Beach behaviour responds to individual storm events, with short-term cross-shore fluctuations, typically flattening rapidly during high wave energy conditions and gradually steepening during calmer conditions. Beach rotation may occur if storm waves come from unusual directions, particularly the northwest, as it differs from prevailing southwest swell. In most cases, these short-term sediment movements are local, and there is limited transfer between adjacent coastal segments. Beach volume change may occur when there is a longer-term adjustment of the beach profile, such as through seasonal and inter-annual variation of waves (Figure 8.3) and water levels (Figure 8.7). In recent decades, there has been significant change in mean sea levels, affecting the Western Australian coast, with reducing incidence of El Nino (low water level) conditions and increased incidence of La Nina (high water level) conditions (Feng & Myers, 2004; BOM, 2012). The very high mean sea levels during 2011 – 2013 produced widespread disturbance of the coast, and for much of Western Australia caused erosion, with recovery taking a number of years.

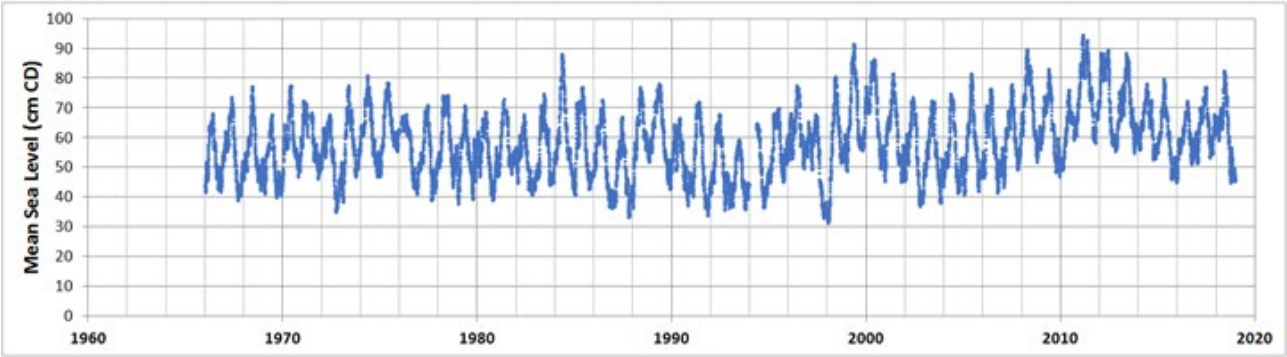


Figure 8.7: Geraldton Mean Sea Level (1966-2018)

Information available to describe historic coastal dynamics is limited:

- Vegetation line mapping by Department of Transport covers from 1944 – 2016 (imagery from 1944, 1965, 1978, 1980, 1988, 1993, 1999, 2004, 2008, 2010 and 2016) for town site areas from Kingy Bay to South Beach, and has been prepared for the remainder of the Shire coast based on 2000, 2008 and 2016 aerial imagery; and
- Satellite derived shoreline position at 500m intervals from 1984 – 2016, through Deltares' Shoreline Monitor (Luijendijk et al., 2018).

Both data sets require interpretation, as they are both proxies for changes in coastal sediment volume (Figure 8.8). The vegetation lines are spatially continuous but have long gaps between successive images. The shoreline time series are widely spaced and may be influenced by short-term cross-shore fluctuations, particularly response to storm events or seasonal fluctuation, depending on the set of satellite images considered for each year.

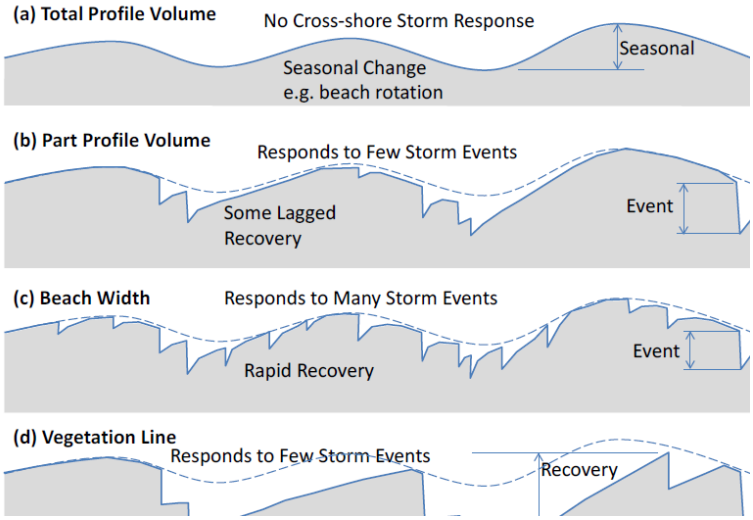


Figure 8.8: Proxy Influences for Different Beach Measurements (Damara 2015)

The two data sets overlap meaningfully around Dongara and Port Denison town sites, where they suggest reasonable correspondence, partly obscured by the influence of seasonal beach movement (Figure 8.9).

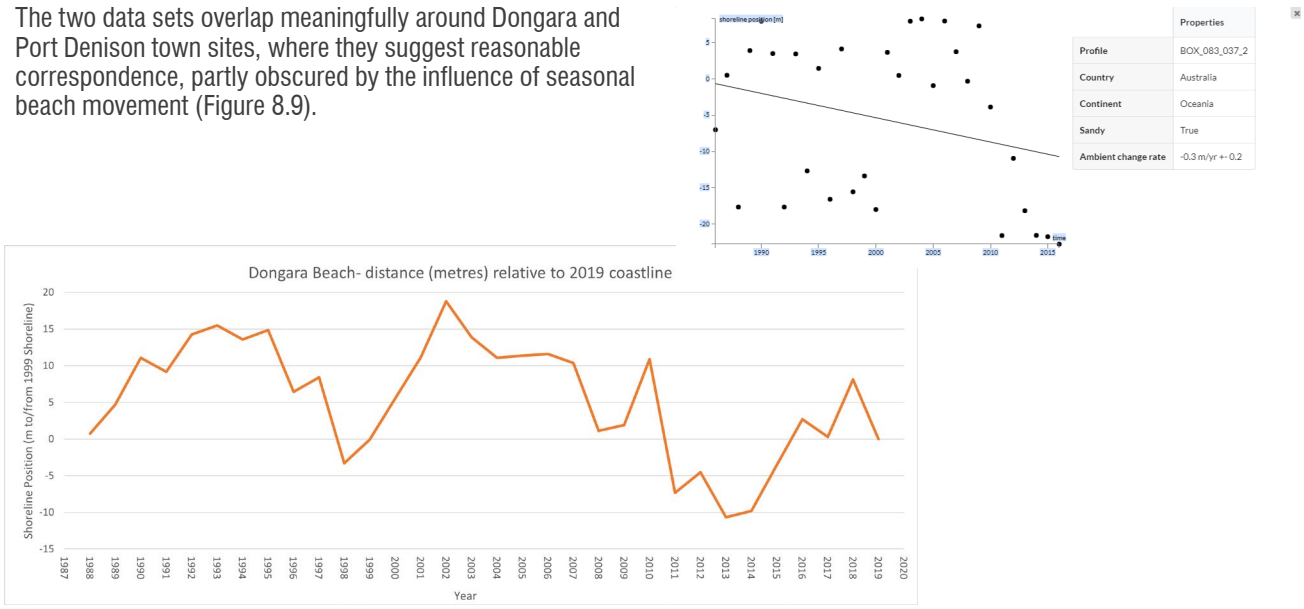


Figure 8.9: Comparison of Shoreline and Vegetation Line Positions for Dongara Beach

A generalised interpretation of the two data sets is that there was a longer-term tendency for accretion between 1944 and 1980, with a subsequent decline toward an intermediate position. However, there is considerable local variation, with some areas showing continuing accretion since 1980 (Figure 8.10) and others illustrating substantial loss over the period 2008-2016 (Figure 8.11).

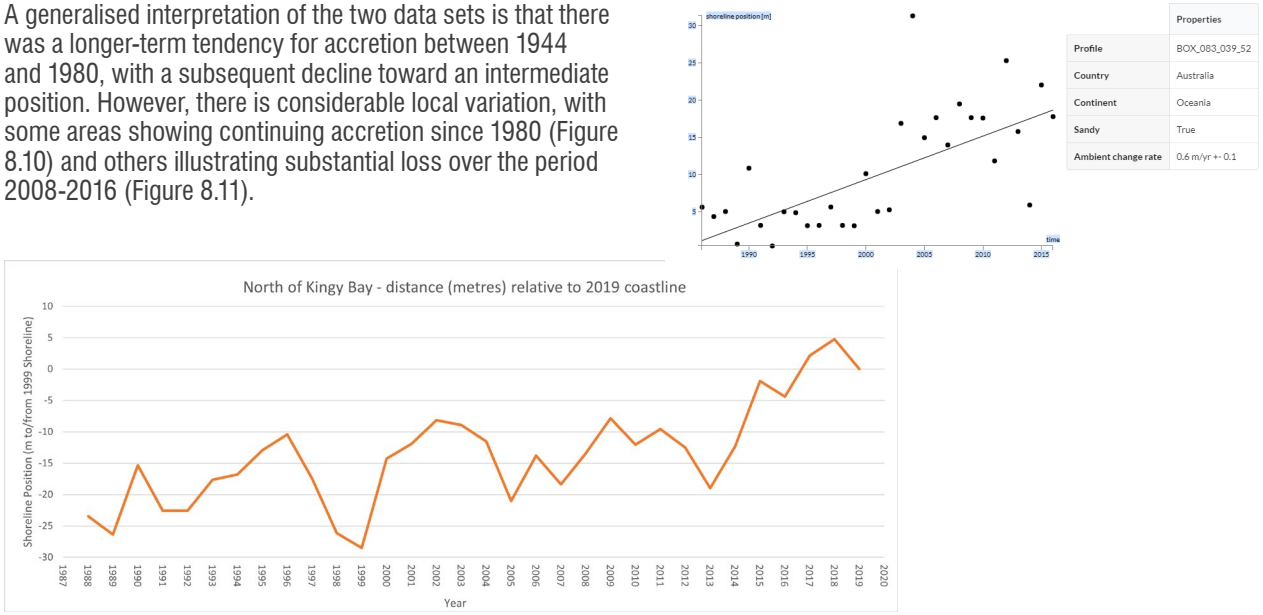


Figure 8.10: Shoreline Position North of Kingy Bay (Shoreline Monitor)

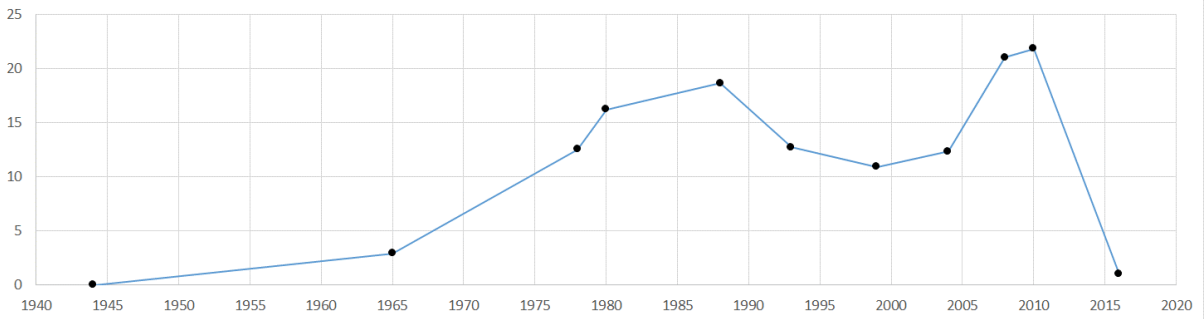


Figure 8.11: Vegetation Line Position South of Seaspray Caravan Park Relative to 1944

Local variation at the specific sites of planning interest is outlined in the table below:

Table 8.1 - Coastal Dynamics Local Variation

Location	Interpreted Coastal Dynamics
McKenzies	Demonstrates a history of net coastal accretion
Seven Mile Beach	Marginal retreat of the beach to the north identified over 1984-2016, mainly occurring in 2008-2013, although there was limited corresponding vegetation line change The shoreline to the south generally remained relatively stable
Kingy Bay	The nearshore reef and salient provides a separation in behaviour, with the beach to the north accreting, and the beach to the south eroding over 2010-2018
Seaspray	High erosion occurred from 2010-2016, such that the shoreline is near to the most landward (eroded) position on record
Grannies Beach	Long-term pattern of gradual erosion (1m/yr) accelerated from 2008 onward, and it is presently at its most landward (eroded) position on record
South Beach	Has experienced substantial ongoing accretion since 1978. Vegetation line retreat from 1944-1978 is opposite the general pattern
Denison Airstrip	High erosion (~30m) occurred from 2010-2016, such that the shoreline and vegetation lines are at the most landward (eroded) positions on record
White Point	Ongoing growth trend of ~1m/yr. Extreme erosion (~100m) occurred from 2010-2016, such that the shoreline and vegetation lines are at the most landward (eroded) positions on record. Substantial accretion of a foredune has occurred on the north side of the point, averaging ~3m/yr, with ~60m accumulation from 2010-2016
Cliff Head	Localised deposition of 350m long sand lobe near the rocky head of up to 70m width 2010-2016. Corresponding erosion of 800m length to the south with up to 30m retreat. Local erosion at North Cliff Head was ~10m, but located at pinch point between shore and rock outcrop, affecting track
Freshwater Point	High erosion (~30-40m) occurred from 2012-2016 downdrift of the rock headland, affecting the camping site Area to south has experienced approximately 1.5m/yr accumulation, including foredune development
Knobby Head	Mild erosion (~10m) occurred from 2008-2012

8.3 DUNE DYNAMICS

A modified version of the United States Army Corps of Engineers (USACE) method for assessing aeolian beach and dune sediment transport has been developed. This is a simplified model of dune physics, which does not include effects of wind funnelling, local sheltering, or vegetation establishment and growth (Bagnold, 1941). Due to these simplifications and assumptions required, model estimates indicate relative behaviour and should not be considered exact.

Typical rates of landward sediment transfer from the beach to the dune are in the range of 2.5-7.5 m3/m/yr, although higher rates have been observed with effective application of sand fencing and revegetation works (USACE, 2003). No equivalent

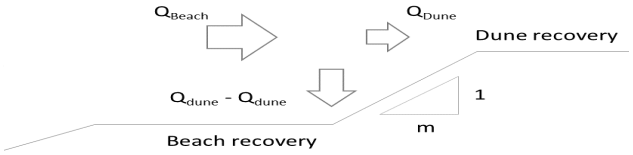


Figure 8.12: Schematic of Beach-Dune Sediment Transfer Model

Natural dune faces in the Midwest tend towards a limiting steepness of 1 in 3. From the beach-dune model, this conveys approximately 35% of the onshore beach supply. Blowouts and foredune swales, have flatter gradients, allowing transfer of 50-75% of beach drift, and consequently supporting higher rates of dune rebuilding. However, for blowouts connected to a landward sand sheet, this may result in high rates of loss from the leeward side of the dune, effectively resulting in a material drain from the dune and amplifying beach erosion (WAPC, 2002).

Application of the model to different dune orientations provides a simple means of comparing the tendency for beach-dune sediment transfer along the Shire of Irwin coast (Figure 8.13). This evaluation highlights the high potential for onshore sediment transfer along Beekeeper's Reserve and South Beach, which displays active longitudinal dunes, and north of Nine Mile Beach, where the coastal dunes are marginally active, with a few local blowouts. Low rates of onshore sediment transfer occur along the southern Irwin coast, suggesting a tendency for limited development of mostly low dunes and beach sediments tending to move alongshore. This variation suggests a need for differences in coastal management effort – for the active dune areas, dune recovery after erosion is high, but there is high potential for blowouts to expand into sand sheets; whereas for the southern areas, dune recovery after storm erosion will tend to be slow, potentially producing scarps and associated beach access issues.

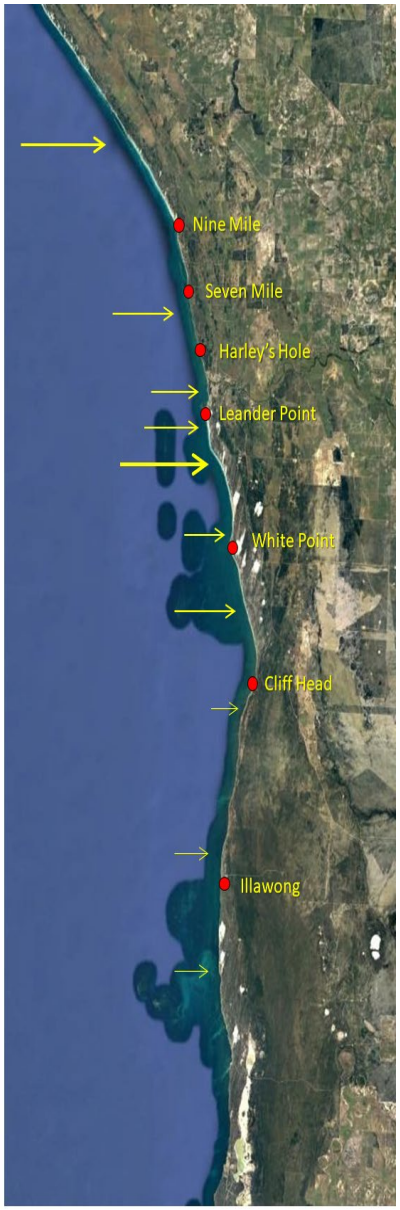


Figure 8.13: Simplified Model of Onshore Sand Transport

8.4 SEDIMENT CELLS AND GEOMORPHIC FRAMEWORKS

The Shire of Irwin mainly occupies two primary sediment cells (Stul et al., 2014), identified on the basis of changes to coastal alignment and morphology (Table 8.2), with Leander Point (and the mouth of the Irwin River) providing a fixed cell boundary that separates alongshore sediment transport between the two cells. Connectivity between the two cells is expected to occur mainly offshore, outside the discontinuous inner shelf (nearshore) limestone reefs. The northern and southern boundaries of the two Irwin primary cells are near Phillips Road and South Illawong respectively; both of which are defined by substantial changes in coastal morphology, although not associated with substantial barriers to alongshore sediment transport.

At finer scales, the two primary cells subdivide into four secondary cells and eight tertiary cells, of which six are in the Shire of Irwin (Figure 8.14), with the two northern cells in the City of Geraldton / Shire of Greenough. Apart from Leander Point, only White Point represents a major structural feature, with the other boundaries all indicative of changes in conditions influencing sediment transport, such as variation in nearshore reef configuration. Adjacent cells that are distinguished by more subtle structural boundaries are expected have higher sediment transport connectivity than those defined by major structural forms.

Table 8.2: Shire of Irwin Sediment Cells

Region	Primary	Secondary	Tertiary
R07. Mid-West Region from Moore River to Glenfield	E. Leander Point to Phillips Road Coast	12. Nine Mile Beach to Phillips Road Coast	b. Headbutts to Phillips Road Coast
			a. Nine Mile Beach to Headbutts
		11. Leander Point to Nine Mile Beach	c. Seven Mile Beach to Nine Mile Beach
			b. Harleys Hole to Seven Mile Beach
			a. Leander Point to Harleys Hole
	D. South Illawong to Leander Point	10. Cliff Head to Leander Point	b. White Point to Leander Point
			a. Cliff Head to White Point
		9. South Illawong to Cliff Head	a. South Illawong to Cliff Head
	C. Middle Head to South Illawong	8. Fisherman Islands to South Illawong	d. Coolimba to South Illawong
			Other Tertiary Cells
		7. Middle Head to Fisherman Islands	Other Tertiary Cells

High resolution LIDAR bathymetry collected from Hillarys to Northampton in 2016 provides an opportunity to develop more detailed interpretation of coastal dynamics (Table 8.3):

At a tertiary sediment cell scale, high resolution bathymetry shows the presence, elevation and continuity of nearshore limestone formations. This supports interpretation of how

the rock may influence coastal dynamics, specifically for the beach and dune systems to landward; and

At a finer scale, the bathymetric surface texture supports distinction between sand and rock seabed, with sandy seabed features including bars, ridges and gullies indicating hydrodynamic forcing, and potentially displaying sediment transport pathways.

Extracts from the LIDAR bathymetry are shown to illustrate these features.

