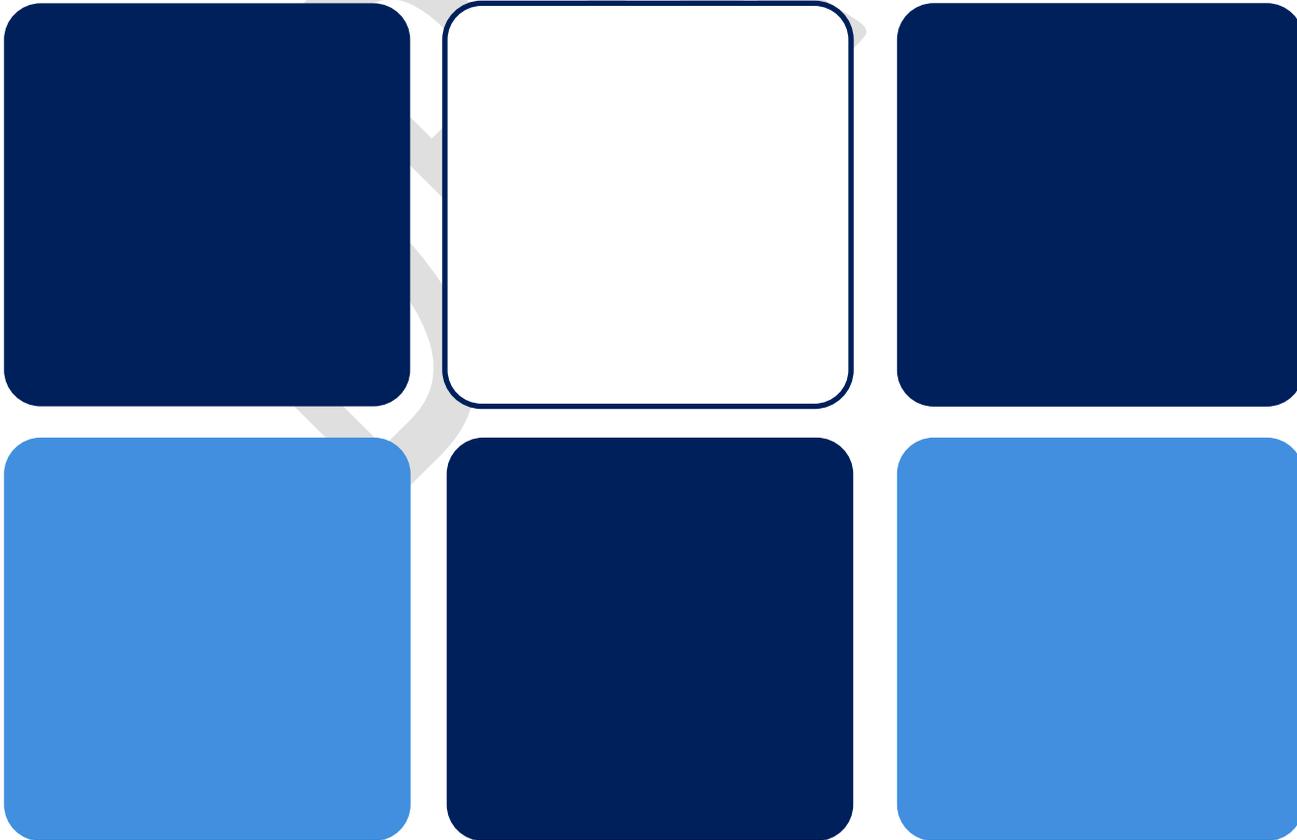




FORESHORE MANAGEMENT PLAN  
*Middleton Beach*

Prepared for **LandCorp and the City of Albany**

20 MARCH 2018



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**LANDCORP AND THE CITY OF ALBANY**



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## Acknowledgements

This Foreshore Management Plan (FMP) has been prepared for LandCorp and the City of Albany (CoA). This FMP has been prepared in collaboration with the CoA and is based upon the following key studies:

1. City's Middleton Beach Foreshore Landscape Management Plan prepared by AECOM; and
2. Technical coastal engineering studies including a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) for the Middleton Beach Activity Centre and Middleton Beach Coastal Management Strategy prepared by MP Rogers and Associates.