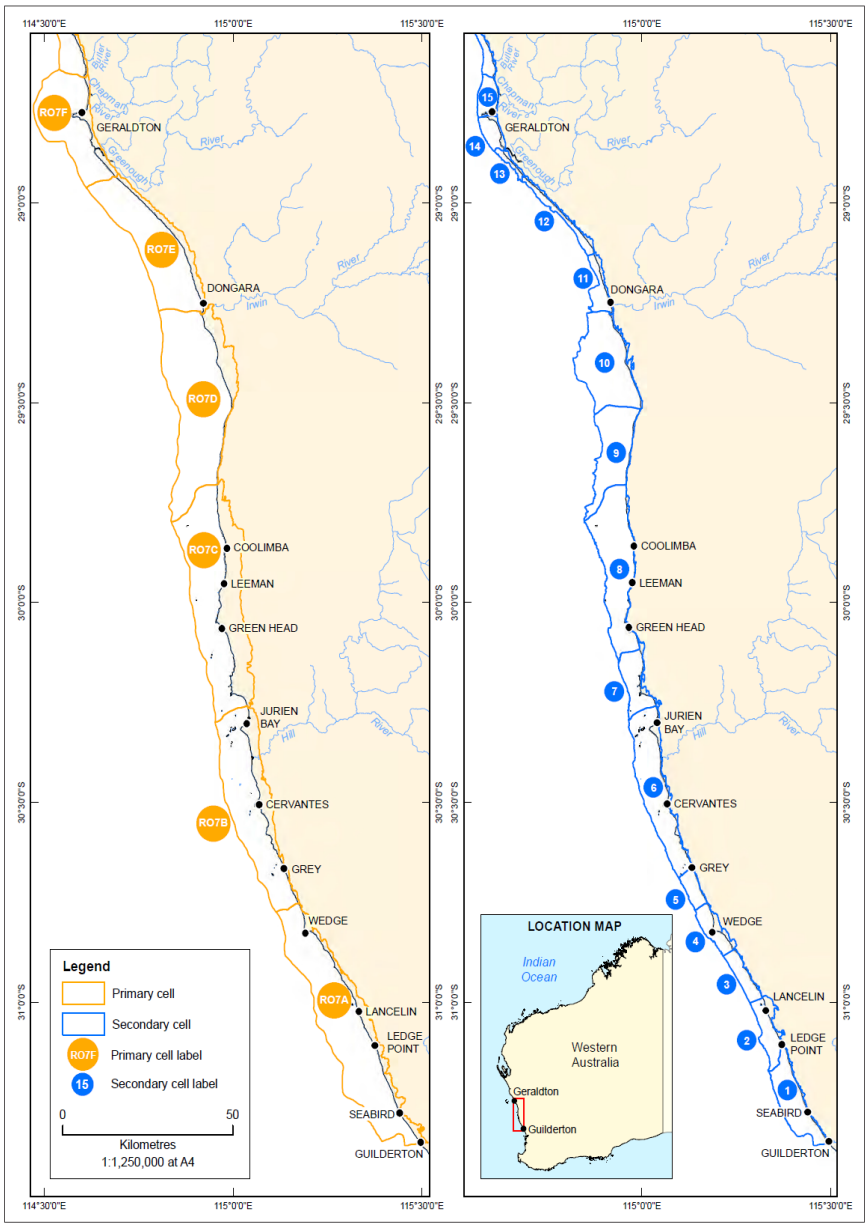


Figure 8.14: Primary and Secondary Sediment Cells for the Midwest (Stul et al. 2014).

Table 8.3: Generalised Morphology for each Tertiary Sediment Cell

TERTIARY SEDIMENT CELL	GEOMORPHIC DESCRIPTION
R07.E.12a. Nine Mile Beach to Headbutts (Figure 9.1)	Discontinuous narrow offshore limestone reef Deep coastal lagoon Multiple nearshore reefs with narrow (~50m) coastal rock platform Active dune with extensive blowouts
R07.E.11c. Seven Mile Beach to Nine Mile Beach (Figure 9.1)	Almost continuous narrow offshore limestone reef Deep coastal lagoon Multiple nearshore reefs providing sheltered coast with narrow (~50m) coastal rock platform Degraded primary dune with some foredune development. Dunes to landward have partly vegetated scarps, with relict mobility
R07.E.11b. Harleys Hole to Seven Mile Beach (Figure 9.1)	Continuous narrow offshore limestone reef, wide area to south Deep coastal lagoon, pinched to south Multiple nearshore reefs providing sheltered coast Multiple linear coastal dunes seaward of relict parabolic dunes
R07.E.11a. Leander Point to Harleys Hole (Figure 10.1)	Discontinuous wide offshore limestone reef Moderate depth coastal lagoon (relict Irwin River basin) Multiple nearshore reefs Degraded dunes with limited foredune rebuilding
R07.D.10b. White Point to Leander Point (Figure 10.1)	Wide but discrete reef areas (Irwin Reef; Jack Reef / White Tops; Long Reef / White Point Reef) Coastal lagoon infilled by salient (i.e. sandy bed) Wide area of nearshore rock platform (Leander Point) Active dune with extensive nearshore blowouts
R07.D.10a. Cliff Head to White Point (Figure 10.1)	Isolated offshore reef areas Wide, shallow, coastal lagoon with seagrass coverage Limited areas of nearshore reef Narrow linear coastal dunes seaward of large relict parabolic dunes

R07.D.09a. South Illawong to Cliff Head (Figure 11.2 & Figure 11.3)	Discontinuous offshore reef areas Shallow coastal lagoon with seagrass coverage Wide area of nearshore rock platform Isolated areas of dune development as foredune ridges landward of nearshore reef sections, with irregular disturbance and migration

The importance of the morphology at a tertiary sediment cell scale is the corresponding variation in active processes and responses to different coastal drivers.

8.5 ACTIONS – COASTAL PROCESSES

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
Relevant objectives: • **Objective 2 – To manage the environmental and recreational values of the coastline in order to retain the broad range of recreational opportunities, environmental values and sense of isolation unique to the area.** • **Objective 3 – Consider risks, actions and recommendations from existing Shire plans and strategies.** • **Objective 4 – To ensure management and protection of the Shire's coastline is undertaken in a sustainable manner.** • **Objective 5 – To ensure adequate consideration of coastal hazards is undertaken and ensure management is undertaken in accordance with SPP 2.6 and associated Guidelines**			
CP1	Give due regard to SPP 2.6 for the planning of any coastal facilities or development following the management and adaptation hierarchy of avoid-retreat-accommodate-protect. The location of coastal facilities and development should consider: • coastal processes, • appropriate coastal setbacks are implemented • any fixed infrastructure is built to the appropriate standard over an appropriate planning timeframe and can accommodate the anticipated range of beach and dune variability. It is recommended most assets on this coast are placed with consideration of how to accommodate the variability in beach position and dunes and allow for retreat where feasible. This is particularly relevant for recreational assets with finite lifespans and coastally dependent and easily relocatable assets noted in Sections 7.1 and 7.2 of SPP2.6 respectively.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
CP2	Conduct regular monitoring of infrastructure and recreational facilities along the beach within Shire-managed reserves.	O	Shire of Irwin
CP3	Ensure coastal users are adequately informed of natural hazards and risk such as flooding and inundation through the use of signs.	O	Shire of Irwin (Shire reserves) Landowners (Freehold) DPLH (UCL)
CP4	Implement actions from the Shire of Irwin CHRMAP (Shire of Irwin, 2016).		Shire of Irwin
CP5	Give due regard to SPP 2.6 which provides for public access to foreshore areas and apply when considering future options for access. Avoid straight line access and locations that may lead to dune destabilisation.	O	Shire of Irwin

9.0 sector 1 – northern beaches

9.1 DESCRIPTION

LOCATION

Sector one extends from the northern boundary of the Shire to north of Dongara (Reserve number 43544 north of Sunset Cove). It includes the following coastal sites:

- McKenzies Beach
- Seven Mile Beach.

A number of minor coastal sites are dotted along this sector including:

- Nine Mile Beach
- Box Rox
- Pistons
- Five Mile Lagoon
- Harleys Hole
- Kingy Bay
- King Bay.

Sector 1 is shown on Plan 9.1.

PLANNING AND TENURE

The Shire of Irwin Local Planning Scheme No. 5 (WAPC, 2008) identifies the following zones and reserves within Sector 2.

Table 9.1 - Sector 1 zoning

LOCATION	ZONE/RESERVE
Northern boundary to the Dongara townsite.	Coastal area is reserved as Local Reserve. Inland from the reserve the land is zoned General Farming.

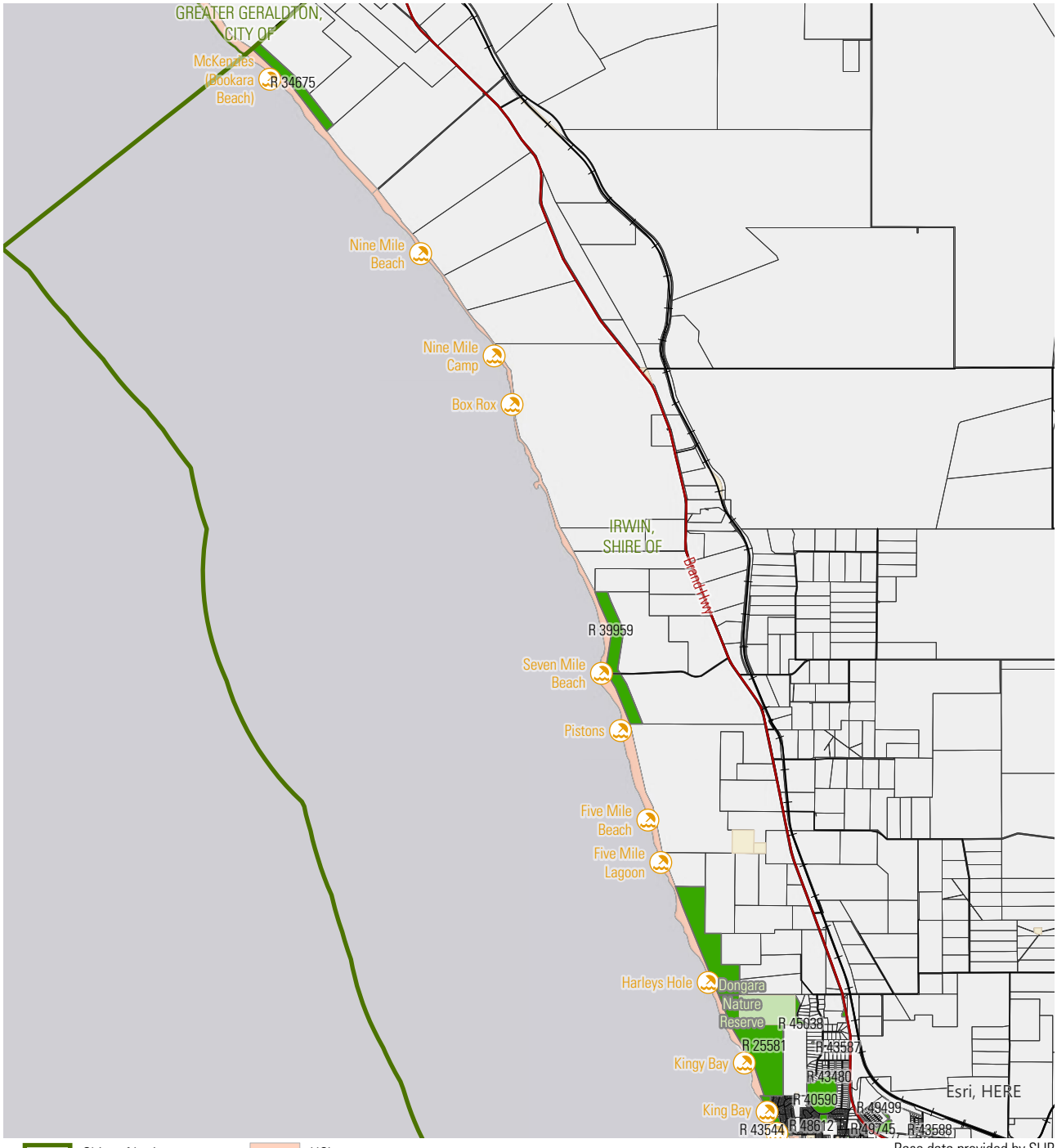
Tenure within Sector 1 comprises a mixture of freehold, Shire-managed reserve and unallocated crown land (UCL). A majority of the coastal dune systems are located on private property. A thin strip of UCL stretches along the beach. Shire-managed reserves are located at Seven Mile Beach (Reserve number 39959) and at McKenzies Beach (reserve number 34675). Tenure is shown in Figure 2.1.

A description of the reserves within Sector 1 is provided in the table below.



Seven Mile Beach

Photo by Land Insights, May 2019



Plan 9.1: Sector 1 Overview

Table 9.2 - Sector 1 Reserve Details

RESERVE NO.	LOT NO.	PLAN NO.	LOCATION	PURPOSE	MANAGEMENT ORDER
25581	2838	P109847	Dongara	Recreation	Shire of Irwin
25581	2838	P109847	North of Dongara		
25581	5949	P082780	North of Dongara		
39959	11735	P105495	Southern side of 7 Mile Beach	Public recreation	Shire of Irwin
39959	11735	P015495	Northern side of 7 Mile Beach		
34675	11222	D047687	Northern boundary of the Shire.	Public recreation	Shire of Irwin

9.2 COASTAL PROCESSES

For the northern Irwin coast, the narrow offshore reef system provides partial sheltering from offshore waves, with greater wave energy able to transfer through any breaks in the reef. As a consequence, the coast north of Nine Mile Beach can be subject to more severe wave attack under extreme conditions, but ambient wave conditions are likely to be observed from Five Mile Beach northwards.

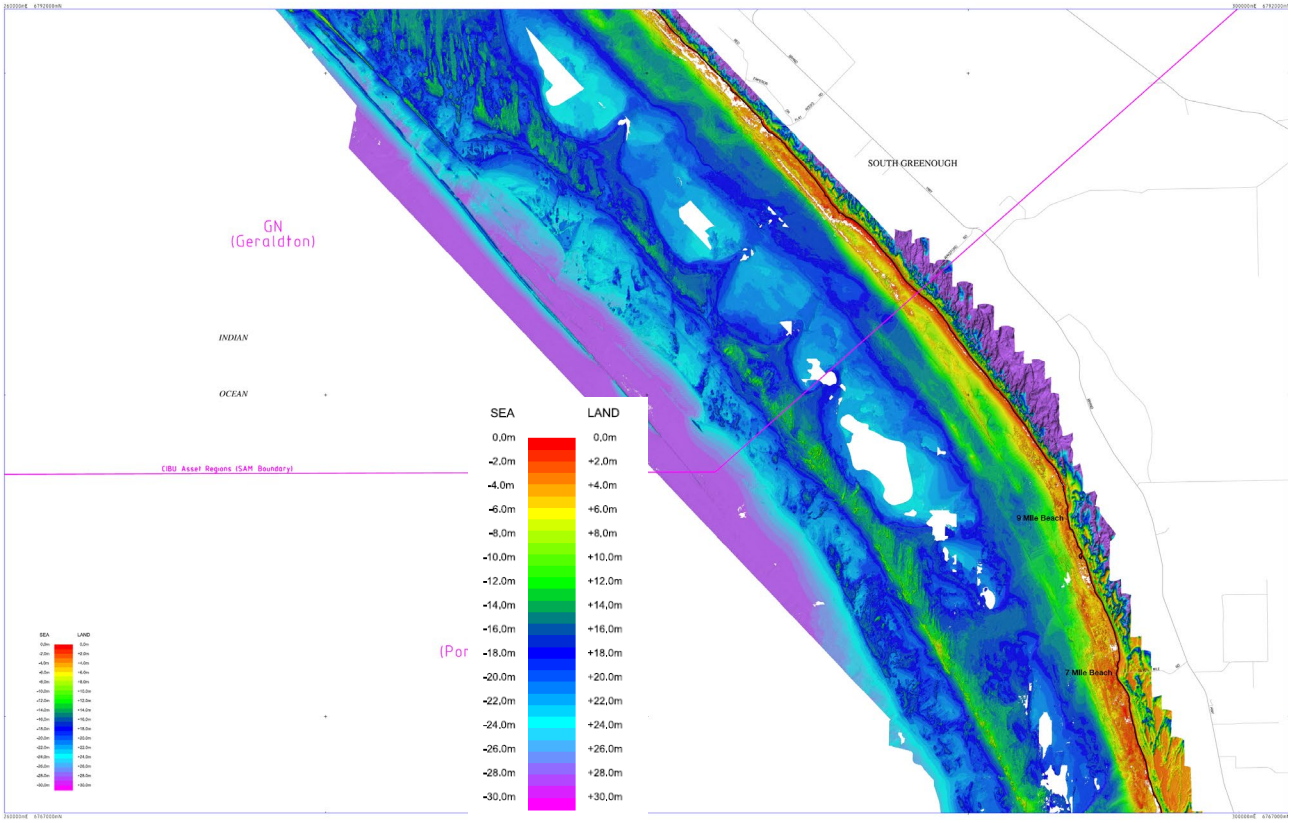


Figure 9.1: North Shire of Irwin Coast

The importance of the nearshore rock platform is indicated by the difference in dune structure, with the lower elevation rock platform north of Nine Mile Beach being directly connected to unstable coastal dunes. The wider and higher nearshore reef system has historically provided greater dune stability north of Headbutts, and south of Nine Mile Beach, with the southern section also supported by the more west-facing shore orientation. The areas with high rock platform are typically resistant to storm erosion under ambient conditions, with erosion mainly occurring during severe events, particularly those causing high water levels. Refer to Figure 9.1 which shows the sea and land elevations for the northern sector.

A continuous coastal track runs between Seven Mile Beach and Nine Mile BeacH. Mild dune degradation is present due to vehicle and pedestrian tracks, however, dune mobility is moderate. The position of the shoreline has remained generally stable, however, a retreated position from 2013-2016 followed after the phase of high mean sea level and may reflect reduced sediment availability (Figure 9.2).

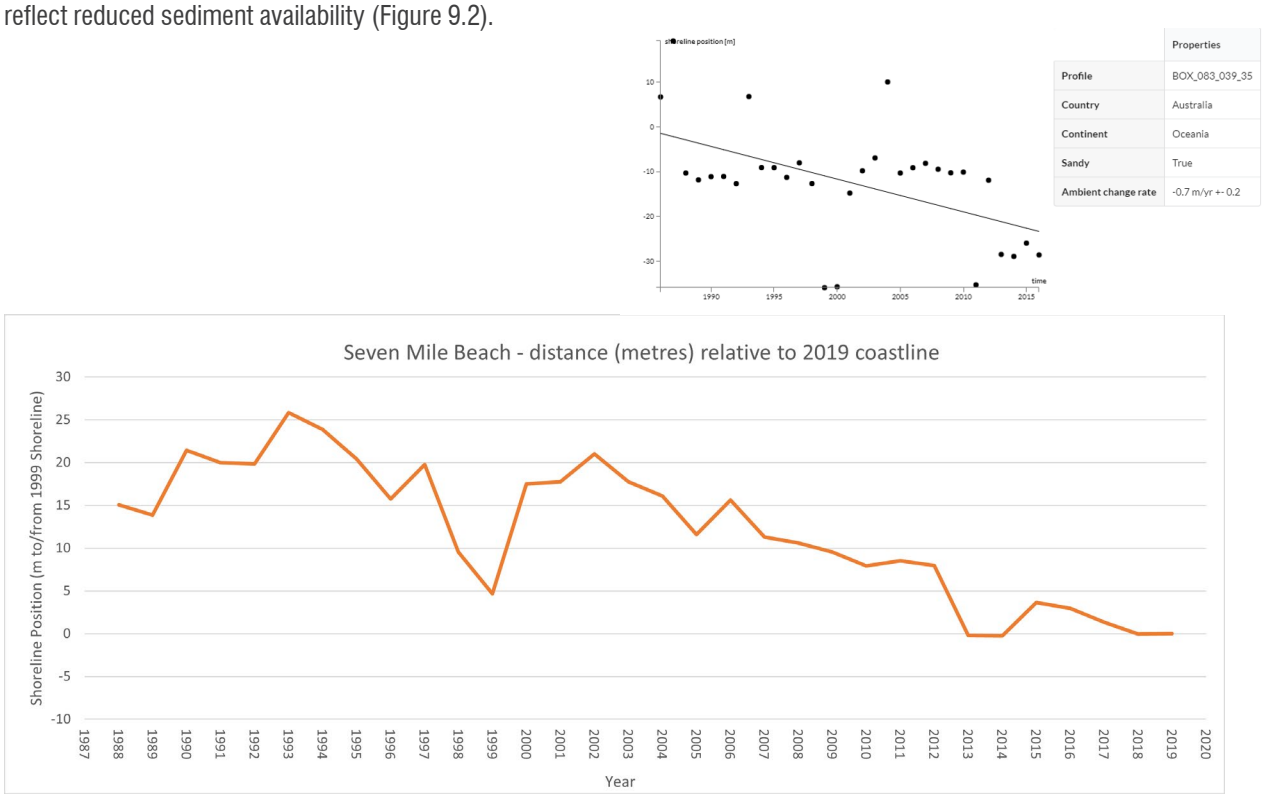


Figure 9.2: Shoreline Position south of Seven Mile Beach (from Shoreline Monitor)

9.3 SOCIAL, RECREATIONAL AND LAND USE

There are only two coastal sites in this sector which have reserves with management orders with the Shire of Irwin:

- McKenzies Beach
- Seven Mile Beach

Owing to the difficulty in accessing the coast north of Dongara, the remainder of the sites are low-key in nature.

McKenzies Beach and Seven Mile Beach can be accessed via gazetted roads. Seven Mile Beach is accessed via Seven Mile Road and McKenzies Beach can be accessed via Wakeford Road. However, unlike Seven Mile Road and despite there being a road reserve from Indian Ocean Drive to the beach, Wakefield Road stops approximately halfway and turns into a couple of ORV access tracks. As a result of this difficult access, McKenzies Beach is a low-key coastal site with no facilities.

Seven Mile Beach comprises a fairly large gravel car park, however no facilities are provided. Overnight camping is permitted within the car park area only. South of Seven Mile Beach is 'closed waters' for research purposes by the Department of Fisheries (DPIRD) and the taking of rock lobsters is prohibited. Pedestrian and vehicle access are provided to the beach.

It should also be noted that although there is a Shire-managed reserve at Seven Mile Beach (reserve 39959) the car park and beach access is located primarily within the UCL.

Other minor coastal sites are also scattered along this section of the coast. Informal access to these sites is provided through tracks which pass through private property. No facilities are provided at these coastal sites. They are located within UCL or private property and therefore not under the control or management of the Shire.

9.4 ENVIRONMENT

The coastal environment along this sector is relatively undisturbed due to the difficulty in access and the low level of use. Apart from off-road vehicle tracks providing access to the beach, the vegetation is relatively undisturbed. It appears that these tracks are relatively well-established and there doesn't seem to be much evidence of duplicate tracks or new tracks being formed, with the exception of tracks near Seven Mile Beach which are causing some minor localised dune degradation. As the tracks are primarily located within freehold land and UCL, they are outside the management of the Shire.

9.5 SECTOR 1 – ISSUES AND OPPORTUNITIES

A review of all issues and opportunities and how they have helped form the recommendations is provided below.

Issues and opportunities for Sector 1 is provided in the table below.

Table 9.3 - Sector 1 Issues and Opportunities

ISSUES	OPPORTUNITIES
TENURE	
A majority of the coastline north of Dongara is Unallocated Crown Land. Inland from UCL to Brand Highway is largely freehold. A few Shire-managed reserves are located in this sector. One is directly north of Dongara (R25581), one is at Seven Mile Beach R39959) and the last is at McKenzies Beach (R34675). The reserves at Seven Mile Beach and McKenzies Beach are setback from the beach. The car park, coastal tracks, camping areas and beach access at Seven Mile Beach is located on UCL. No development is located at R34675 at McKenzies Beach. Access to this site is not currently well-established and is unlikely to be formalised in the near future.	There is an opportunity to extract a portion of the UCL at Seven Mile Beach and transfer this to Shire-managed reserve. The reserve can include the car park, camping area, coastal tracks and beach access.
ACCESS	
As a majority of the coast north of Dongara is located on UCL or private property, access is not readily available to the public. There are some well-established access tracks leading from Brand Highway through private property to the beach and access tracks also lead north from Dongara. These tracks are most likely only used by locals. They are all only accessible by 4WD (except for the access road to Seven Mile Beach). A road to McKenzies Beach (Wakeford Road) is only established for half of the length. The remainder of the access track to McKenzies Beach is a 4WD track through the dunes. Wakeford Road is also located in a road reserve which is within the City of Greater Geraldton.	The access restrictions north of Dongara act as a form of self-management for the northern coastline as most areas are only accessible by locals or people who know the area and can gain access to private property. Access to Seven Mile Beach is well-established for 2WD and should be maintained. Boat launching occurs at Seven Mile Beach, however is problematic at the time of site visits due to the vertical separation distance between the beach and the car park. No upgrades are recommended for Wakeford Road and access to McKenzies Beach should remain low-key.

ISSUES	OPPORTUNITIES
FACILITIES	
There are limited facilities available at the coastal sites within Sector 3. This is largely due to the low-key nature of these sites and the low visitation due to difficult access to many access nodes (apart from Seven-Mile Beach). A majority of the sector is UCL or freehold and not the responsibility of the Shire. Seven Mile Beach is the only site with a formal car park. Camping is allowed within the car park but is not permitted in the dunes north of the site. Campers should be fully self-contained as no toilet facilities are provided. One skip bin is located in the car park.	Due to the low-key nature of the sites north of Dongara and the issues around tenure and management, there are no recommendations to provide additional facilities in this Sector. No additional facilities are recommended at Seven Mile Beach. This is due to the low-key nature of this site and the availability of Shire resources to manage facilities.
SIGNAGE	
There is some signage at Seven Mile Beach. One is regarding the closed waters for rock lobster fishing to the south of the beach and the other signs advise of the dune conservation area to the north of the car park and that no camping is permitted in the dunes.	As the only coastal site north of Dongara, which is managed by the Shire, there is an opportunity to provide some additional signage regarding safety and emergency, as well as educational and interpretative signage.
COASTAL PROCESSES	
The coast north of Nine Mile Beach can be subject to more severe wave attack under extreme conditions, but ambient wave conditions are likely to be observed from Five Mile Beach northwards. There is mild dune degradation from Nine Mile Beach to Seven Mile Beach, however, dune mobility is moderate. The position of the shoreline has remained generally stable with some reduced sediment availability.	There are generally no requirements to respond to the coastal processes in this sector as it is generally undeveloped. Coastal processes should be managed at Seven Mile Beach by discouraging vehicle access and camping north of the car park to reduce erosion and blowouts. This can be achieved through clear signage, ranger monitoring etc.



Seven Mile Beach

Photo by Land Insights, May 2019

9.6 SECTOR 1 – RECOMMENDED ACTIONS

OBJECTIVES

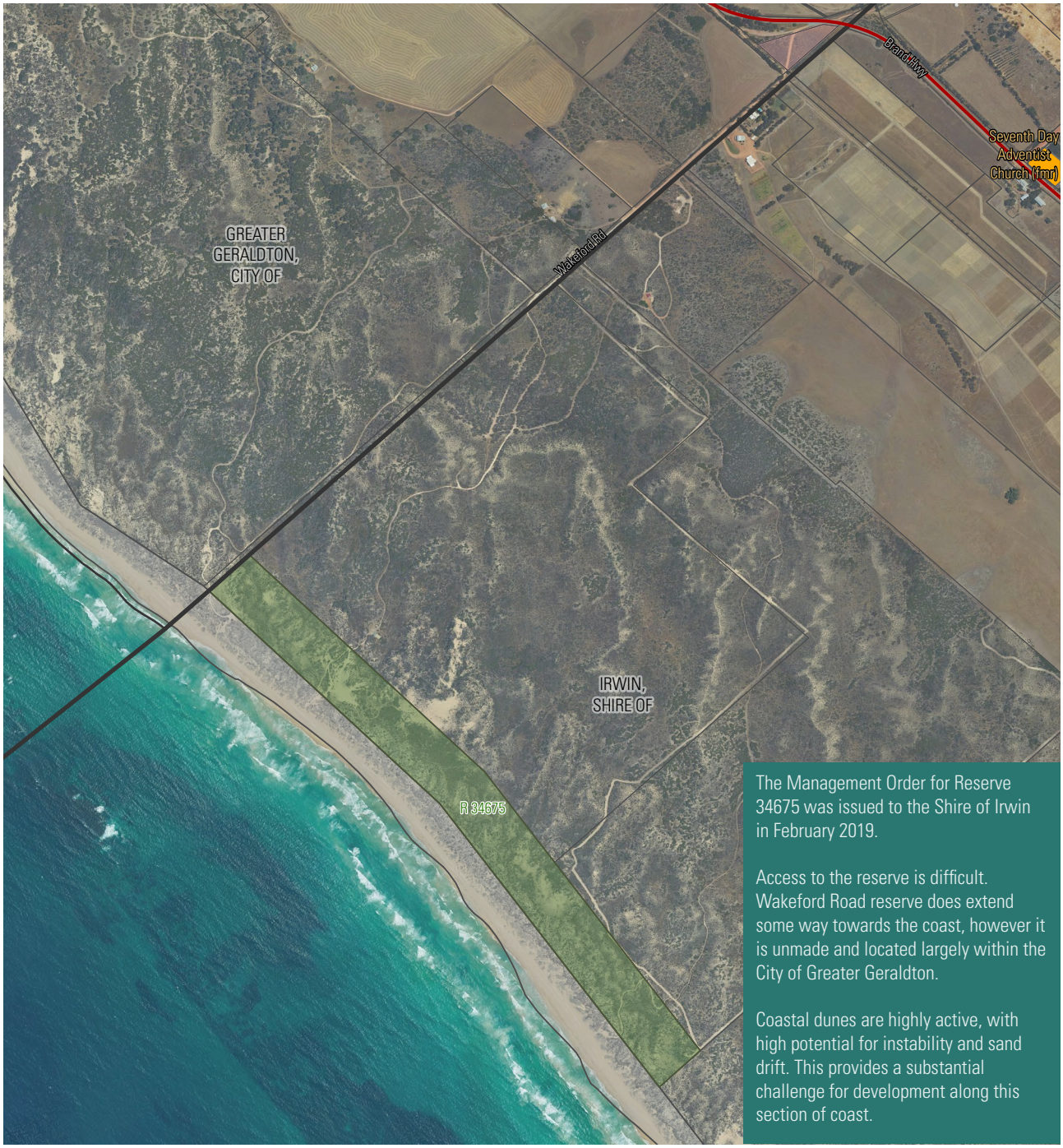
To maintain the low-key recreational nature of this sector and to focus on Seven Mile Btiaeach as the main Shire-managed coastal site in this sector for day use.

ACTIONS

The recommended actions for Sector 1 are listed in the table below and shown on Plans 9.2 and 9.3.

Table 9.4 - Sector 1 Actions

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
S1-1	Maintain Seven-Mile Beach as an unserviced and self-contained site to limit the likelihood of the site being used for overnight camping. Liaise with CGG & MRWA should Wakeford Rd be used for public beach access in the future.	O	Shire of Irwin
S1-2	Improve signage at Seven Mile Beach, specifically outlining the remoteness of the site in case of emergency, and that (as at the time of writing) no mobile phone coverage is provided.	S	Shire of Irwin
S1-3	Reinstate the 'no camping' signs for the area immediately north of the Seven Mile car park.	S	Shire of Irwin
S1-4	Local dune instability due to vehicle and pedestrian access should be managed periodically (2-5 years) through track closure, brushing and revegetation.	S-M	Shire of Irwin
S1-5	Consider provision of minor improvements to informal boat ramp, including surface drainage diversion and seasonal placement/removal of beach matting and/or possible NW/SE alignment.	S-M	Shire of Irwin
S1-6	Review the interface boundary between the Shire Reserve (R39959) and adjoining UCL to incorporate the car park into the Reserve.	S	Shire of Irwin



The Management Order for Reserve 34675 was issued to the Shire of Irwin in February 2019.

Access to the reserve is difficult. Wakeford Road reserve does extend some way towards the coast, however it is unmade and located largely within the City of Greater Geraldton.

Coastal dunes are highly active, with high potential for instability and sand drift. This provides a substantial challenge for development along this section of coast.

Base data provided by SLIP

State Road
Cadastre
UCL
Reserve - Shire of Irwin
Other Reserves
Heritage - State Register

1:20,000

N

0 250 500 750 1,000 m

Plan 9.2: McKenzies Beach (Overview) Sector 1

RECOMMENDATIONS:

1. Maintain Seven-Mile Beach as an un-serviced and self-contained site to limit the likelihood of the site being used for overnight camping.

2. Improve signage at the site, specifically outlining the remoteness of the site in case of emergency, and that (as at the time of writing) no mobile phone coverage is provided.

3. Reinstate the 'no camping' signs for the area immediately north of the car park.

4. Local dune instability due to vehicle and pedestrian access should be managed periodically (2-5 years) through track closure, brushing and revegetation.

5. Consider provision of minor improvements to informal boat ramp, including surface drainage diversion and seasonal placement/removal of beach matting and/or possible NW/SE alignment.

6. Review the interface boundary between the Shire Reserve (R39959) and adjoining UCL to incorporate the car park into the Reserve.



Cadastre

UCL

Reserve - Shire of Irwin

N

1:10,000

0 125 250 375 500 m

Plan 9.3: Seven Mile Beach (Overview)
Sector 1

10.0 sector 2 – Dongara/Port Denison

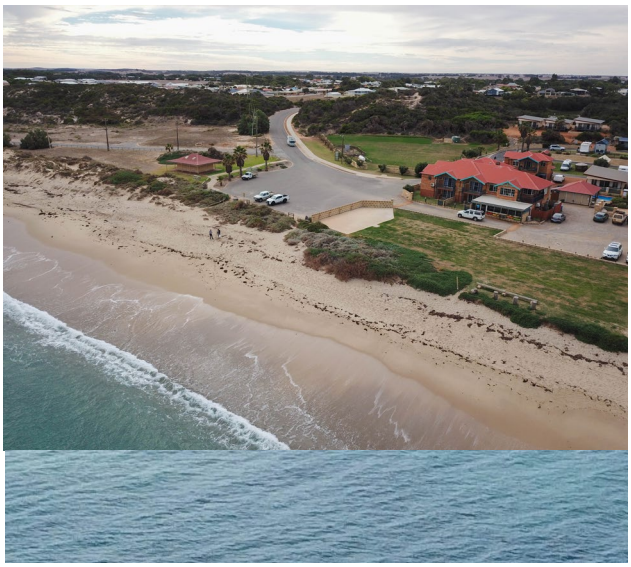
10.1 DESCRIPTION

LOCATION

This sector stretches from north of the Dongara townsite (Reserve number 43544 north of Sunset Cove) to the south of Port Denison (south of South Beach and Reserve Number 137). It includes the following coastal sites:

- Sunset Cove
- Seaspray Beach
- Irwin River Mouth
- Nuns Pool
- Surf Beach
- Grannies Beach
- Port Denison foreshore
- South Beach.

The extent of sector 2 is shown on Plan 10.1



PLANNING AND TENURE

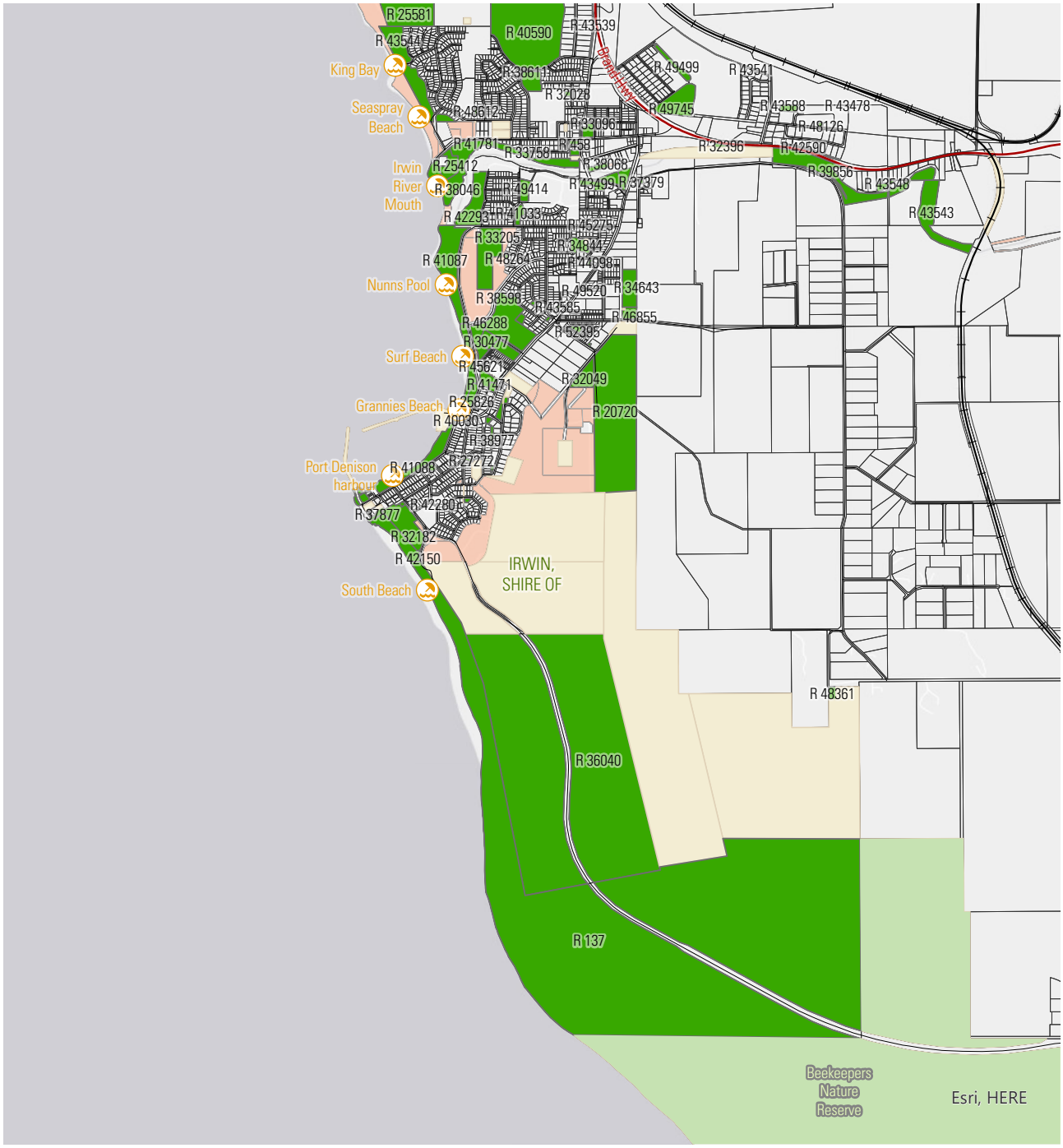
The Shire of Irwin Local Planning Scheme No. 5 (WAPC, 2008) identifies the following zones and reserves within Sector 2.

Table 10.1 - Sector 2 zoning

LOCATION	ZONE/RESERVE
Dongara and Port Denison townsite	Coastal area is reserved as Local Reserve. Directly south of Port Denison the coastal area is reserved as Local Reserve. Inland from the Local Reserve the land is reserved for Public Purposes (Airport and Common).

A majority of the coastal area within the Port Denison and Dongara townsite is located within local reserves managed by the Shire (with the exception of the coastal area north of the Irwin River which is UCL).

A list of all reserves within Sector 2, including purpose of the reserve and management orders, is provided in the table below.



Plan 10.1: Sector 2 Overview

Table 10.2 - Sector 2 Reserves

RESERVE NO.	LOT NO.	PLAN NO.	LOCATION	PURPOSE	MANAGEMENT ORDER
137	650	P401935	South of Port Denison	Common	Shire of Irwin
24829	12124	DP219523	South of Port Denison	Lime deposit	N/A
36040	12126	P219524	South of Port Denison – inland	Aerial landing ground (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands).	Shire of Irwin
42150	924	P190555	Port Denison	Recreation	Shire of Irwin
32182	3000	P46591	Port Denison	Camping and caravan park (with power to lease for any term not exceeding 50 years subject to the consent of the Minister for Lands).	Shire of Irwin
37877	917	P189498	Port Denison	Dune Protection	Shire of Irwin
41089	546	P216836	Port Denison – jetty	Harbour Purposes	Minister for Transport
41088	305	P042170	Port Denison	Recreation (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands).	Shire of Irwin
41088	307	P042170	Port Denison		Shire of Irwin
40029	581	P186882	Port Denison	Navigation Beacon Site	Minister for Transport
41088	306	P042170	Port Denison	Recreation (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands).	Shire of Irwin
41088	954	P036803	Port Denison		
41088	945	P221338	Port Denison		
41089	953	P036803	Port Denison	Harbour Purposes	Minister for Transport
40030	950	P221338	Port Denison	Foreshore Management	Shire of Irwin
40030	949	P221338	Port Denison		
46561	948	P221338	Port Denison	Recreation (with power to lease for any term not exceeding 5 years subject to the consent of the Minister for Lands).	Shire of Irwin
46561	947	P221338	Port Denison		

RESERVE NO.	LOT NO.	PLAN NO.	LOCATION	PURPOSE	MANAGEMENT ORDER
25826	946	P122138	Port Denison	Recreation camping and caravan park (with power to lease for any term not exceeding 30 years subject to the consent of the Minister for Lands).	Shire of Irwin
41087	590	P216835	Port Denison	Foreshore Management	Shire of Irwin
38046	300	P050241	Dongara	Recreation and foreshore management	Shire of Irwin
25412	94	P191394	Dongara	Caravan park (with power to lease for any term not exceeding 30 years subject to the consent of the Minister for Lands).	Shire of Irwin
43544	12053	P018271	Dongara	Public recreation	Shire of Irwin
43544	12053	P018955	Dongara		
43544	12361	P023156	Dongara		
43544	12815	P039794	Dongara		
43544	619	P053786	Dongara		



Pt Denison - Grannies Beach and Marina

Photo by Land Insights, May 2019

10.2 COASTAL PROCESSES

The North-Central Shire of Irwin coast, which includes the town sites of Dongara and Port Denison, is morphologically complex, largely due to the influence of the Irwin River. During phases of lower sea level, the river has supported a coastal lagoon, with remnant river channels still evident in the high resolution bathymetry (Figure 10.1).