## Summary

### Middleton Beach Foreshore Management Area

The Foreshore Management Plan (FMP) area covers the existing Middleton Beach foreshore reserves adjacent to the Middleton Beach Activity Centre site (Figure A).

The FMP area is generally situated:

- west of the Southern Ocean
- south of the Big4 Middleton Beach Holiday Park
- east of the Middleton Beach Activity Centre site
- north of Mount Adelaide.

The FMP area contains a formal landscape area containing Norfolk pine trees, established grasses areas, the Albany Surf Lifesaving Club and the Three Anchors restaurant (Figure A). The existing foreshore reserve is comprised of Reserves 14789 and 26149, which are managed by the City of Albany (CoA) for Recreation purposes (CoA 2010).

### Purpose of the Foreshore Management Plan

LandCorp is developing the Middleton Beach Activity Centre site and as a condition of implementing this development is required to undertake a FMP. This FMP has been prepared in collaboration with the CoA who separately have engaged AECOM to prepare a Landscape Management Plan for Middleton Beach. The Middleton Beach Activity Centre site is located within and adjacent the City's broader Landscape Management Plan boundary (Figures A and B). This FMP document, in accordance with the advice from the CoA, Department of Planning, Lands and Heritage (DPLH), includes:

- an adaptation plan for the development site which commits to interventions in relation to Coastal Protection over the next 100 years on a staged basis.
- The City's long term vision and proposed infrastructure for Middleton Beach as defined in the Middleton Beach Foreshore Landscape Management Plan (AECOM 2018).

The City identified the following benefits of an integrated approach to coastal protection to the LandCorp development and the Middleton Beach foreshore:

- Coastal protection requirements are met for at least 50 years;
- High quality community amenity improvements on the dilapidated foreshore;
- Removal of drainage that currently flows directly onto the beach;
- Creation of a new beach promenade over the buried seawall.

This FMP has been prepared to be in accordance with the CoA's Local Planning Scheme (LPS) No.1, State Planning Policy (SPP) 2.6: *State Coastal Planning Policy* (Western Australian Planning Commission [WAPC] 2013a) and the State Coastal Planning Policy Guidelines (WAPC 2013b) to outline the foreshore location, detail the proposed foreshore infrastructure and depict the extent of revegetation works.

This report also includes:

- City of Albany - December 19<sup>th</sup> 2017 Ordinary Council Meeting resolution (Appendix A)
- Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) for the Middleton Beach Activity Centre (Appendix B; MP Rogers and Associates 2015) has been prepared to be in accordance with State Planning Policy (SPP 2.6) and the Coastal Hazard Risk Management and Adaptation Planning Guidelines (WAPC 2014).

- Middleton Beach Coastal Management Strategy (Appendix C; MP Rogers and Associates 2018) outlines the future requirements for the management of the coast within the FMP area and includes details on both the requirement for coastal management as well as the proposed foreshore management approach.
- The Middleton Beach Foreshore Landscape Management Plan (Appendix D; AECOM 2018) details of the key structural elements of the foreshore design and has been developed having regard for the foreshore's local and regional context, social and environmental characteristics, and a range of practical management requirements (e.g. access, tree retention).
- The design approach can be summarised as follows
  - > retention of the Norfolk Pine trees, established grasses areas, grassed terraces and Ellen Cove Jetty to maintain the foreshore area's existing usage and character
  - > path connections through the vegetated sand dunes to be formalised allowing direct pedestrian access to the beach, with accompanying revegetation works implemented
  - > upgrades and improvements to the Albany Surf Lifesaving Club
  - > dual use and primary use path network to allow for pedestrian and cycle access throughout the foreshore area
  - > foreshore promenade to provide an activation interface between the beach and landscaped foreshore environments
  - > additional grassed terraces to create an amphitheatre overlooking the beach environment.