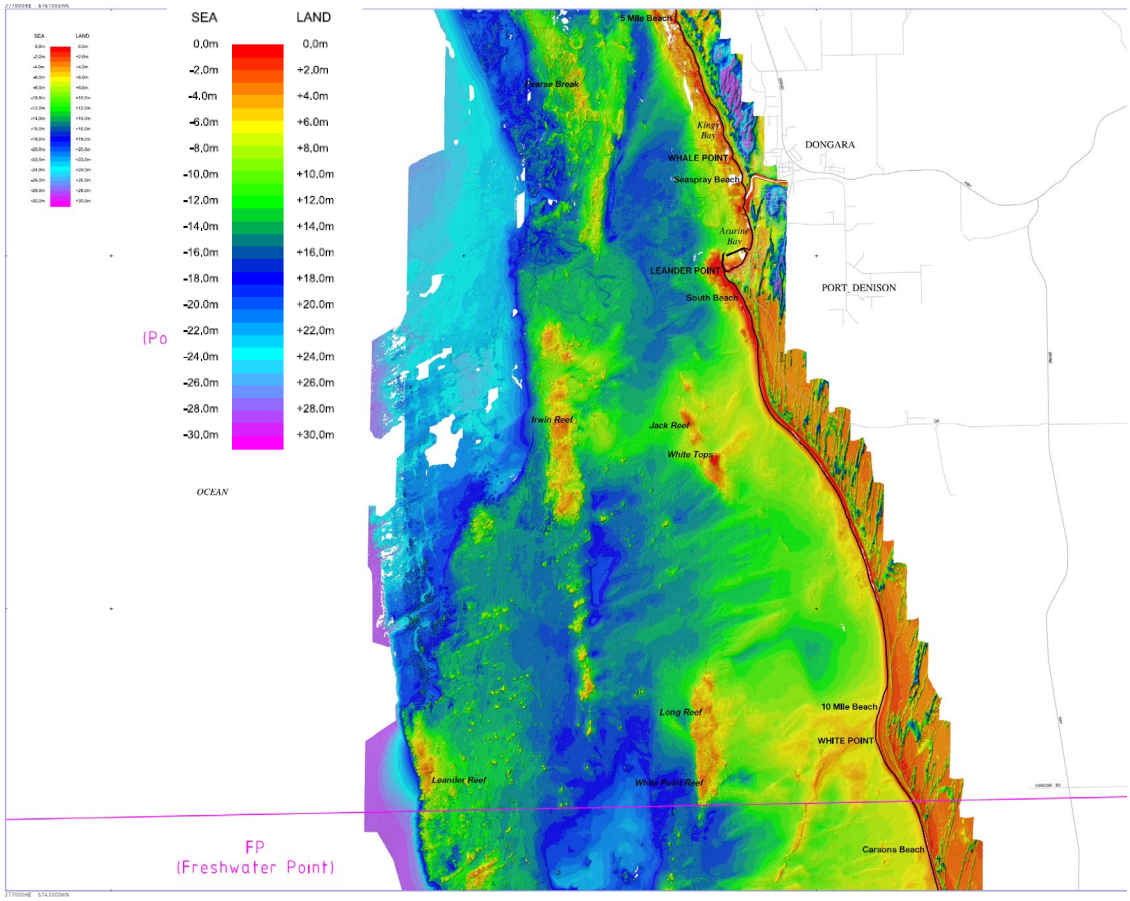
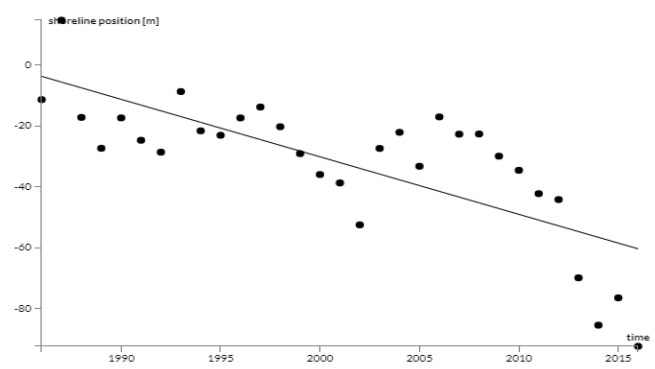


Figure 10.1: North Central Shire of Irwin Coast

Patches of offshore reef actively modify the nearshore wave climate. The resulting areas of shelter have supported accumulation of sand salients or tombola (Sanderson & Eliot 1996), as well as helping to preserve inshore reef ridges, such as the sequence between Leander Reef and White Point (Figure 17). Reef sheltered areas are typically subject to a wider range of disturbing processes than the adjacent coast, particularly due to unusual storm directions, or periods of elevated sea level (Seashore Engineering 2018); however, the sheltering also encourages subsequent recovery, producing a locally dynamic coastline. The relative

sensitivity of salients to sea level variation is demonstrated by rapid erosion of the coast near Denison Airstrip (Figure 10.2) which provides a cautionary warning for response to projected sea level rise.



	Properties
Profile	BOX_083_037_18
Country	Australia
Continent	Oceania
Sandy	True
Ambient change rate	-1.9 m/yr +- 0.3

Figure 10.2: Shoreline Position near Denison Airstrip (from Shoreline Monitor)

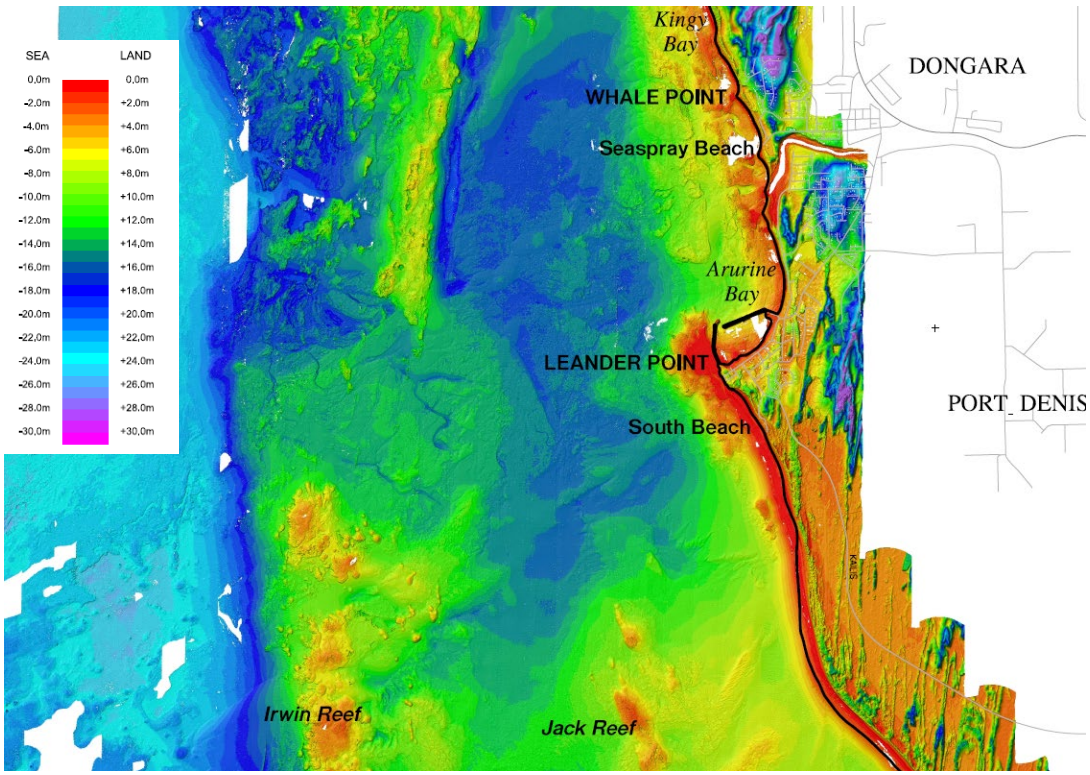
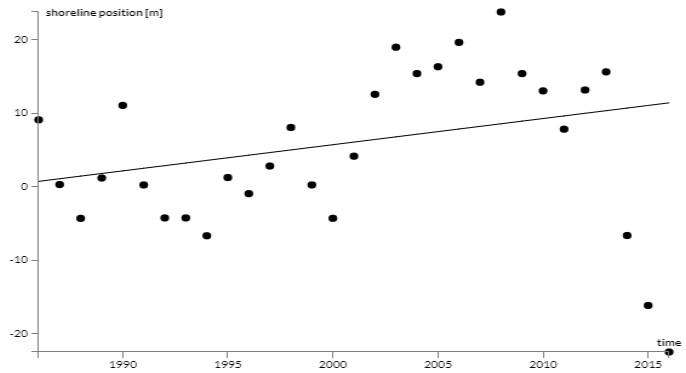


Figure 10.3: Localised Bathymetric Features in the Vicinity of Dongara-Port Denison

The effective barrier to alongshore sediment transport provided by Leander Point is suggested by the sandy accumulation behind Irwin Reef and corresponding absence inshore of Pearse Bank to the north; the alongshore barrier provided by the rock platform at Leander Point; and the high onshore sediment supply suggested by the active dunes between South Beach and White Point. This area has generally exhibited accretion over recent decades, however, the substantial influence of reef sheltering and its absence during high water level conditions is apparent at White Point (Figure 10.4), with the released material apparently supporting foredune growth to the north.

The beach between South Beach and White Point is comparatively exposed to wave action, with broken offshore reefs. This provides highly variable wave conditions, with associated cross-shore beach movement. Combined with the high potential for onshore sediment supply from wind drift, there is opportunity for cyclic dune formation and destruction, evidenced by frequent formation of scarps along this section of coast. In consequence, interventions on this section of coast, including beach access points, will have limited effective life (Figure 10.4).



	Properties
Profile	BOX_083_037_43
Country	Australia
Continent	Oceania
Sandy	True
Ambient change rate	0.4 m/yr +- 0.2

Figure 10.4: Shoreline Position at White Point (from Shoreline Monitor)

10.3 COASTAL PROCESSES AND MANAGEMENT SPECIFIC TO GRANNIES BEACH

Since construction of Port Denison Boat Harbour, ongoing erosion has occurred at Grannies Beach, Port Denison. From 1980-2010, loss was relatively gradual, with seasonal fluctuations in beach width. The erosion issue was exacerbated following construction of a revetment in front of the Holiday Parks caravan park in 2011. Erosion now threatens Ocean Drive and had forced closure of a section of dual use path (which has now been repaired).

Grannies Beach is located on the eastern side of Port Denison Boat Harbour, which was constructed in the lee of Leander Point, on the southern side of Arurine Bay (Figure 10.5). Leander Point naturally provides a substantial barrier to alongshore sediment transport and therefore this section of coast is subject to minimal sediment supply from offshore, or through irregular release of sediments from the river mouth. The natural coast developed as a 'stable' zeta-form bay on the downdrift side of Leander Point, and therefore the beach curvature relates to the pattern of wave sheltering and diffraction, characteristically with near zero sediment supply or loss (Hsu & Silvester 1996).

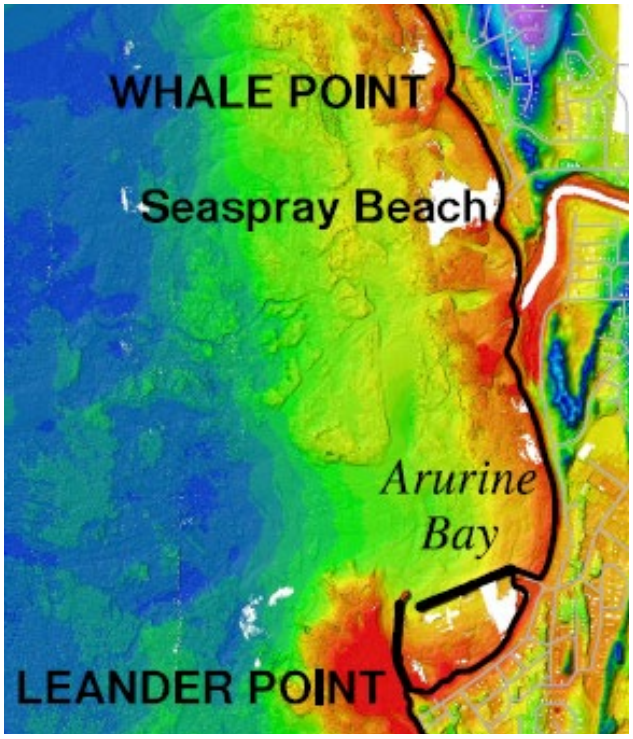


Figure 10.5: Extract from High Resolution Bathymetry

Alignment of the main harbour breakwater was designed to be within the lee of Leander Point from prevailing swell, and therefore minimise impact on the Arurine Bay coast (PWD 1976). It was recognised that some alteration of bay structure would be expected, to the modified wave climate, however, it was anticipated that a new stable bay shape would develop. A new bay shape was not predicted at the time, however, the expected response to Port Denison breakwaters can be inferred from application of zeta-form bay geometry, using MEPBay software which relates wave angle and headland control points to bay shape (Klein et al. 2003). Indicative curvature suggests that the original bay shape corresponded reasonably well to a zeta-bay form, and that construction of the main breakwater was likely to have created erosion pressure on Grannies Beach and Ocean Drive (Figure 10.6).

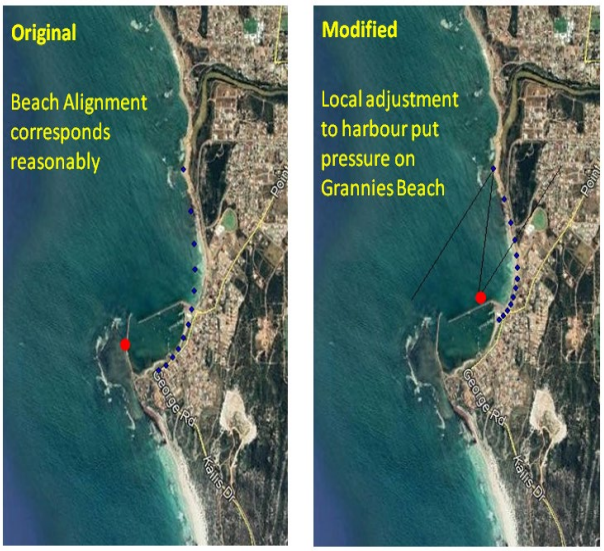


Figure 10.6: Expected Beach Response to Port Denison Breakwaters

Although this general pattern was observed, in the longer term, there was limited indication of declining erosion over 30 years, suggesting that a new 'stable' beach was not being established.

Continuation of unusual behaviour occurred after installation of the revetment in front of the Holiday Parks caravan park in 2011, designed to be in the lee of Port Denison main breakwater. Unlike the original harbour construction, this structure does not create a new point of diffraction, and therefore, following the theory behind zeta-form bays, would not modify the bay shape. However, subsequent behaviour has demonstrated an accelerated rate of erosion.

An alternative explanation for the erosion along Grannies Beach and Ocean Drive has been developed through the geomorphic frameworks approach (French & Burningham 2009), with consideration of the dynamic concepts of sediment transfer and storage. This interpretation suggests that coastal change within Arurine Bay has resulted from a combination of human actions and natural processes.

Prior to coastal engineering works, Arurine Bay was able

to achieve a measure of stability by balancing seasonally alternating northward and southward sediment transport. Variation in wave direction was accommodated by the presence of two sediment storage areas (Figure 10.7), with the southern storage area being in the lee of Leander Point and the northern storage area being behind the shelter of nearshore reefs, near to the present day Irwin River mouth (Figure 10.5).

For longer term coastal stability (relative) to occur in this coastal segment, there needed to be an approximate balance of seasonal sediment transport, which is largely determined by beach angle. In addition, to cater for seasonal dynamics, storage areas at either end need to be able to hold the seasonal volume of sediment exchange. As a headland, Leander Point had a very large storage capacity, whereas the reef controlled salient provided a much smaller storage volume. Consequently, extreme southward conditions would result in beach accretion, whereas extreme northward conditions would cause sediment to bypass the reef and effectively be lost from the beach segment. This framework provides the basis for an approximate balance of sediment volumes (Figure 10.7).

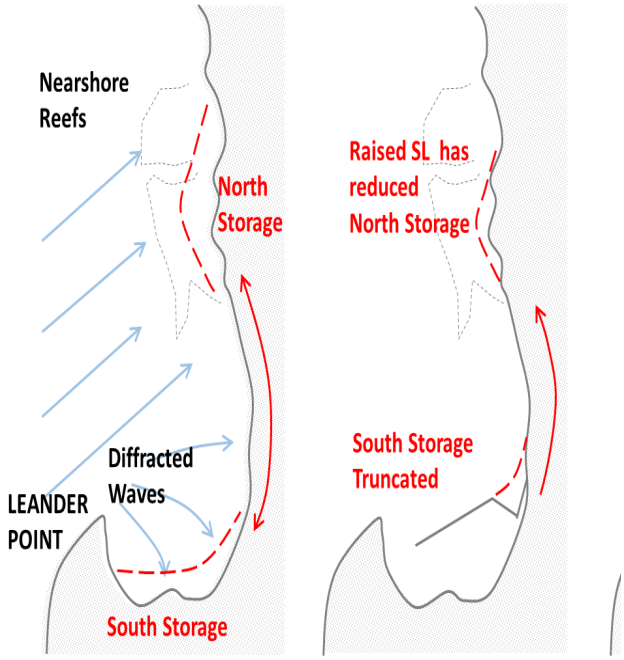


Figure 10.7: Original Controls for Arurine Bay and Subsequent Modifications

Construction of Port Denison Boat Harbour truncated the south storage area, reducing the effective beach length by 600m, but caused limited change to the alongshore seasonal sediment transport (Figure 10.7). This has the effect of reducing the capacity of the southern storage area to capture sediment during stronger southerly transport, and although there has been negligible change to sediment transfers under ambient conditions, a net loss was developed (Figure 10.8). The consequent response has been progressive erosion of the beach, which is greater toward the south (Figure 10.9).

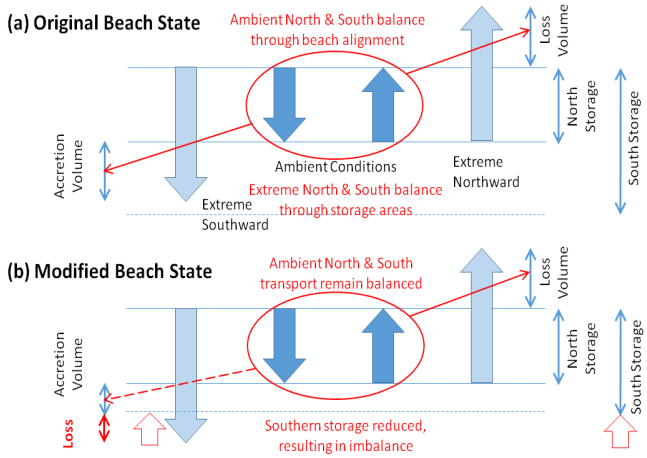


Figure 10.8: Conceptual Model of Beach Dynamics

Subsequent pressures to the beach have included:

- From 2011-2013, very high mean sea levels occurred during La Nina conditions, reducing the effective sheltering provided by the nearshore reefs and reducing the northern storage volume. As the effective storage capacity is determined by the proximity of the reef to the shore, associated beach retreat contributed to longer-term storage loss; and
- Construction of a 300m long revetment in front of Holiday Parks caravan park, which increased wave reflection and further truncated the beach length. These changes will have further reduced the effective southern storage volume.

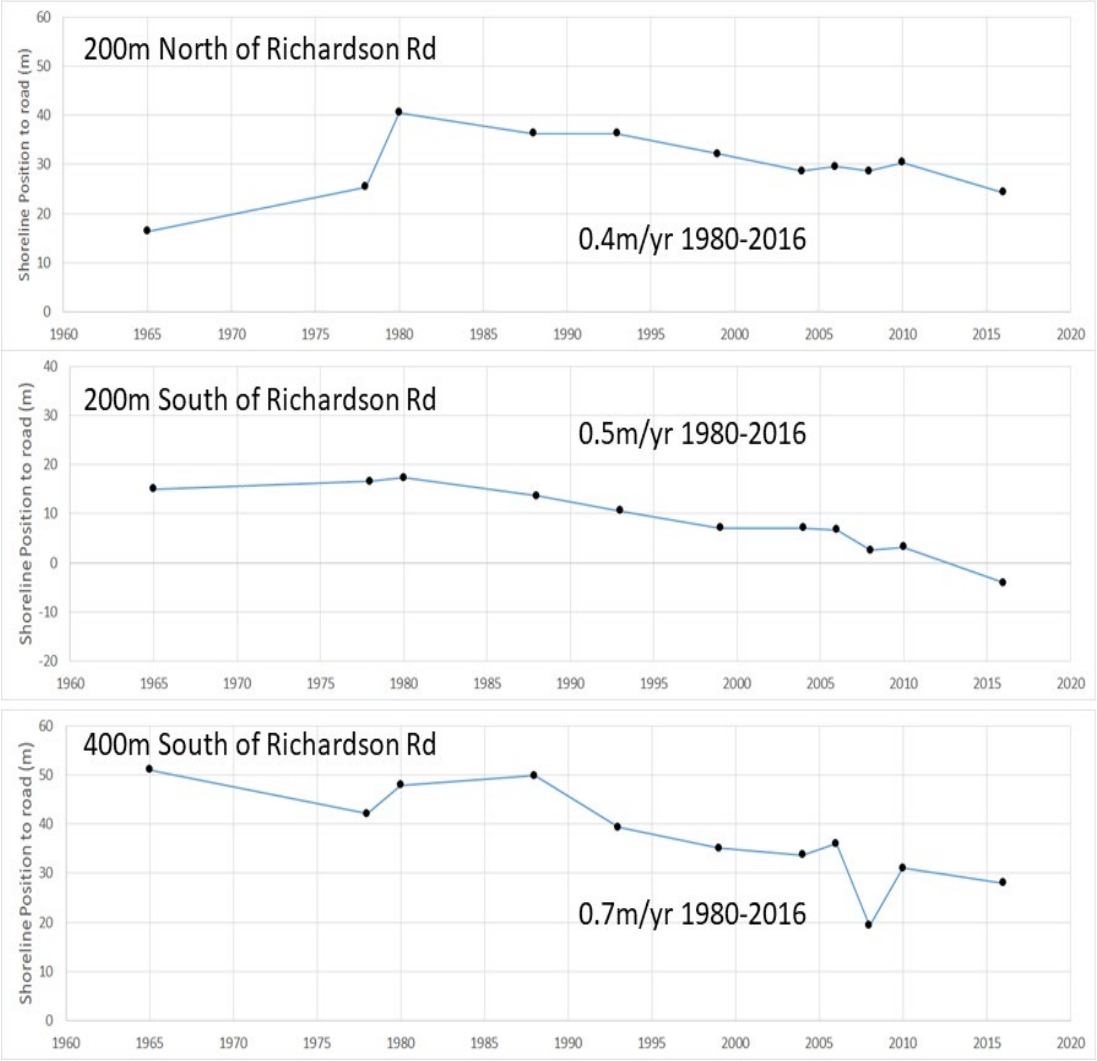


Figure 10.9: Vegetation Line Time Series for Grannies Beach

There is an immediate need to address the progressive erosion problem, as it is already impacting on Ocean Drive. Potential alternatives to be considered include:

- Relocation of Ocean Drive
- Ongoing renourishment
- Construction of a revetment along the affected foreshore
- Renourishment, with supporting reinforcement of the reef point structures to improve the longevity of placed material. This may involve enhancing the storages areas at either end of the beach, or construction of a groyne field (Figure 10.10). A preliminary indication of relative effectiveness of these three options has been developed using MEPBay, which suggests that groynes

may be required to address both pressure points at Grannies Beach and Ocean Drive.

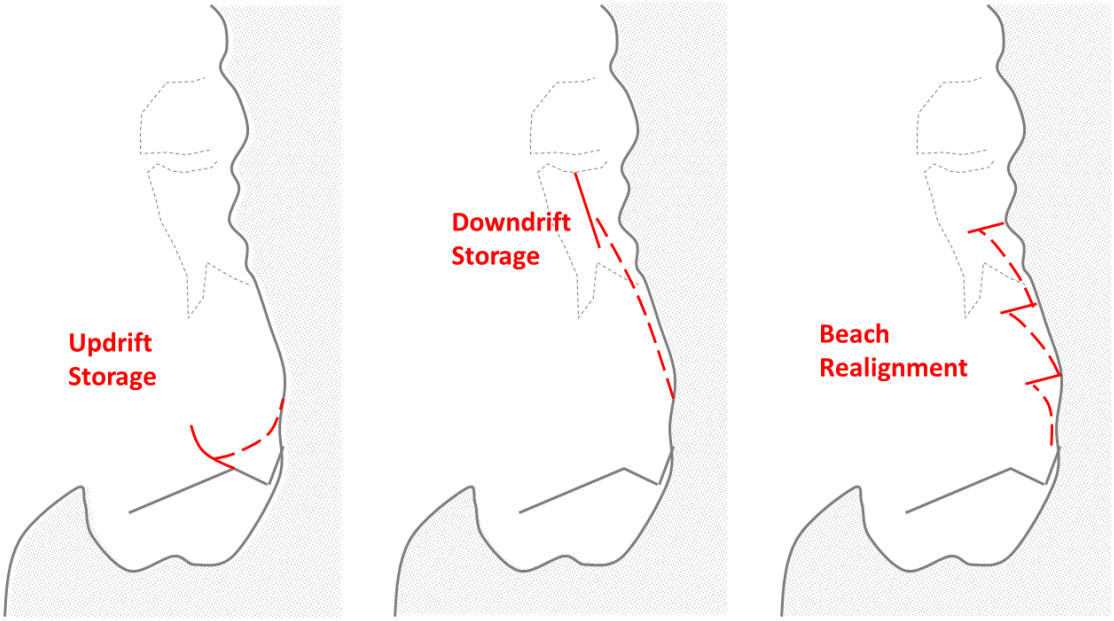


Figure 10.10: Generalised Coastal Engineering Options with Beach Amenity

Preliminary consideration of engineering interventions, along with an estimated cost, are provided in the figures over.

Carpark relocation activities are anticipated to provide the lowest per annum cost in the short-term (<10 years), with a moderate increase of cost for road relocation within the existing road reserve.

Subsequently (maybe >20 years), continued use of the existing road reserve would require installation of a 400m long revetment (cost ~$2.4m), or alternatively Ocean Drive could be relocated further landward. This is considered likely to be a high expense approach. The installation of a revetment would result in the effective removal of beach amenity.

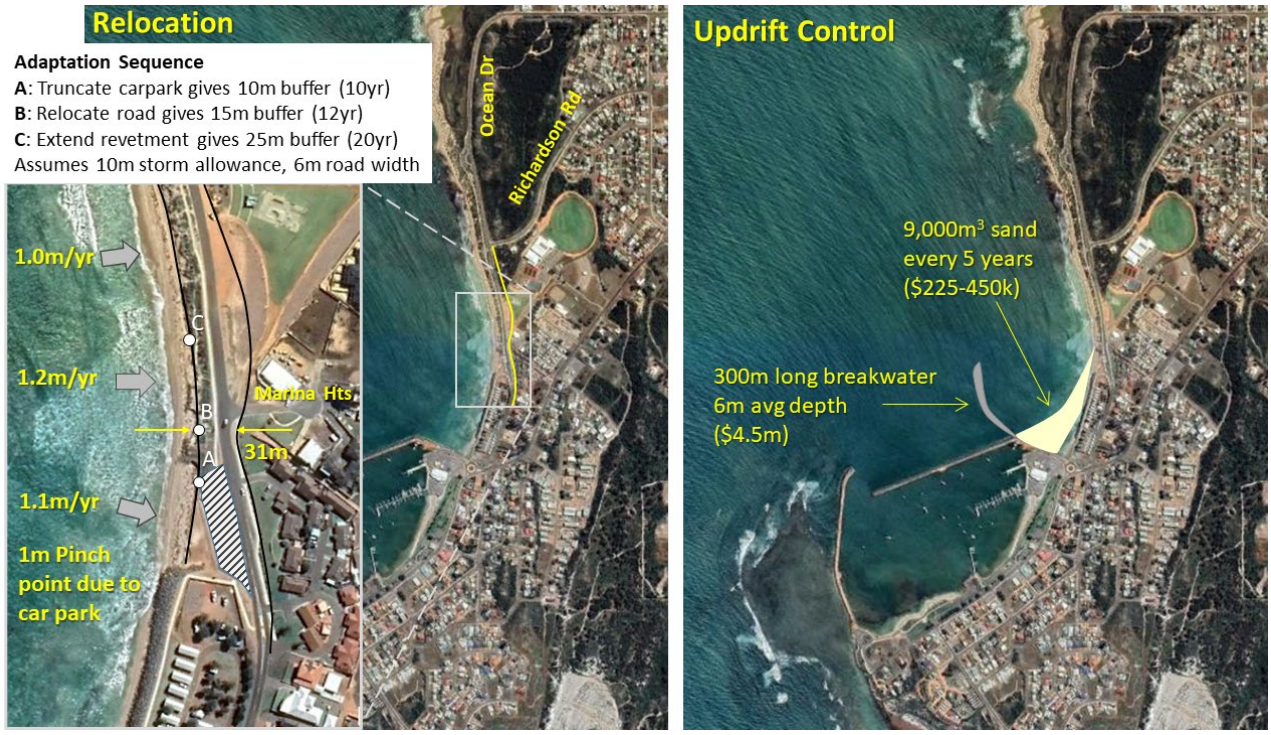


Figure 10.11: Relocation and Updrift Control options

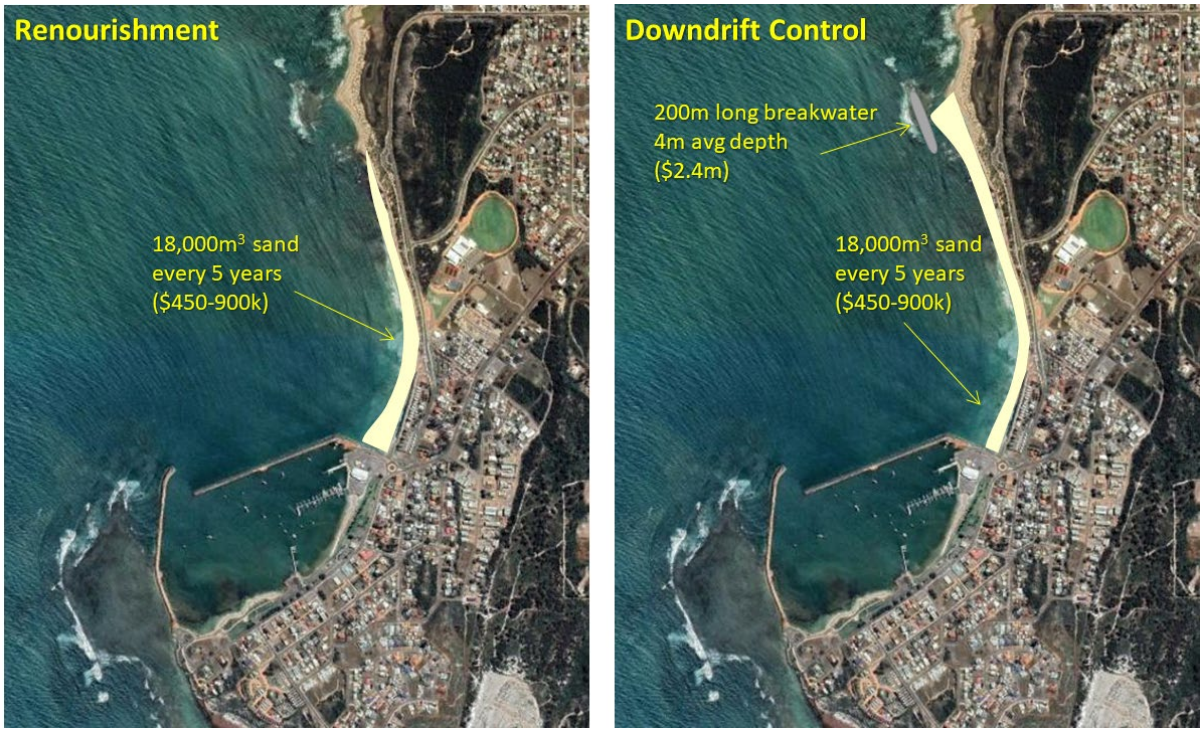


Figure 10.12: Renourishment and Downdrift Control options

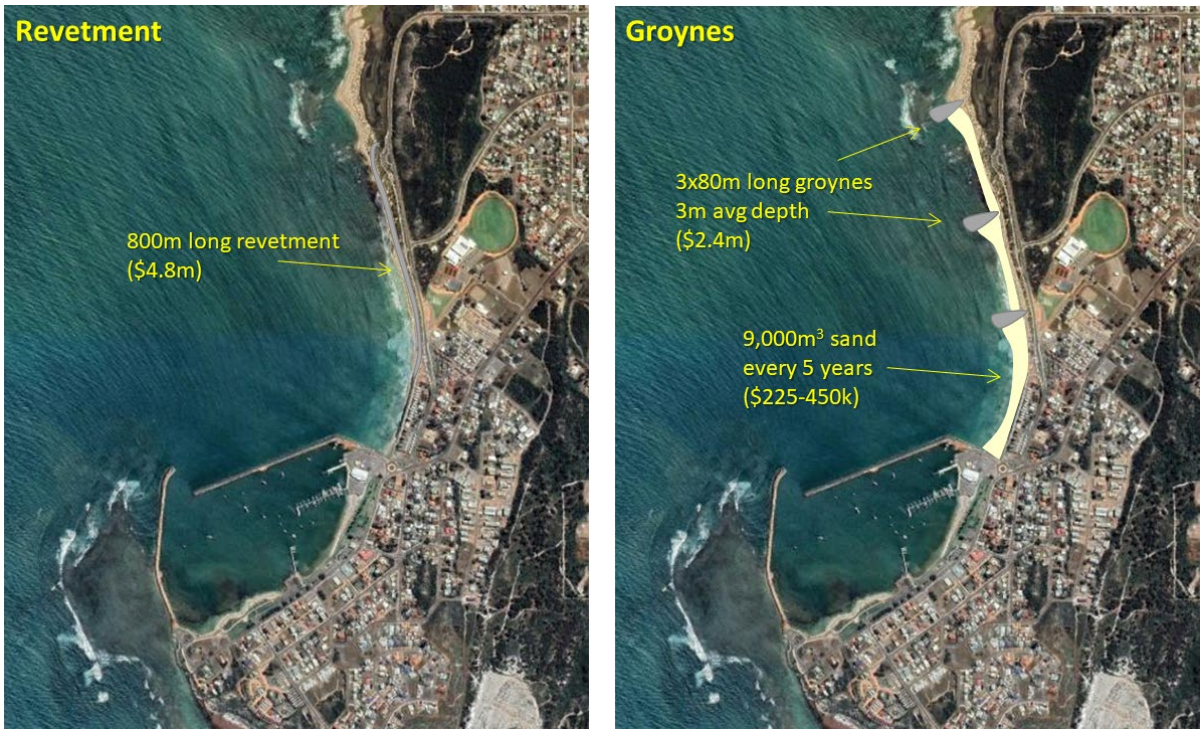


Figure 10.13: Revetment and Groynes options



Rock Walling at Grannies Beach

Photo by Land Insights, May 2019

10.4 SOCIAL, RECREATION AND LAND USE

Sector 2 comprises beach locations located within the Dongara and Port Denison townsite and are primarily adjacent to residential areas or tourist sites (such as caravan parks). A description of each site is provided below.

SUNSET COVE

This existing Sunset Cove coastal location was created between 2001 and 2006, presumably in association with the housing development adjacent to this site. Previous to this, a sandy pedestrian access track existed to the south of the current car park.

A relatively large bitumen car park is located at this site which is surrounded by a grassed area to the south and east. A children's playground and picnic bench are located to the east of the carpark on the grassed area. A pedestrian track provides access to the beach. The pathway has bollards on either side to control movement of pedestrians (and to prevent disturbance to the adjacent dune system), however the pathway and bollards are now almost completely covered with sand.

The car park, grassed area and the start of the pedestrian track are located within Reserve 43544 which is a Shire-managed reserve for the purpose of public recreation.

Sandy pedestrian tracks also provide access to the beach from Sea View and Brady Road, just south of Sunset Cove.

SEASPRAY BEACH

Seaspray Beach is located adjacent to the Seaspray Beach Holiday Site. Pedestrian access is provided from the holiday site direct to the beach.

The Seaspray Beach Holiday Site comprises chalets, apartments, cabins, villas and powered sites for caravans. The northern part of the site is freehold property (Lot 502 on strata plan 31704), however a majority of the holiday site is located on reserve 25412 which has managed orders with the Shire of Irwin for the purpose of caravan park (with power to lease for any term not exceeding 30 years subject to the consent of the Minister for Lands).

The foreshore and beach area are reserved with the Shire of Irwin (reserve number 38046) for the purpose of recreation and foreshore management.

A well-established pedestrian pathway provides access from the holiday site to the beach. The pathway has bollards on either side to delineate the access track and to reduce dune disturbance. Some unsuccessful dune revegetation has taken place either side of the pedestrian track which can be attempted again at an appropriate time of the year.

A fish cleaning station and a sheltered BBQ and picnic area is provided at the top end of the pedestrian pathway.

To the north of the caravan park is a public car park, public amenities and a grassed area for recreation. Pedestrian access tracks lead from the car park to the beach. It should be noted that these facilities are entirely located on UCL, although they are managed by the Shire. This area of UCL has been committed under the Yamatji Nation Agreement to the Yamatji Land Estate. As the Shire currently manages this land and the Shire assets are located on this land there should be further discussion between the Shire and the native title claimants on the future management of this area.

IRWIN RIVER MOUTH

Irwin River Mouth comprises Reserve 38046 (northern side of the river mouth), UCL (through the centre of the river mouth) and Reserve 41087 (southern end of the river mouth). Both reserves have management orders with the Shire of Irwin. The purpose of Reserve 38046 is recreation and foreshore management and Reserve 41087 is foreshore management.

No facilities are provided at the Irwin River Mouth. Some pedestrian tracks cross through the dunes on the northern side of the river mouth. The southern side of the river mouth comprises the estuary on reserve 41087. A timber boardwalk is runs along the perimeter of the estuary to provide for bird watching and for enjoying the scenery. The boardwalk also provides pedestrian access to the beach.

Management of the Irwin River and estuary is provided in the Irwin River Estuary Management Plan (Land Insights and Shire of Irwin, 2014) and the Irwin Estuary Weed Management Plan (NACC, 2013).



Sunset Cove Beach Access

Photo by Land Insights, May 2019

NUNS POOL

Nuns Pool is a low-key coastal site located just south of the Irwin River mouth. It comprises a small bitumen car park. Some informal pedestrian tracks provide access to the beach. The car park and beach are located within Reserve 41087. This reserve has management orders with the Shire of Irwin for the purpose of foreshore management.

SURF BEACH

Surf Beach is located to the north of the BIG4 Dongara Denison Beach Holiday Park located along Ocean Drive. It comprises a small bitumen car park and pedestrian access to a small beach. No camping is permitted at Surfs Beach.

Surfs Beach is located within Reserve 41088 which has management orders with the Shire of Irwin for the purpose of Recreation (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands).

Reserve 25826 has management orders with the Shire of Irwin for the purpose of recreation camping and caravan park (with power to lease for any term not exceeding 30 years subject to the consent of the Minister for Lands).

GRANNIES BEACH

Grannies Beach is located adjacent to the BIG4 Dongara Denison Beach Holiday Park, just north of the Port Denison foreshore. It comprises a small sandy beach with a rock sea wall to the north. The sea wall was constructed in 2011 to allow for the development of additional chalets at the Holiday Park. Inland from the beach is a grassed area for picnics and a children's playground. No camping is permitted at Grannies Beach.

Grannies Beach is located within Reserve 41088 which has management orders with the Shire of Irwin for the purpose of Recreation (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands). A small section of the grassed area is within Reserve 40030 which has management orders with the Shire of Irwin for the purpose of Foreshore Management. The car park and grassed area next to the holiday park is located in Reserve 46561 which has management orders with the Shire of Irwin for the purpose of recreation (with power to lease for any term not exceeding 5 years subject to the consent of the Minister for Lands).