## Future Foreshore Planning and Environmental Approvals

The CoA is currently undertaking a CHRMAP process for the broader Emu Point to Ellen Cove regional as required by the State as part of long term planning for coastal communities. This CHRMAP process shows the Middleton Beach foreshore and associated infrastructure is at risk within an approximate 20 year time frame. The CoA is required as part of the long term CHRMAP process to prepare an adaptation plan for the coastal areas at risk. LandCorp will contribute funding towards a portion (Stage 1) of the coastal protection for the Middleton Beach Activity Centre and adjacent foreshore area. The CoA acknowledges this FMP also presents an opportunity to appropriately define all the coastal protection works along Middleton Beach and to incorporate the coastal requirements into a larger integrated foreshore plan.

The benefits of an integrated approach to coastal protection to the LandCorp development and the Middleton Beach foreshore include:

- coastal protection requirements are met for at least 50 years
- high quality community amenity improvements for the dilapidated foreshore
- removal of drainage that currently flows directly onto the beach
- creation of a new beach promenade over the buried sea wall (CoA 2017).

This FMP has been prepared in consultation with the CoA. Post public advertising and adoption of the FMP by the CoA, the management plan will require endorsement from the WAPC. Post approval of the FMP, by the WAPC, future proposed development (e.g. in accordance with the Middleton Beach Foreshore Landscape Management Plan [Appendix D; AECOM 2018]), within the existing foreshore reserve, requires the approval of the CoA.

The development works will be subject to the following planning and environmental approvals:

- Development Applications (CoA)
- engineering / landscape construction design drawings (CoA)
- Purpose Permit clearing application approval (Department of Water and Environment Regulation [DWER]).

## FMP Implementation and Responsibility

### Implementation

LandCorp will contribute \$1.15 million (excl. GST) towards the Middleton Beach Activity Centre coastal infrastructure.

In February 2018, the CoA resolved the following in regard to the funding and responsibility for implementation of the Middleton Beach Activity Centre coastal infrastructure (Appendix A):

- that the CoA will undertake works in timed stages to protect the Middleton Beach Foreshore, associated infrastructure and the Middleton Beach Activity Centre (Figures 1,2 and K). The staging plan shows
  - > Stage 1 - Construction of buried sea wall and culvert within 5 years
  - > Stage 2 - Construction of promenade and seating/deflection wall within 10 years
  - > Stage 3 - Construction of foreshore improvements within 25 years
  - > Stage 4 - Assessment and possible construction of coastal protection additions after 50 years
- that the CoA will accept the funding contribution from LandCorp for the purpose of implementing the works required in the Middleton Beach Activity Centre FMP - Adaptation Plan
- the CoA will seek State and Federal funds to complete works on the Middleton Beach Foreshore
- the CoA will approve the advertisement of the completed Draft Middleton Beach Activity Centre FMP (which includes the agreed Adaptation Plan) for the purpose of public consultation (CoA 2018).