The BIG4 Dongara Denison Beach Holiday Park is located within Reserve 25826 which has management orders with the Shire of Irwin for the purpose of recreation camping and caravan park (with power to lease for any term not exceeding 30 years subject to the consent of the Minister for Lands).

PORT DENISON FORESHORE

The Port Denison foreshore includes the area within the fishing boat harbour. The foreshore largely comprises of grassed areas, narrow beaches and bitumen car parks. Future development and management for the foreshore area is addressed by the Port Denison Foreshore Masterplan (Shire of Irwin and RPS, 2013). The Master Plan proposes new car parking, new amenities block, creation of sandy beach areas, children's play area, new fig and pine trees and construction of footpaths.

The Port Denison foreshore is located on Reserve 41088 which has management orders with the Shire of Irwin for the purpose of Recreation (with power to lease for any term not exceeding 21 years subject to the consent of the Minister for Lands).

SOUTH BEACH

South Beach is located south of the Port Denison Harbour and the Dongara Tourist Park. It is accessed via White Tops Drive which leads to a bitumen car park. The car park comprises a shelter, picnic benches and bins.

Vehicular and pedestrian access is provided to the beach. Vehicles are permitted to drive to the south (left turn at the entrance) but not to the north. Dogs are permitted both on-lead and off-lead in certain locations along South Beach.

The Dongara Denison Surf Life Saving Club and the Starfish Café are located at South Beach. Their respective buildings are situated next to each other to the south of the bitumen car park. There are toilets located within the café, however these are not open to the public when the café is closed.

South Beach is located on Reserve 137 which has management orders with the Shire of Irwin for the purpose of Common.

The reserve adjoining to the north of South Beach has some limited pedestrian access from Dongara Tourist Park. This section leads to a rocky cliff rather than a sandy beach area, although pedestrians can continue south to South Beach. It is located on Reserve 42150 which has management orders with the Shire of Irwin for the purpose of Recreation. Although management orders are with the Shire, a majority of the pedestrian access maintenance is undertaken by the Dongara Tourist Park.

10.5 ENVIRONMENT

Sector 2 comprises the Port Denison and Dongara townsites and has been developed with a harbour, caravan parks, commercial buildings, recreational buildings and housing. As a result of this development, the coastal environment in Sector 2 has been modified through the removal of vegetation and modification of landscape in certain places. The coastal sites within Sector 2 are also more highly used than sites further along the coast. This higher level of use can also result in increased disturbance to the coastal environment without careful management.

Coastal vegetation has been modified along the Point Denison Foreshore and from Grannies Beach to Surf Beach. South Beach from Dongara Tourism Park to the southern end of Reserve 137 has been partially degraded from use, however, there has been no large-scale clearing for development. Vegetation north of Surf Beach is relatively undisturbed. Seaspray Beach is another popular coastal site which has some evidence of degradation, however, is largely undeveloped.

Vegetation disturbance occurs from the creation of new pedestrian tracks and by driving vehicles through the dunes. The most effective way of managing vegetation disturbance is to encourage pedestrians to use designated pathways, to prevent vehicles driving through the dunes and by closing new tracks as soon as they form (employing appropriate methods such as brushing, physical barriers, signage etc).

Coastal vegetation has not been formally assessed in Sector 2 apart from the vegetation around the Irwin River Mouth. This assessment was undertaken by ATA Environmental in 2005. Further information on the environment is provided in Chapter 7.

The only surface water feature in this Sector is the Irwin River which discharges into the Indian Ocean when flooding is significant enough to break through the river mouth sandbar. The river mouth is a highly valued ecological area for vegetation and birdlife. It also contributes to the aesthetics of the town. The river mouth is undeveloped except for some pathways/boardwalks and bird hides.



South Beach

Photo by Land Insights, May 2019

10.6 SECTOR 2 – ISSUES AND OPPORTUNITIES

A review of all issues and opportunities and how they have helped form the recommendations is provided below.

Table 10.4 - Sector 2 Issues and Opportunities

ISSUES	OPPORTUNITIES
TENURE	
A majority of the coastal land within Sector 2 is located within reserves with management orders with the Shire of Irwin. A few parcels of UCL exist which are currently used for coastal recreation. One small parcel is located at the Irwin River Mouth. A few parcels of UCL are located at Seaspray Beach. These parcels are currently developed with a car park, toilets and beach access. An area allocated as 'road reserve' is located south of Port Denison Harbour at the end of Point Leander Drive and Coles Way. This road reserve is not developed as a road and is currently vegetated and used for coastal access.	The areas of UCL are currently already used for coastal recreation and, in the case of Seaspray Beach, have been developed with coastal facilities and are already managed by the Shire. The parcel of UCL at the Irwin River Mouth is also managed by the Shire and a bird hide already exists in this location. It is therefore recommended that these areas of UCL are transferred to a reserve for recreation purposes with management orders with the Shire. The road reserve located at the end of Point Leander Drive and Coles Way could also be transferred to a coastal reserve with management orders with the Shire.
Seaspray Beach Holiday Site is located partially within freehold property (Lot 502 on strata plan 31704), and the remainder is on reserve 25412 which has management orders with the Shire of Irwin. The coastal area adjoining the caravan park is within reserve 38046 which has management orders with the Shire of Irwin. There is pedestrian access from the caravan park to the beach, however the access track, the fish cleaning station and picnic shelter are completely located on the Shire reserve. The pedestrian access is currently from the freehold lot.	There is an opportunity for the Shire to work with the Holiday Site owners with regards to management of the access and facilities located within the Shire reserve. Should there be any changes to ownership of the freehold lot and the access point is removed it may be necessary to shift the access slightly so that it is from reserve 25412.

VEHICLE ACCESS	
Vehicle access to coastal sites within Sector 2 is generally good as each site has access from a gazetted road. Car parking areas are provided at most of the coastal sites. Some off-road vehicle tracks are created through the dunes in some places, such as at South Beach. The vehicle access at South Beach is problematic as it faces the prevailing winds which results in sand being blown and deposited on the access. The sand needs to be periodically moved by the Shire. Realignment of the vehicle access is also an issue as curving the access away from the prevailing winds will result in a cured road which could have sight problems. Moving the access will also cause dune disturbance.	Duplicate any unnecessary off-road vehicle tracks through the dunes should be closed, especially where vehicle access is already provided via a gazetted road. The vehicle track from George Street/Kailis Drive through the dunes to White Tops Drive should be closed as a gazetted road already provides access to South Beach. The vehicle access to the beach at South Beach will most likely need to stay with its current alignment. The Shire may be required to move sand from the track periodically. A Clearing Permit has been submitted to allow the Shire to manage sand drift in this location.
PEDESTRIAN ACCESS	
Pedestrian access tracks have been created where necessary through the dunes from car park areas or from the road. It is important that a minimal number or tracks are provided to result in the least amount of vegetation and dune disturbance. On the whole, there does not appear to be many duplicate or unnecessary pedestrian tracks through the dunes. Nevertheless, it is important for the Shire to close and rehabilitate any duplicate tracks as soon as they form. Ad-hoc tracks are located through the dunes north of the river mouth on Reserve 38046. The pedestrian access at Sunset Cove was originally constructed with bollards on either side of the track. Since construction the dunes have moved slightly and sand has covered the track so that the bollards are partially or completely covered and may create a tripping hazard.	The Shire should monitor pedestrian tracks and close any new or duplicate tracks as soon as they form. The ad-hoc tracks through Reserve 38046 should be closed and rehabilitated. It is recommended that the bollards on the Sunset Cove pedestrian track are either removed or replaced.
FACILITIES	
Many of the coastal sites within Sector 2 are already provided with facilities such as playgrounds (Sunset Cove and Grannies Beach), picnic benches, shelters, rubbish bins and grassed areas. Some facilities are beginning to show some age (such as the shelter and picnic bench at South Beach car park), but most are in good condition.	Some coastal sites would benefit from having a few additional facilities such as additional shelters (for example at Sunset Cove, South Beach and Grannies Beach). The need for these can be determined based on demand and budget. A toilet or amenities block could also be considered at some sites.

SIGNAGE	
Signage is provided at most sites, however it is not consistent, and some sites do not have any signage.	The Shire should employ a coastal signage strategy which provides for the use of consistent signage at coastal sites. Most importantly, the signage should include standard symbols to communicate warnings and regulations. Signage can also include educational and interpretative information, locational, directional and other information as considered relevant to each site.
COASTAL PROCESSES	
Continuous erosion at Grannies Beach, Surf Beach and the coastline north of the beach is now encroaching onto Ocean Drive. Erosion control work at Grannies Beach has been ongoing for many years. The beach between South Beach and White Point is comparatively exposed to wave action and has high potential for onshore sediment supply from wind drift. As a result, any developments such as beach access points will have a limited life.	There are some options to address erosion at Grannies Beach and Ocean Drive: • Relocation of Ocean Drive • Ongoing renourishment • Construction of a revetment along the affected foreshore • Renourishment, with supporting structures to improve the longevity of placed material. Management of areas with high sediment movement such as at South Beach will need to consider the need to provide new access points as the coast changes and to relocate buildings such as the Surf Life Saving Club if required.



Uncontrolled Beach Access from Kailis Drive, South Beach

Photo by Land Insights, May 2019



Limestone Walling, Grannies Beach

Photo by Land Insights, October 2019

10.7 SECTOR 2 – RECOMMENDED ACTIONS

OBJECTIVES

To consider opportunities to enhance and improve management of the coastal sites within Sector 2 as significant recreational nodes through the provision of low impact day use facilities, access and ongoing management of impact from use.

ACTIONS

The recommended actions for Sector 2 are listed in the table below. Recommendations are shown on Plans 10.2 to 10.7.

Table 10.5 - Sector 2 Actions

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
SUNSET COVE			
S2-1	Monitor and manage the access track from the car park to the beach to ensure ongoing ease of access, protection/separation of the pathway and adjoining dunes. Consider the use of low maintenance options such as log and chain steps rather than fixed infrastructure.	O	Shire of Irwin
S2-2	Undertake an internal annual review of sand drift at the beach access. If required, replace the existing path with a NW facing segment to reduce sand drift.	O	Shire of Irwin
S2-3	Manage the narrow, mobile dunes in this area (and to the north) following guidance (for activities such as repairing blowouts, brushing, revegetation, stabilisation etc) in the WAPC (2003) Coastal Management Manual.	O	Shire of Irwin
SEASPRAY BEACH			
S2-4	Review tenure north of Church Street to include within R43544.	S	Shire of Irwin
S2-5	Manage the pedestrian pathways across the dunes to the beach from Sea View and Brady Road in accordance with the Coastal Management Manual (WAPC, 2003).	O	Shire of Irwin
S2-6	Review arrangements related to the use of private parking and grassed area on Reserve 38046 to ensure that public use of these areas is maintained.	S	Shire of Irwin
S2-7	Undertake improved dune management, in accordance with WAPC (2002) Coastal Management Manual, to limit pedestrian damage and reduce sand drift.	O	Shire of Irwin
S2-8	Undertake an annual review of existing dunes, to confirm recovery from recent disturbance. If there is no substantial recovery within 5 years, undertake dune restoration works.	O	Shire of Irwin
S2-9	Determine a trigger for planned retreat or relocation of Seaspray Caravan Park via the current LDP process.	M	Shire of Irwin
S2-10	Review tenure at the Irwin River Mouth to include within R41087 or R38046.	S-M	Shire of Irwin
S2-11	Continue to implement the recommendations of the Irwin River Estuary Management Plan (Shire of Irwin and Land Insights, 2014).	O	Shire of Irwin

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
SURF BEACH & GRANNIES BEACH			
S2-12	Truncate the north-west corner of the car park and close the northern access where subject to erosion on Ocean Drive.	S	Shire of Irwin
S2-13	Continue with current interim management arrangements of sand replenishment and local stabilisation works.	O	Shire of Irwin
S2-14	Continued erosion is expected along Grannies/Surf Beach and will require road and carpark relocation in the longer-term.	M-L	Shire of Irwin
S2-15	Interim options to defer road relocation should be evaluated (by undertaking a site-specific hazard assessment), including reinforcement of existing nearshore reef control point/construction of Groyne field (refer to Table 10.3).	M – 10 years	Shire of Irwin
PORT DENISON FORESHORE & DENISON SOUTH			
S2-16	Refer to the 'Port Denison Foreshore Master Plan' (Shire of Irwin and RPS, 2013) for the development and management of the Port Denison Foreshore.	O	Shire of Irwin
S2-17	Close the road reserve located between Reserve 37877 and Reserve 41088 and place in a reserve with management orders with the Shire for the purpose of 'foreshore protection'.	S-M	Shire of Irwin
S2-18	Refer to the 'Local Development Plan and Foreshore Management Plan Dongara Tourist Park' (Halsall and Associates, 2016) for management of Reserve 42150.	O	Shire of Irwin
S2-19	Update the plaque and signage around the Obelisk to educate visitors and locals about history of the site, marine life and bird life (ospreys), coastal plants, safety signage re boating, water sports, local emergency numbers.		
SOUTH BEACH			
S2-20	Close and rehabilitate vehicle track located between White Tops Drive and George Street.	S	Shire of Irwin
S2-21	Undertake improved dune management, in accordance with WAPC (2003) Coastal Management Manual, to limit pedestrian damage and reduce sand drift by using sand fencing / brushing to direct sand where it causes the least problem and is conducive to vegetation growth (note that vegetation growth is significantly enhanced through watering).	O	Shire of Irwin
S2-22	Progressive coastal dune growth is likely to occur. Dune growth should be monitored, with a trigger for relocation of Surf Life Saving Club and toilet facilities identified (such as when the current management practice of manually moving sand becomes problematic).	O	Shire of Irwin

RECOMMENDATIONS:

1. Monitor and manage the access track from the car park to the beach to ensure ongoing ease of access, protection/ separation of the pathway and adjoining dunes. Consider the use of low maintenance options such as log and chain steps rather than fixed infrastructure.

2. Undertake an annual review of sand drift at the beach access. If required, replace the existing path with a NW facing segment to reduce sand drift.

3. Manage the narrow, mobile dunes in this area (and to the north) following guidance (for activities such as repairing blowouts, revegetation, stabilisation etc) in the WAPC (2002) Coastal Management Manual.



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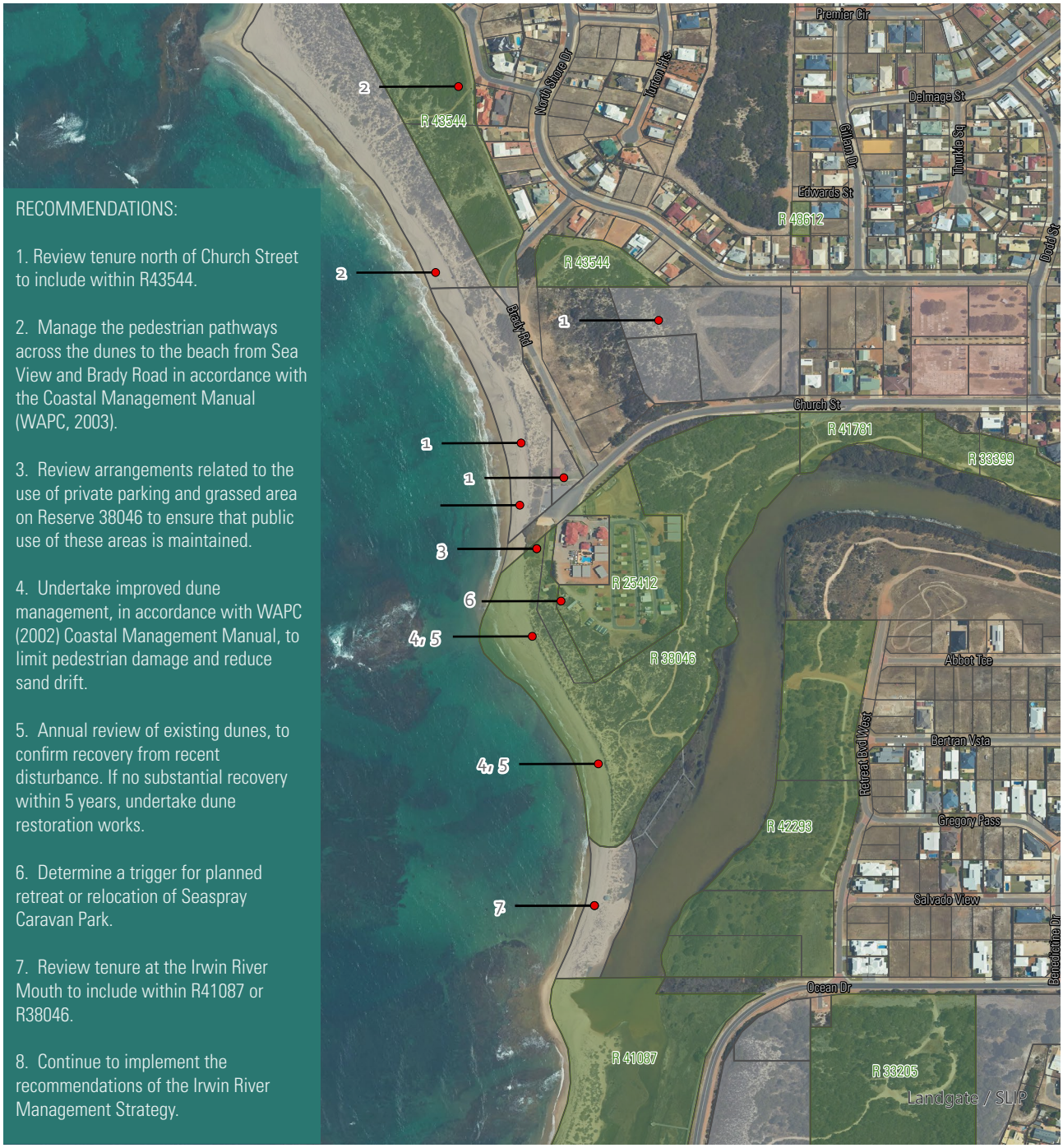
Reserve - Shire of Irwin

N

1:2,500

0 25 50 75 100 m

Plan 10.2: King Bay / Sunset Cove (Sector 2)



Plan 10.3: Seaspray Beach (Overview)
Sector 2

RECOMMENDATIONS:

1. Truncate the north-west corner of the car park and close the northern access where subject to erosion on Ocean Drive.

2. Continue with current interim management arrangements of sand replenishment and local stabilisation works.

3. Continued erosion is expected along Grannies/Surf Beach, and will require road and carpark relocation in the longer-term.

4. Interim options to defer road relocation should be evaluated (by undertaking a site-specific hazard assessment), including reinforcement of existing nearshore reef control point/ construction of Groyne field (refer to Table 10.3).



Cadastre
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Reserve - Shire of Irwin
Other Reserves

N

1:7,500

0 50 100 150 200 m

Plan 10.4: Surf Beach and Grannies Beach (Overview) Sector 2

RECOMMENDATIONS:

1. Refer to the 'Port Denison Foreshore Master Plan' (Shire of Irwin and RPS, 2013) for the development and management of the Port Denison Foreshore.

2. Update the plaque and signage around the Obelisk to educate visitors and locals about history of the site, marine life and bird life (ospreys), coastal plants, safety signage re boating, water sports, local emergency numbers.



Cadastre
UCL
Reserve - Shire of Irwin
Other Reserves
Heritage - State Register

N

1:7,500

0 75 150 225 300 m

Plan 10.5: Boat Harbour & Port Denison Foreshore (Overview) Sector 2



Plan 10.6: Denison South (Overview)
Sector 2



RECOMMENDATIONS:

1. Close and rehabilitate vehicle track located between White Tops Drive and George Street.

2. Undertake improved dune management, in accordance with WAPC (2003) Coastal Management Manual, to limit pedestrian damage and reduce sand drift by using sand fencing / brushing to direct sand where it causes the least problem and is conducive to vegetation growth (note that vegetation growth is significantly enhanced through watering).

3. Progressive coastal dune growth is likely to occur. Dune growth should be monitored, with a trigger for relocation of Surf Life Saving Club and toilet facilities identified (such as when the current management practice of manually moving sand becomes problematic).

4. Encourage pedestrians to use the existing access tracks.

5. Close and rehabilitate new pedestrian tracks as soon as they form.

Cadastre
UCL
Reserve - Shire of Irwin
Other Reserves
Mining Tenement

N

1:5,000

0 50 100 150 200 m

Plan 10.7: South Beach (Overview)
Sector 2

11.0 sector 3 – southern nodes

11.1 DESCRIPTION

LOCATION

Sector 3 extends from South Beach to the southern boundary of the Shire. It includes the following key coastal sites:

- North Cliff Head
- Cliff Head
- South Cliff Head
- Freshwater Point
- North Knobby Head
- Knobby Head

Concept Plans are provided for these key nodes. There are a range of other sites also located within this Sector where standard management will apply. These sites are shown in Appendix B.

The extent of sector 3 is shown on Plan 11.1.



Cliff Head Camping Node

Photo by Land Insights, May 2019

PLANNING AND TENURE

The Shire of Irwin Local Planning Scheme No. 5 (WAPC, 2008) identifies the following zones and reserves within Sector 3.

Table 11.1 - Sector 2 zoning

LOCATION	ZONE/RESERVE
South of Port Denison to North Cliff Head	Reserved as Conservation for Beekeepers Nature Reserve.
North Cliff Head to the Shire's southern boundary	Coastal area is reserved as Local Reserve.

Sector 3 is entirely located within reserves. These are managed by the Shire except for Reserve 24496 which is managed by the DBCA. A description of all reserves along the coast is provided in the table below.



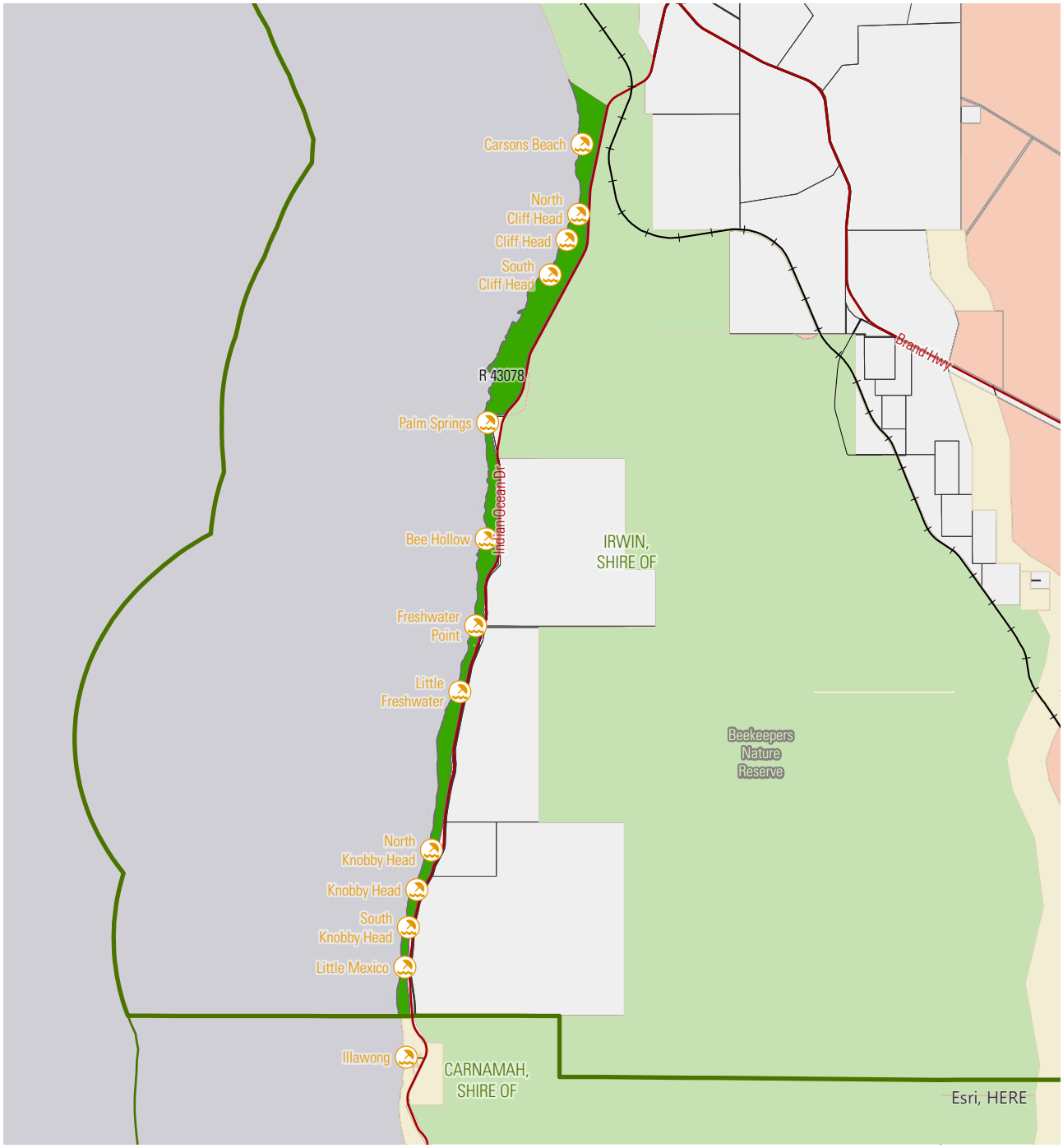
South Cliff Head Camping Node

Photo by Land Insights, May 2019



North Cliff Head Camping Node

Photo by Land Insights, May 2019



Plan 11.1: Sector 3 Overview

Table 11.2 - Sector 3 Reserves

RESERVE NO.	LOT NO.	PLAN NO.	LOCATION	PURPOSE	MANAGEMENT ORDER
43078	11982	P243167	Little Mexico to North Cliff Head	Parkland recreation and the letting of cottages existing thereon on 14/2/1994 (with power to lease for any term not exceeding 8 years subject to the consent of the Minister for Lands).	Shire of Irwin
24496	12174	P039607	Beekeepers Reserve	Protection of Flora	National Parks and Nature Conservation Authority
39270	11560	187025	South of Freshwater Point	Navigation Beacon Site	Minister for Transport

11.2 COASTAL PROCESSES

The southern coast of the Shire of Irwin, which includes the series of small coastal nodes and fishermen's shacks (Figure 11.2 and Figure 11.3), has a wide, shallow nearshore area, resulting in substantial wave damping for both extreme and ambient wave conditions. The shoreline orientation promotes alongshore sediment transport, with limited dune building. This interacts with local variation in seabed structure, particularly nearshore reef platforms, to create small zones of sediment accumulation, which subsequently evolve, typically migrating as a 'pulse' of sediment alongshore, which gradually widens in alongshore length. There is a relative lack of capacity for alongshore dunes to build elevation from wind-blown sand transport due to the coastal orientation. This is modified locally where there is a cross-shore feature such as a rock headland or a sand salient toward a nearshore reef, resulting in high dunes building on the south side of headlands or formation of foredune 'lobes' such as has built recently at Cliff Head.

The ability of rock headlands to capture sediment on their southern side can affect the relative availability of alongshore sediment supply. This has been locally highlighted at Freshwater Bay, where rapid erosion occurred on the downdrift (northern side) from 2013-2015 (Figure 11.1). For other headlands, including Cliff Head and Knobby Head, sufficient beach width remained during this period for sand supply to naturally bypass. This behaviour is important for the south Irwin coast in the context of projected sea level rise, as general coastal retreat will cause the headlands to have greater influence, producing local downdrift 'scalloping' similar to that observed at Freshwater Bay.



Freshwater Point Camping Node

Photo by Land Insights, May 2019

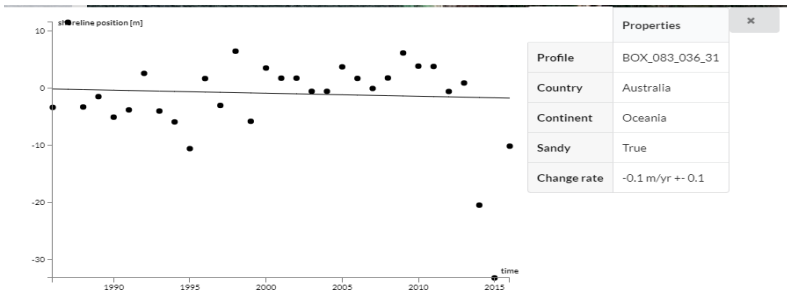


Figure 11.1: Shoreline Position at Freshwater Bay (from Shoreline Monitor)

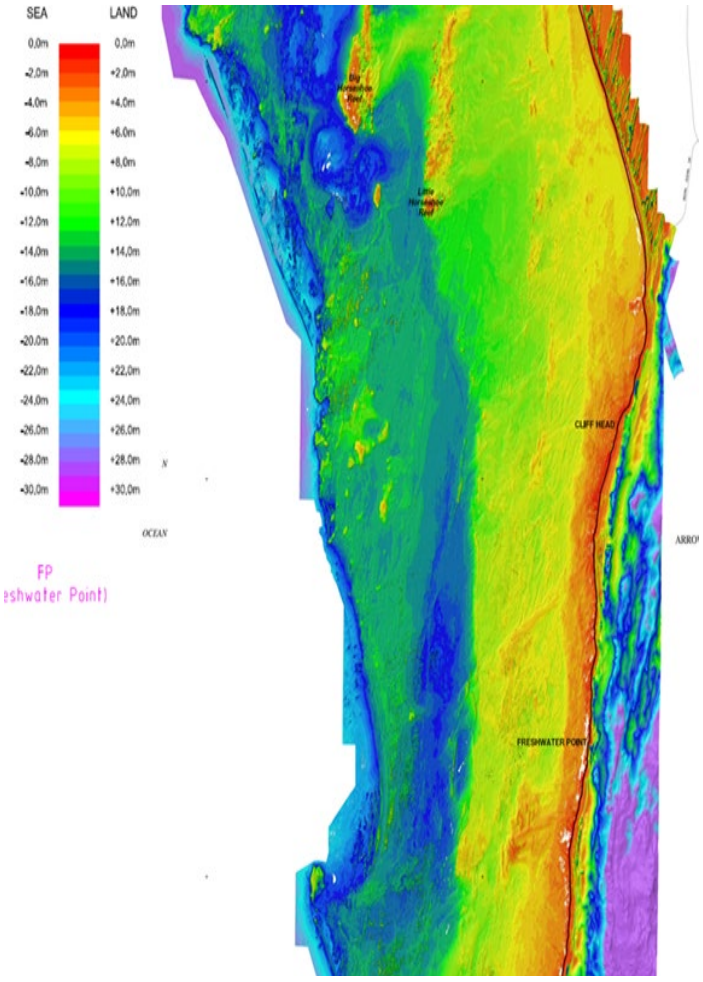


Figure 11.2: South Central Shire of Irwin Coast

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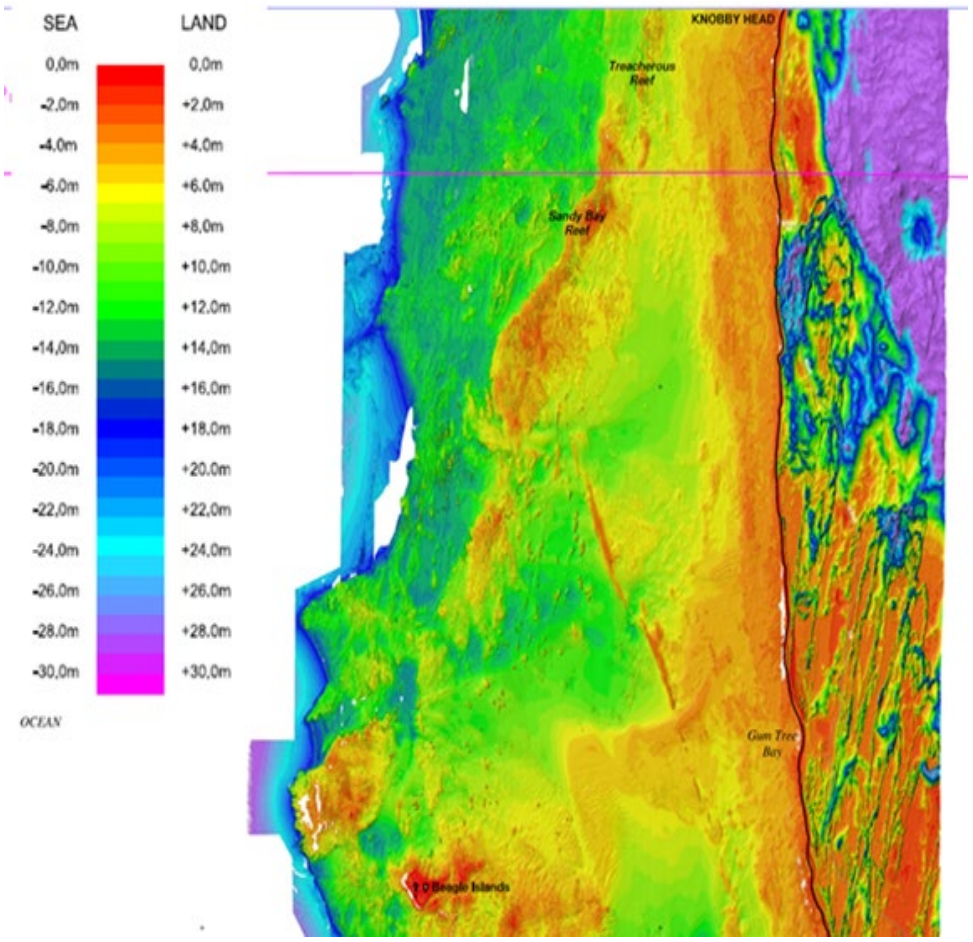


Figure 11.3: South Shire of Irwin Coast

11.3 SOCIAL, RECREATION AND LAND USE

NORTH CLIFF HEAD, CLIFF HEAD AND SOUTH CLIFF HEAD

This site comprises of North Cliff Head, Cliff Head and South Cliff Head which are all slightly separate coastal sites located in close proximity to one another.

The entrance signage states that the site is a '72-hour rest area'. Camping is permitted up to three nights in any period of 28 consecutive days at either Cliff Head, Knobby Head or Freshwater Point. Camping is currently available free of charge (although the Shire is currently in the process of implementing paid camping at these nodes in 2020). The Shire Community Ranger occasionally checks on the coastal sites to make sure that visitors aren't staying too long and are abiding by the Shire rules.

The following facilities are provided:

- North Cliff Head – One toilet block (older than the others)
- Cliff Head – One toilet block, skip bin.
- South Cliff Head – Two new toilet blocks, shelter with picnic benches, fire pit and skip bin.

Camping bays exist along the tracks leading north from Cliff Head. While the camping areas are not signposted or fenced, they seem to provide sufficient space for campers and there is no evidence of native vegetation degradation around the edges.

Some fishermen shacks remain at Cliff Head, although this is a significant reduction from the past.

A small jetty was previously located at Cliff Head, however this was removed by locals/shack owners in December 2018. The reason for removing the jetty was due to sand accretion along the beach from the past few years which had essentially completely covered the jetty.

FRESHWATER POINT AND LITTLE FRESHWATER

Freshwater Point is another popular camping spot along this Sector. It is one of the three camping spots (the other two being Knobby Head and Cliff Head) which are permitted '72-hour rest areas' in which campers can stay at any of the three locations for up to three consecutive days. Access is from a track leading from Indian Ocean Drive.

There is space for camping on the beach, although room is limited due to the topography (rising dunes to the east and a headland to the south).

There is evidence of old shacks at Freshwater Point. Recent coastal erosion has eaten away at the beach and most of the shacks have fallen into the sea. The only remains are the concrete pads which are currently falling apart. No shacks remain at Freshwater Point.

Facilities at Freshwater Point include a long-drop toilet and a skip bin.

Crayfishermen boats moor within the bay at Freshwater Point.

The limestone cliff to the south of the bay offers protection to the beach area from strong south-westerly winds. There is evidence of pedestrian tracks up the cliff. This can potentially be a safety issue and signage with some warnings of the dangers will be beneficial.

NORTH KNOBBY HEAD

North Knobby Head is accessed via Indian Ocean Drive. A limestone track leads into the site and well-established tracks weave throughout to provide access north and south and to fishermen shacks.

Only approximately five shacks exist at North Knobby Head, which is a reduction to the original number.

The entrance signage at North Knobby Head states that the site is a '72-hour rest area'. Camping is permitted up to three nights in any period of 28 consecutive days at either Cliff Head, Knobby Head or Freshwater Point. Camping is currently available free of charge.

Facilities available at North Knobby Head include a rubbish bin for waste and long-drop toilets. The Shire ranger regularly checks on the coastal sites to make sure that visitors aren't staying too long and are abiding by the Shire rules.



Beach Access, Nobby Head

Photo by Land Insights, May 2019

11.4 SECTOR 3 – ISSUES AND OPPORTUNITIES

A review of all issues and opportunities and how they have helped form the recommendations is provided below.

Issues and opportunities for Sector 3 is provided in the table below.

Table 11.3 - Sector 3 Issues and Opportunities

ISSUES	OPPORTUNITIES
DEVELOPMENT PLAN	
The Development Plan prepared in 2000 recommended extensive development of key nodes in the Shire's south. While some of the lower-key elements have been implemented, the majority of the larger scale tourist-based proposals have not. It is suggested that the significant development proposed within this Sector be scaled back significantly.	There has been a significant increase in nature-based camping and RV accommodation demand throughout Australia, which has seen the popularity of the southern coastal nodes increase significant for short-term camping. This has been reflected in Council Policy (e.g. Non-Commercial Camping Policy) and the promotion of Dongara as being 'RV Friendly' with the provision of appropriate facilities. Some improvements have already been put in place by the Shire in recent years and following some informal discussion between the CMP Project Team and people using the camping facilities, it appears that the improvements have been well received. There is an opportunity as part of this CMP process to review, refine and adopt longer-term Concept Plans for key nodes.
EXTENT AND NUMBER OF NODES	
There are a large number of nodes located along the southern section of the Shire. Many of these have been established for many years and were the location of squatter shacks which have now been removed. The large number of sites, most of which are interconnected by tracks, could make ongoing management difficult and resource intensive.	The focus of management should be on key nodes, where appropriate management can occur and facilities provided for those people wishing to utilise this section of the coast. Other areas should generally be managed over time to reduce general public access, rehabilitate duplicate tracks and revegetate degraded dune areas.
ACCESS	
The coastal reserve in this sector is often narrow, with numerous tracks accessible from Indian Ocean Drive. The number of access points should be reduced over time to focus vehicles to key locations – particularly for general public access to the coast. It is important that safe ingress/egress points from the highway are provided at key sites.	Good access to key nodes is available directly from Indian Ocean Drive and thus there is an opportunity consolidate these as the key points to access the coast within this sector. Main Roads WA has suggested that public accessways be formalised where appropriate, and upgraded (including a sealed portion at the intersection of Indian Ocean Drive) following the completion of a Traffic Assessment. Where other existing access points are not required for other purposes (e.g. professional fisherman access) consideration should be given to closing them from the highway.

ISSUES	OPPORTUNITIES
FACILITIES	
Increasing demand for short stay camping/RV parking at coastal nodes has resulted in a demand for facilities. This has been met by the Shire recently with the installation of some infrastructure such as toilets and picnic tables. The Shire also provides a rubbish collection services at key sites. During peak periods there is likely to be increased demand for facilities, which will need to be monitored by the Shire. Provision of facilities is expensive, and their distance from Dongara adds to the cost and time required for ongoing management and maintenance.	Facilities provided for short stay camping should be focused on the key sites, with no facilities provided elsewhere. The provision of facilities at each of the key sites is considered largely adequate for the short to medium term use. The majority of private shacks have been removed from this section of coast. The continual removal of any remaining shacks (apart from authorised professional fisherman shacks) can continue.
SIGNAGE	
Signage is provided at most sites, however it is not consistent, and some sites do not have any signage.	The Shire should employ a coastal signage strategy which provides for the use of consistent signage at coastal sites. Most importantly, the signage should include standard symbols to communicate warnings and regulations. Signage can also include educational and interpretative information, locational, directional and other information as considered relevant to each site.
BENEFIT TO SHIRE	
The Shire currently provides free camping at the coastal nodes in this sector. It is unclear what the economic benefit of these sites is, however, presumably there is some benefit to the Dongara/Denison local economy as it is the largest town in the immediate vicinity.	While outside the scope of this CMP, opportunities to encourage campers to visit Dongara and Pt Denison should be further explored. Consideration is also being given currently to the implementation of a camping fee at Cliff Head, along with a caretaker at this site. While this will provide some benefit to the Shire in regard to collection of camping fees, it may result in the increased use of other nodes in the area where free camping remains.
COASTAL PROCESSES	
The orientation of the shoreline in this Sector promotes the movement of sediment along the coast, with limited dune-building. The movement of sediment interacts with elements of the seabed (such as nearshore reefs) resulting in some areas of sediment accumulation. The rocky headlands along this section of the coast will have increasing influence on sediment movement in the context of projected sea level rise, where sediment transfer is interrupted, and erosion can rapidly occur on the northern side of the headlands.	Given the possibility of sediment transfer interruption and subsequent erosion, development near the coast will need to be set-back and equality, particularly around the rocky headlands of Knobby Head, Freshwater Bay and Cliff Head.
MINING TENEMENT	
Camp Grounds (North Cliff Head, Cliff Head and South Cliff Head) should not encroach into Mining Lease M70/613.	Tenement holders should be notified of any additional/ upgraded access tracks through their tenement. Any other identified mining tenements should be consulted where necessary.