### Responsibility

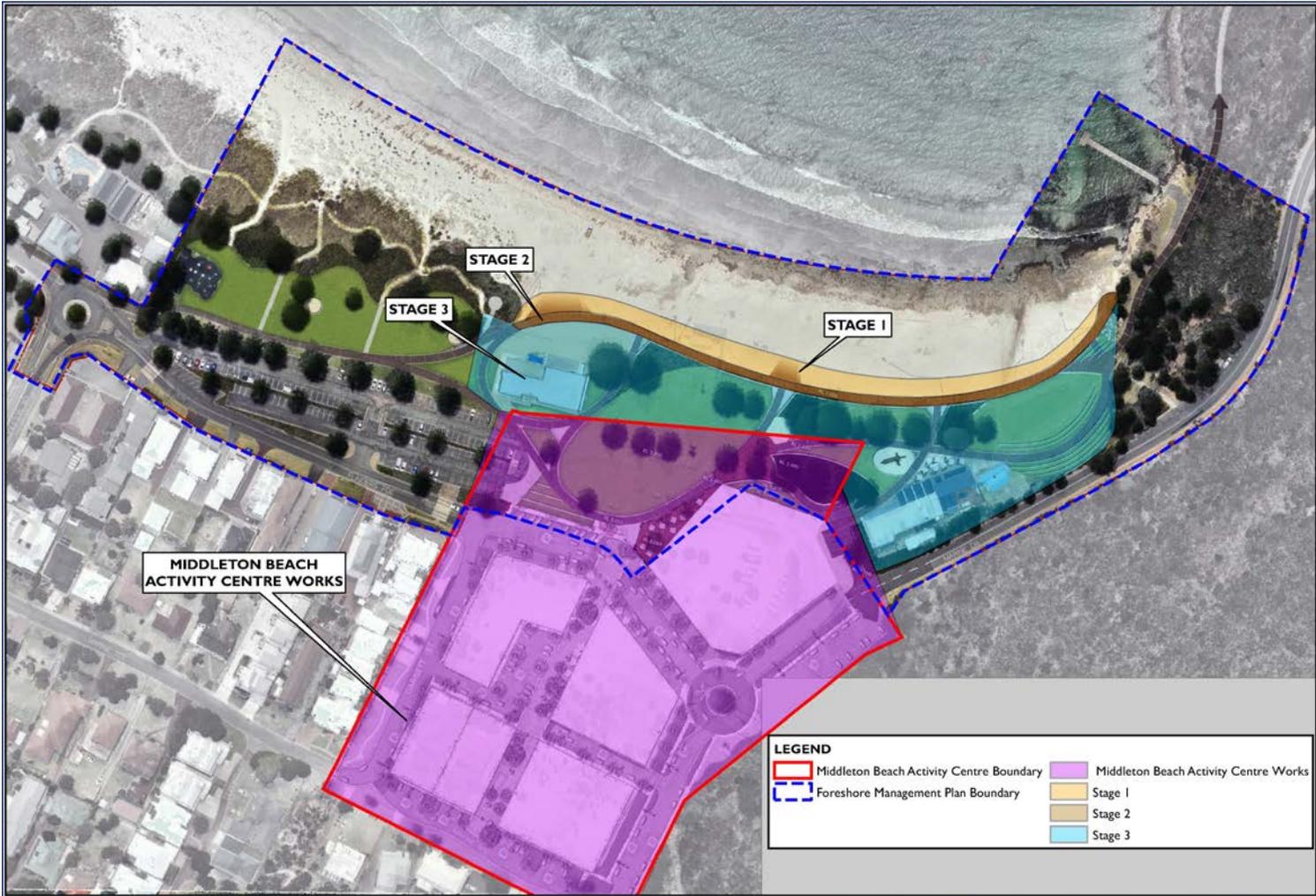
The responsibility for the implementation of the staging plan has been defined in consultation with the CoA as outlined below:

- The CoA and LandCorp will jointly be responsible for Stage 1 (buried sea wall to 1.1m AHD and drainage culvert installation) to be completed within 5 years. The CoA will be responsible for Stages 2, 3, and 4.
- The CoA and LandCorp will be jointly responsible for the detailed design and project management for construction of Stage 1 works. The CoA will be solely responsible as project manager for construction of future stages as required.
- The CoA and LandCorp will be jointly responsible for any maintenance requirements for a period of 5 years following the Practical Completion of Stage 1 construction. Maintenance costs will be apportioned on the basis of the original funding contribution made by each party.

It is anticipated that the cost of the coastal protection structure, which would extend along the entire length of the FMP area, would be in the order of \$4.2 million (excl. GST). This excludes the implementation of the Middleton Beach Foreshore Landscape Management Plan, which is estimated to cost an additional \$4.5 million (Appendix D; AECOM 2018).

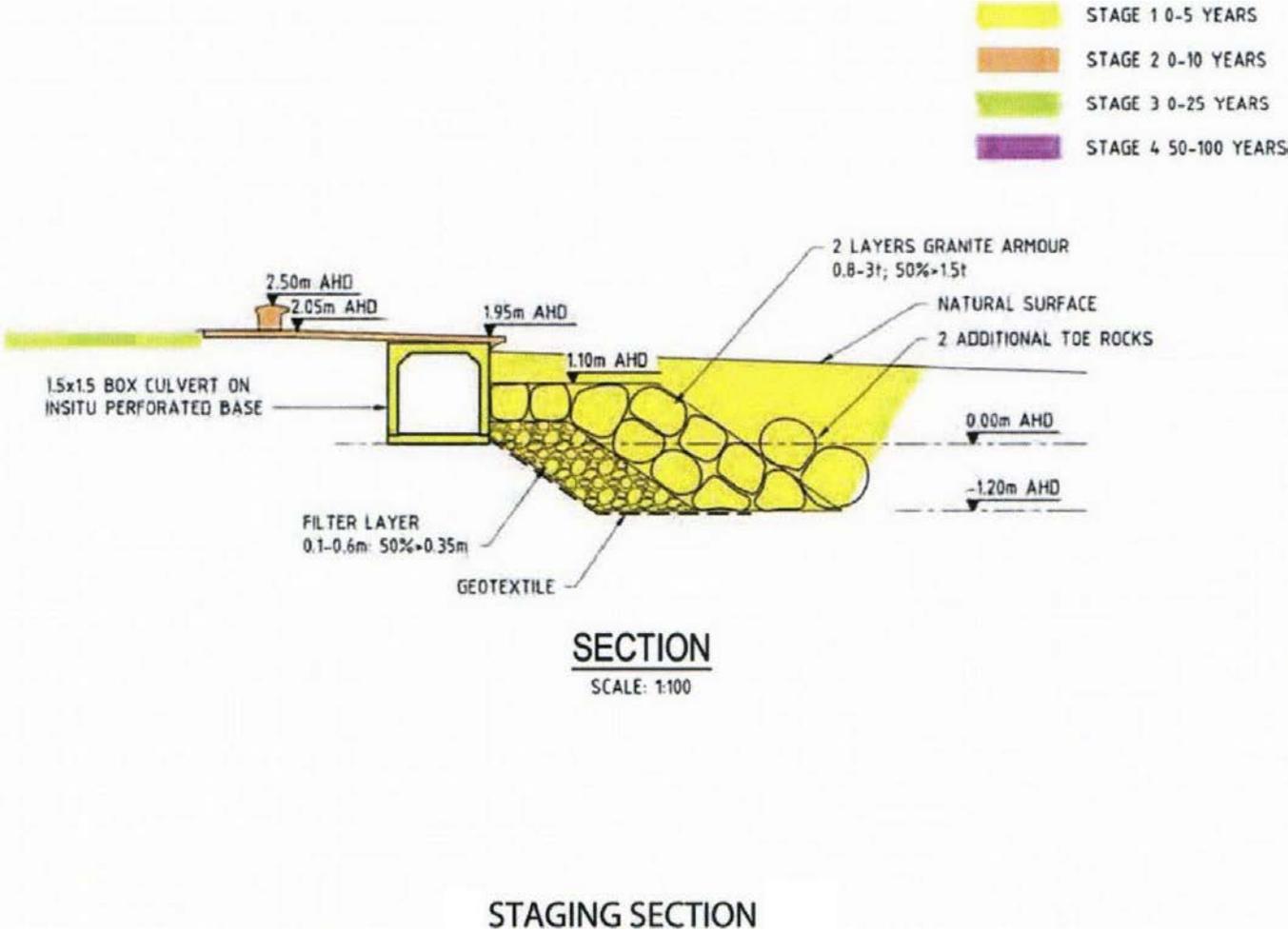
With the exception of the \$1.15 million (excl. GST) contributed by LandCorp towards the construction of the coastal protection structure, the remaining FMP budget is planned to be sourced from State and Commonwealth Governments.

An implementation schedule, which includes management responsibilities and detailed cost estimation for this FMP is provided in Table 4. The timing for the implementation of the FMP will commence with the construction of the buried sea wall in accordance with the CoA council staging and funding resolution (Figures 1 and 2).