11.5 SECTOR 3 – RECOMMENDED ACTIONS

OBJECTIVES

To promote sustainable recreational uses and to preserve the environmental values and low impact character of the Sector.

ACTIONS

Actions for the southern nodes/Sector 3 are provided in the form of Concept Plans for the key nodes (Plans 11.2 to 11.8). These are presented on the following pages and summarised below.

Table 11.4 – Sector 3 Actions

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
CLIFF HEAD			
CH1	Monitor demand at the South Cliff Head. Consider a longer-term opportunity for expansion between the two existing camping spots at South Cliff Head if demand requires.	M-L	Shire of Irwin
CH2	Avoid development seaward of the access tracks at South Cliff Head due to the possibility of dune re-mobilisation in this area.	O	Shire of Irwin
CH3	Maintain the camping spots at Cliff Head (central) to their current extents.	O	Shire of Irwin
CH4	Fence camping spots and bays with low-level, non-intrusive fencing. Focus on areas where vegetation is damaged or there is evidence of camping areas encroaching landward into vegetated areas.	M	Shire of Irwin
CH5	Maintain access to North Cliff Head by monitoring erosion of the current track and providing an alternative inland route if required.	M	Shire of Irwin
CH6	Retain the currently closed North Cliff Head track as an emergency access only.	O	Shire of Irwin
CH7	Limit the further northerly expansion of the North Cliff Head beyond the northern (closed) access point.	O	Shire of Irwin
CH8	Increase Patrol Officers presence and increase monitoring/ management at Cliff Head during peak periods (to monitor Cliff Head, South and North Cliff Head).	M	Shire of Irwin
CH9	Consider options for payment of a fee for camping/pre-booking during peak periods (for Cliff Head, South and North Cliff Head).	M	Shire of Irwin
CH10	Install low-level fencing around areas that require protection (such as sensitive vegetation and dunes) and hazardous areas (such as cliff rocks). Fencing can also be installed to help direct access around camping sites to prevent vegetation disturbance and around picnic shelters and surrounding shade trees to prevent these areas from being exclusively used by campers (ensuring availability to all).	M	Shire of Irwin
FRESHWATER POINT			
FP1	Close and rehabilitate the track to the north as indicated on Plan 11.6.	S	Shire of Irwin

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
FP2	Remove the remaining concrete slabs associated with now-removed shacks and re-contour beach.	S	Shire of Irwin
PF3	Establish a fenced low-key day use area in the shaded central area of the site.	M	Shire of Irwin
KNOBBY HEAD			
KH1	Close and rehabilitate the track to the north as indicated on Plan 11.8.	S	Shire of Irwin
KH2	Maintain the extent of the overnight camping area as shown on Plan 11.8.	O	Shire of Irwin
KH3	Install signage to direct users to the overnight camping area as shown on Plan 11.8.	S	Shire of Irwin



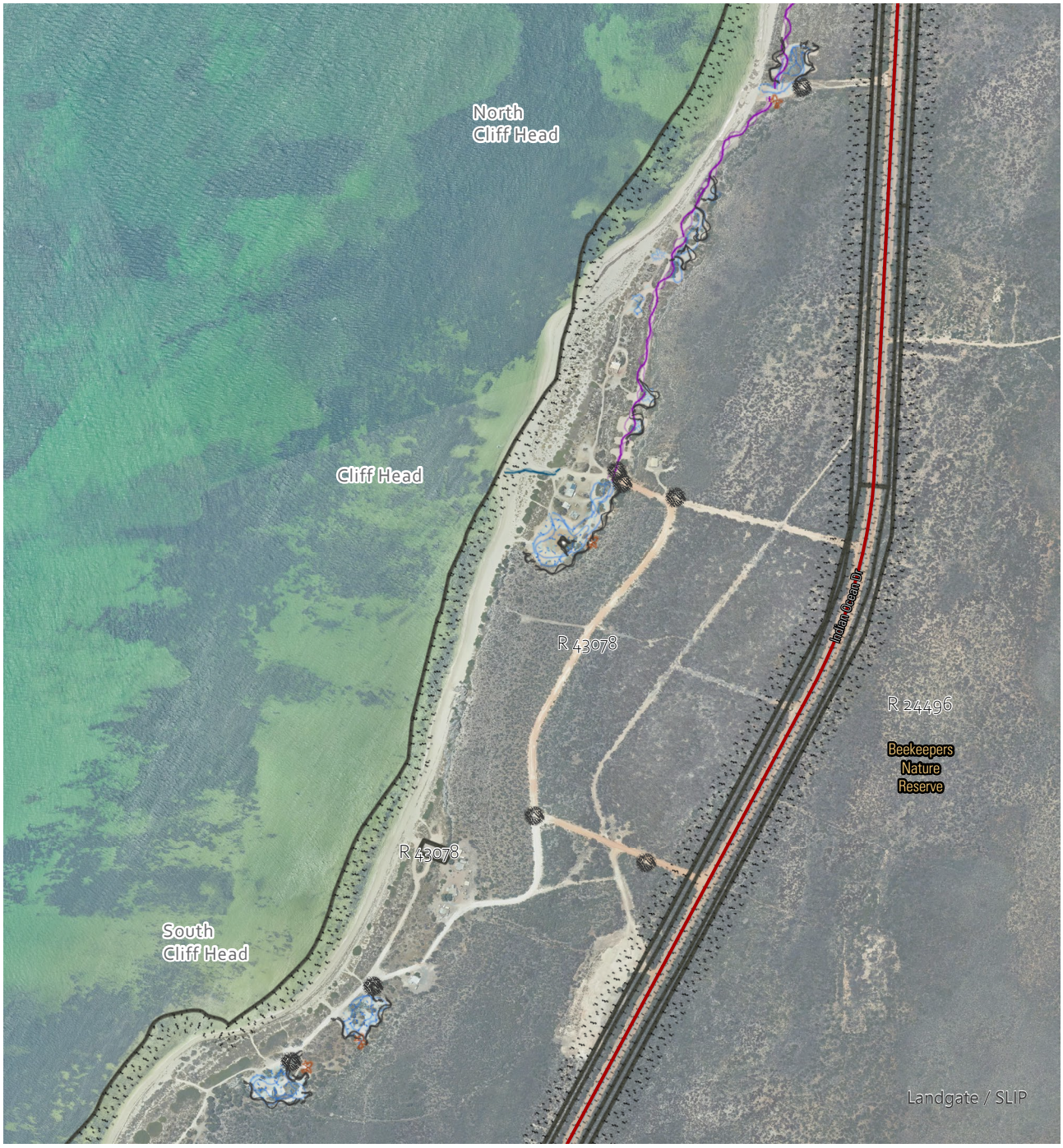
South Cliff Head Panorama

Photo by Land Insights, May 2019



Existing Shacks, Cliff Head

Photo by Land Insights, May 2019



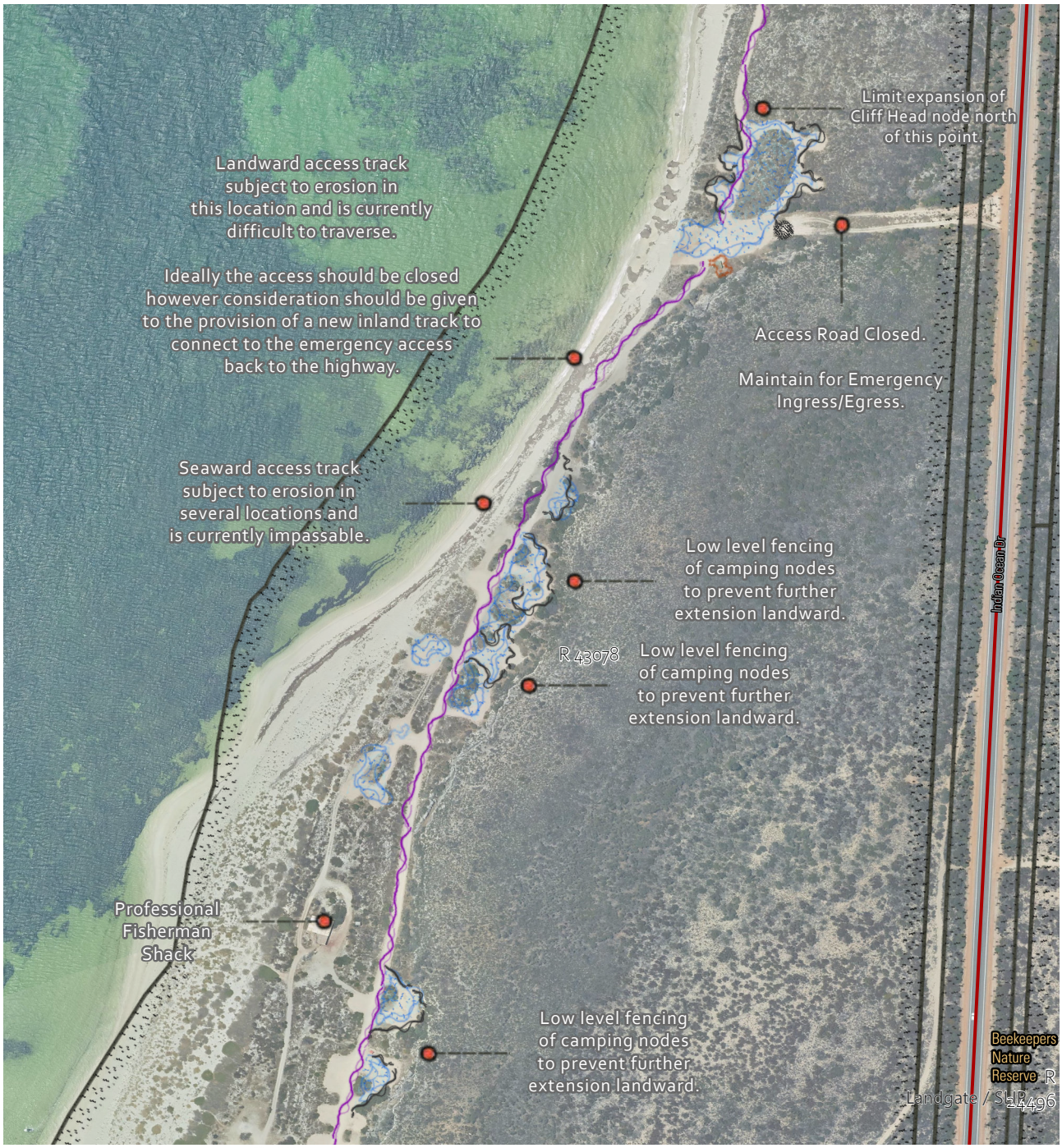
Cadastre
Low Level Fencing
Camping Node Extent
Signage - Existing/Proposed
Main access track
Boat Launching
Ablution Block
Picnic Shelter

N

1:10,000

0 100 200 300 400 m

Plan 11.2: Cliff Head Concept Overview - Camping Nodes Sector 3



Plan 11.3: North Cliff Head Overview Sector 3



Plan 11.4: Cliff Head Overview Sector 3



Cadastre
Camping Node Extent
Ablution Block
Low Level Fencing
Signage - Existing/Proposed

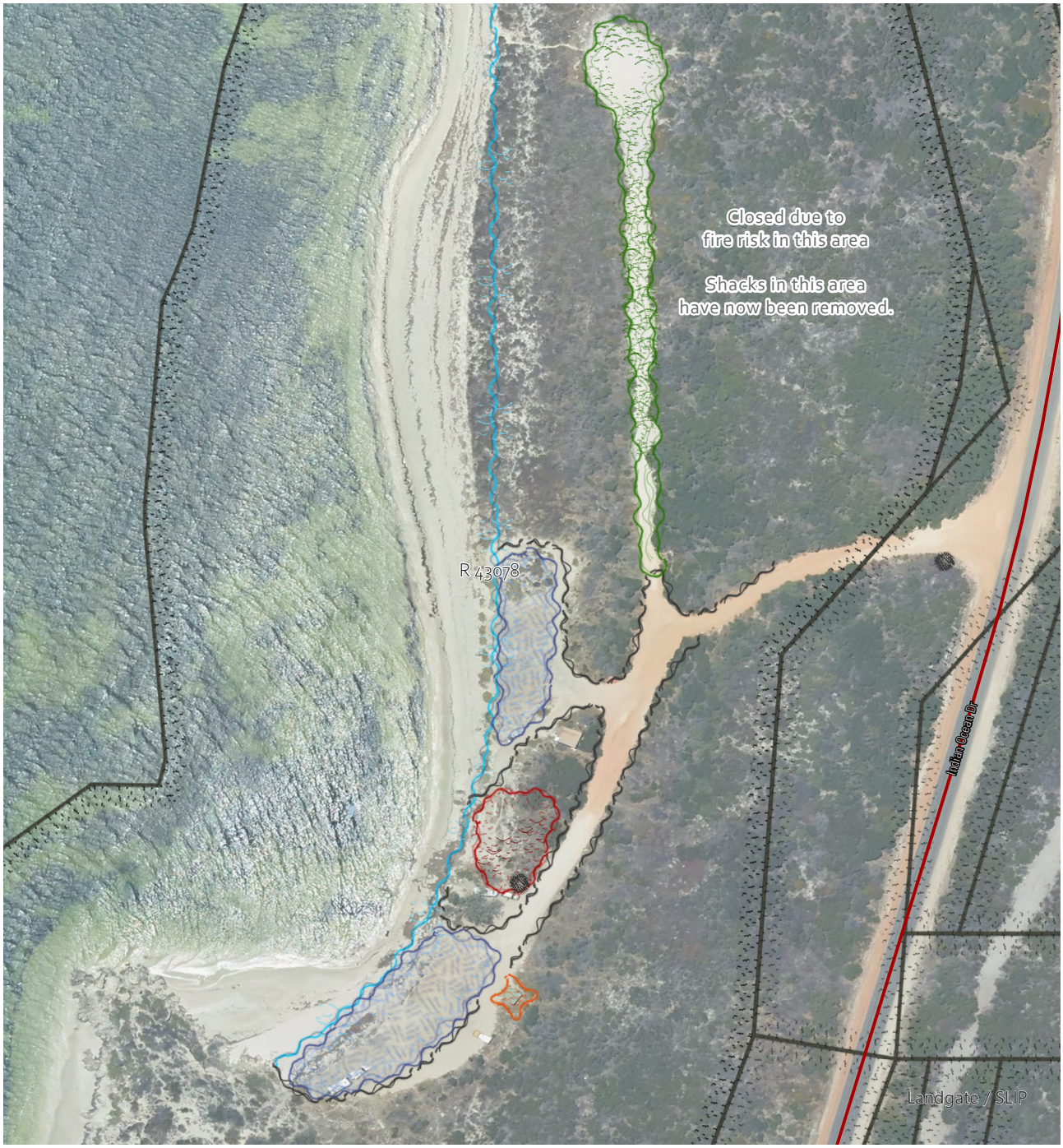
Image
Red: Band_1 Red: Band_1
Green: Band_2 Green: Band_2
Blue: Band_3 Blue: Band_3

N

1:2,000

0 25 50 75 100 m

Plan 11.5: South Cliff Head Overview
Sector 3



Freshwater Beach Location (Approx) May 2019
Signage Location
Ablution Block
Day Use Site
Close and Rehabilitate
Low Level Fencing
Overnight Camping Area
Cadastre

N

1:2,000

0 20 40 60 80 m

Plan 11.6: Freshwater Point Concept Overview
Sector 3



Freshwater Beach Location (Approx) May 2019
Signage Location
Ablution Block
Day Use Site
Close and Rehabilitate
Low Level Fencing
Overnight Camping Area
Cadastre

N

1:1,000

0 12.5 25 37.5 50 m

Plan 11.7: Freshwater Point Concept Detail Sector 3



Plan 11.8: Knobby Head Concept Overview Sector 3

12.0 implementation

12.1 INTRODUCTION

This chapter provides guidance on the implementation of the Coastal Management Plan. It can be used as a framework to ensure coastal management is adequately catered for in future budgets. The implementation of recommendations from the Plan will need to be appropriately costed and programmed for implementation by the responsible land managers.

12.2 PRIORITIES

The priorities assigned to each action are advisory only and reflect a timeframe for implementation. Priorities can be reviewed as required to take into account availability of resources and granting of funding requests.

Priorities have been classified as follows:

S: Short term – within the next 2 financial years

M: Medium term – within the next 5 financial years

L: Long term – within the next 5 to 10 financial years

O: Ongoing – over life of the CMP as required.

With regards to management actions with responsibilities assigned to the Shire, it is envisaged that those listed as Short priority will be works provided for either in the Shire annual budget or through grant funded projects within the next 2 years. Actions with Medium priority could be implemented by Council within the next 5 years, and actions identified as Long-term priorities could be implemented in the next 5 plus years.

Priority was determined through consideration of the comments received from the Steering Group, stakeholders and the community (which indicated issues and concerns which were high priority for them and which should be addressed in the short to medium term), the costs associated and the complexity of each action.

12.3 RESPONSIBILITIES

The responsibilities for implementation vary depending on the coastal landowner or manager. The responsibilities were determined largely through consideration of the tenure and land managers responsible for each site. While there is some UCL and the northern coastal dunes are largely located within private ownership, the remainder of the Shire's coastline is located within Shire-managed reserves. In addition, most of the coastal recreation sites are located within the Shire-managed reserves. As such, a majority of the responsibilities will be with the Shire of Irwin.

12.4 MONITORING & REVIEW

Monitoring is an essential component of the Coastal Management Plan. Its purpose is to assess the success of recommended actions and to determine whether they have achieved the desired outcome. It can also indicate whether the Plan requires modification to help reach the objectives more efficiently.

It is considered relevant to monitor the following within the study area:

- Visitor numbers to sites, especially during peak periods
- The success of rehabilitation
- The creation of new tracks and the amount of dune degradation
- The condition of facilities
- The condition of signs
- The cleanliness of coastal areas and whether clean-ups are required
- Rate of dune migration.

It is suggested that the Shire prepare a Monitoring Plan (Action EL15). This should include a process for the Shire to follow in order to review actions in this Plan and whether they have been achieved. Monitoring should ideally be undertaken at least annually, but possibly sooner in particular areas or where management issues are evident. In addition to visual observation of coastal features, monitoring could use technology to get an indication of how things are changing. For example, select locations can be chosen to undertake a photo database (take photos at a certain site on a regular basis over time to get an idea of coastal changes) or an annual drone flight (to take photos of the coast from the air). It may also be possible to utilise technology (such as mobile apps) to assist with monitoring. These apps could also be used by the community (e.g. to notify the Shire of any issues that may need to be resolved).

Relevant actions such as weed control, revegetation, closure of tracks, replacement of signs and facilities, provision of a caretaker or ranger etc. should be undertaken if monitoring results indicate no improvement or degradation. The Shire is encouraged to involve community where possible and where there is interest.

It is recommended that this Plan is reviewed after a 10-year period to determine if the actions are still relevant and to take into consideration changes to the social, economic and environmental context.

12.5 FUNDING SOURCES

Responsible land managers may be able to seek funding for

certain activities from other sources. Funding opportunities such as these tend to change on a regular basis and as a result a review of options should be undertaken each year. Projects and activities tend to be given higher priority if the proposed activities have been identified in a Coastal Management Plan. Applications will generally need to show how the proposed activities will have an environmental and social benefit and will need to provide details as to how the activity will be carried out, timeframes, costings and responsibilities. Funding can currently be applied for through the following:

- Coastwest Grants Program (through the Department of Planning, Lands and Heritage)
- Coastal Management Plan Assistance Program (Department of Planning, Lands and Heritage)
- Coastal Adaptation and Protection (CAP) Grants (Department of Transport)
- State Natural Resource Management (Department of Primary Industries and Regional Development)
- Recreational Boating Facilities Scheme (RBFS) grants (Department of Transport)
- Regional Grants Scheme (RGS) (Department of Primary Industries and Regional Development).

12.6 ACTIONS

Actions associated with Implementation are provided in Table 12.1 below.

Table 1201 – Implementation Actions

ACTION #	DESCRIPTION	PRIORITY	RESPONSIBILITY
IA1	Prepare a Monitoring Plan which sets out a list of actions to review the outcomes of this Coastal Management Plan and their effectiveness. The Monitoring Plan should list timeframes/frequency of monitoring and responsibilities.	S	Shire of Irwin
IA2	Prepare and Implement a simple Beach Monitoring Plan to regularly monitor (site visits and photography) key coastal locations to identify triggers for management identified throughout the CMP.	S	Shire of Irwin
IA3	Plan to undertake a review of this Coastal Management Plan within 10 years of its final adoption date.	L	Shire of Irwin

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APPENDIX A

COMMUNITY MEETING OUTCOMES REPORT

APPENDIX B
OTHER MINOR SITES



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