(Source (Staging Plan) – City of Albany 2018)

**Figure 1: Middleton Beach Sea Wall Structure Staging Plan**



(Source City of Albany 2018 – based on MP Rogers Design)

Figure 2: Middleton Beach Sea Wall Structure Staging Section

# 1.0 Introduction

## 1.1 Background

Located on the site of the former Esplanade Hotel, the Middleton Beach Activity Centre development will create a mixed-use centre with tourist facilities, restaurants, cafés, shops, holiday and short stay accommodation and permanent residential apartments. Covering approximately 3.29 ha, the activity centre development will provide around 295 dwellings, as well as mixed use and hotel lots.

The Middleton Beach Activity Centre Local Structure Plan (LSP) (LandCorp 2016) was adopted by the CoA in 2016 and endorsed by the WAPC in 2017.

The foreshore interface between the Middleton Beach Activity Centre site and the Southern Ocean is a critical component for the activity centre development and needs to be designed and managed to preserve and enhance its unique community attributes for future generations.

## 1.2 Site Details

### 1.2.1 Location

The FMP area is generally situated:

- west of the Southern Ocean
- south the Big4 Middleton Beach Holiday Park
- east of the Middleton Beach Activity Centre site
- north of Mount Adelaide.



**Figure 3: Middleton Beach and Surrounding Environments**

(Source: AECOM 2017)

### 1.2.2 Site Description and Tenure

The FMP area is an approximately 6.21 ha parcel of coastal land and includes the existing Middleton Beach foreshore reserve adjacent to the Ellen Cove Jetty stretching north to the caravan park. The foreshore reserve contains Norfolk pine trees, established grasses areas, the Albany Surf Lifesaving Club and Three Anchors restaurant (Figure 3).

The existing foreshore reserve is comprised of Reserves 14789 and 26149, which are managed by the CoA for Recreation purposes (CoA 2010).

### 1.3 Purpose

LandCorp is developing the Middleton Beach Activity Centre site and as a condition of implementing this development is required to undertake a FMP. This FMP has been prepared in collaboration with the CoA who separately have engaged AECOM to prepare a Landscape Management Plan for Middleton Beach. The Middleton Beach Activity Centre site is located within and adjacent the City's broader Landscape Management Plan boundary (Figures A and B). This FMP document, in accordance with the advice from the CoA, Department of Planning, Lands and Heritage (DPLH), includes:

- an adaptation plan for the development site which commits to interventions in relation to Coastal Protection over the next 100 years on a staged basis.
- The City's long term vision and proposed infrastructure for Middleton Beach as defined in the Middleton Beach Foreshore Landscape Management Plan (AECOM 2018).

LandCorp is developing the Middleton Beach Activity Centre site and is required to undertake a FMP in consultation with the CoA. This FMP has been prepared to be in accordance with the CoA's LPS No.1, and State Planning Policy (SPP) 2.6: *State Coastal Planning Policy* (WAPC 2013a), which requires the following assessment to protect Middleton Beach and associated developments from coastal processes across a 100-year period:

- consideration of coastal hazards and to evaluate their likelihood and the consequence for specific assets
- identification of realistic and effective management and adaptation responses to those risks
- prioritising management and adaptation responses.

This FMP in accordance with the Coastal Hazard Risk Management and Adaption Planning Guidelines (WAPC 2014) outlines the existing foreshore location and development context, details the proposed coastal infrastructure and depicts the approximate foreshore areas for revegetation works (Figure J).

This report also includes:

- City of Albany - December 19<sup>th</sup> 2017 Ordinary Council Meeting resolution (Appendix A)
- Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) for the Middleton Beach Activity Centre (Appendix B; MP Rogers and Associates 2015) has been prepared to be in accordance with State Planning Policy (SPP 2.6) and the Coastal Hazard Risk Management and Adaption Planning Guidelines (WAPC 2014).
- Middleton Beach Coastal Management Strategy (Appendix C; MP Rogers and Associates 2018) outlines the future requirements for the management of the coast within the FMP area and includes details on both the requirement for coastal management as well as the proposed foreshore management approach.
- The Middleton Beach Foreshore Landscape Management Plan (Appendix D; AECOM 2017) details of the key structural elements of the foreshore design and has been developed having regard for the foreshore's local and regional context, social and environmental characteristics, and a range of practical management requirements (e.g. access, tree retention).

### 1.4 Objectives

The overall aim of this FMP is to retain and enhance the key recreational and amenity values of the Middleton Beach foreshore environment, whilst ensuring its ongoing protection from coastal hazards.

Aligned with this aim, the following key objectives have been established:

- Site definition. Define the Middleton Beach foreshore area, which includes a broader precinct adjacent to the Middleton Beach Activity Centre and specifically focus upon the foreshore area between the existing boardwalk and the Albany Surf Lifesaving Club, which enables the CoA's broader aspirations for the Middleton Beach foreshore environments to be realised.

- Strategy development. Develop integrated strategies for servicing essential infrastructure, engineering and coastal adaptation and protection, inclusive of defining the risk to existing and future infrastructure from coastal hazards over the 100-year planning horizon and the development of specific mitigation measures to address SPP 2.6.
- Staged approach. Implementing a short, medium and long-term approach to the design and planning of the Middleton Beach foreshore centred around coastal adaption, urban growth, transport, infrastructure, climate change and implementation factors to support the development of the Middleton Beach Activity Centre in accordance with CoA's strategies, plans and policies.
- Public realm. Integrate design strategies for high quality public spaces and facilities for all users which are safe, accessible, attractive, comfortable, flexible (event capability), well connected and long lasting.
- Community focus. Build on the objectives established by the by community engagement undertaken for the Middleton Beach Activity Centre and the Coastal Parks Strategy and engage and inform the local community.
- Partnerships. Work in partnerships with key stakeholders throughout the process, taking a collaborative approach to design, planning, implementation and management decisions.
- Economic viability. Support the development aims and investment strategy of the Middleton Beach Activity Centre and the broader foreshore precinct.
- Sense of place. Protect, enhance and communicate the culture and heritage values of the locale, create memorable, diverse and authentic experiences which express civic pride and encourage repeat visitation.

This FMP guides management actions and outlines the proposed design response to the following issues within the Middleton Beach foreshore reserve:

- coastal inundation and erosion hazards
- pedestrian access to Middleton Beach
- tree retention and environmental rehabilitation.

The FMP in addressing the above issues has been set out in the following sections:

- Statutory and Policy Context (Section 2.0)
- Middleton Beach Context (Section 3.0)
- Existing Environment (Section 4.0)
- Foreshore Design and Function (Section 5.0)
- Coastal Hazard Risk Management and Adaptation (Section 6.0)
- Foreshore Rehabilitation (Section 7.0)
- Implementation and Responsibility (Section 8.0).

## 1.5 Statutory Requirements

The requirement to prepare and implement an agreed FMP was established through the Minister for Planning's approval of Amendment No. 1 to the CoA's LPS No.1.

Planning approval required that Special Performance Criteria were incorporated into the Schedule 4 – Special Uses Zones of LPS No. 1. The Special Performance Criteria required that foreshore protection and management measures be implemented, specifically:

1. Development within the Hotel/Mixed Use precinct and/or creation of the Hotel/Mixed Use Precinct and/or creation of the Hotel/Mixed Use Lot will be subject to satisfactory arrangements for the

implementation and ongoing management of coastal adaptation and protection measures consistent with State Planning Policy 2.6, including but not limited to:

- a. Public advertising, adoption and implementation of a Foreshore Management Plan that includes the existing foreshore reserve adjacent to the Special Use zone, prepared in conjunction with the City of Albany in accordance with SPP 2.6 Sub-Clause 5.10 Coastal Strategies and Management Plans and endorsed by the WAPC.
- b. Notification on Title stating that the lot within a Vulnerable Coastal Area.

### 1.5.1 Approval Process

Informed by the above Special Performance Criteria, it is envisioned that the approvals process for this FMP would generally include the following stages:

1. Adoption of the draft FMP by CoA for the purpose of advertising / public consultation.
2. Commencement of the advertising / public consultation period.
3. Review and respond to any submissions received by the CoA.
4. FMP to be updated (this stage would be undertaken on an 'as required' basis).
5. Final adoption of the FMP by CoA.
6. Submission of FMP to WAPC for endorsement.

## 1.6 Middleton Beach Foreshore Landscape Management Plan

The Middleton Beach Foreshore Landscape Management Plan (Appendix D; AECOM 2018) provides details of the key structural elements of the foreshore design and has been developed having regard for the foreshore's local and regional context, social and environmental characteristics, and a range of practical management requirements (e.g. access, tree retention).

The design approach can be summarised as follows:

- retention of the Norfolk Pine trees, established grasses areas, grassed terraces and Ellen Cove Jetty to maintain the foreshore area's existing usage and character
- path connections through the vegetated sand dunes to be formalised allowing direct pedestrian access to the beach, with accompanying revegetation works implemented
- upgrades and improvements to the Albany Surf Lifesaving Club
- dual use and primary use path network to allow for pedestrian and cycle access throughout the foreshore area
- foreshore promenade to provide an activation interface between the beach and landscaped foreshore environments
- additional grassed terraces to create an amphitheatre overlooking the beach environment.

The FMP area is planned to operate as an interface between the Middleton Beach Activity Centre development and Middleton Beach. The FMP area will provide opportunities for active and passive recreation whilst responding to the cultural and ecological sensitivities within the existing foreshore reserve and the surrounding Middleton Beach and Mount Adelaide environments.

## 2.0 Statutory and Policy Context

A range of plans, strategies and policies provide the context for the future conservation, development and use of the Middleton Beach foreshore. The following provides a summary of those statutory and policy mechanisms applicable to the subject land, noting key issues/requirements of relevance to this FMP.

### 2.1 City of Albany Local Planning Scheme

The LPS zonings and reservations, as an outcome of Amendment No.1, for the Middleton Beach Activity Centre are shown in Figure B. The foreshore area subject of this FMP is primarily reserved for “Parks and Recreation”, with an approximate 0.5 ha portion being zoned Special Use Zone SU25’, under the LPS No. 1.

#### 2.1.1 Improvement Plan No. 40

Improvement Plan No. 40 set out future planning, development and land uses by establishing the strategic intent for the Middleton Beach Activity Centre. Improvement Plan No. 40 was gazetted and came into operation in October 2014. However, in February 2015 the DPLH subsequently recommended that traditional Local Planning Scheme Amendment and Structure Plan mechanisms should be followed for the statutory planning of the site rather than an Improvement Scheme.

#### 2.1.2 Amendment No. 1

LPS Amendment No. 1 proposed to rezone part of Lot 8888 Flinders Parade, Middleton Beach from ‘Hotel/Motel’ and ‘Tourist Residential’ zones, Lots 660 and 661 Marine Terrace, Middleton Beach from ‘Tourist Residential’ zone and portions of Adelaide Crescent, Marine Terrace, Barnett Street, Flinders Parade and Marine Drive from ‘Priority Road’ and Local Road Reserves to ‘Special Use Zone SU25’.

On 23 December 2017, the Minister for Planning approved Amendment No. 1 to the CoA LPS No. 1 Public notice was provided by way of Government Gazette on 24 January 2017 (Appendix E).

### 2.2 City of Albany Activity Centres Planning Strategy

The objectives of the Activity Centres Planning Strategy (CoA 2010) are:

1. Promote and facilitate the provision and responsive evolution of a viable, convenient, and attractive network of activity centres to serve the retail, other commercial and socio / cultural needs of the regional and local population.
2. Encourage and facilitate the provision of more localised business and employment opportunities.
3. Preserve and where possible enhance the local character and amenity of residential neighbourhoods.

The CoA (2010) identifies Middleton Beach as an Activity Centre (Local Centre).

### 2.3 Middleton Beach Activity Centre Local Structure Plan

The LSP was prepared in support of Amendment No. 1 to guide future subdivision and development of the Middleton Beach Activity Centre (Figure C).

The LSP was adopted by the WAPC on 04 January 2017, following endorsement by the CoA on 13 June 2016. It comprises the 3.29 ha parcel of land that was subject to Amendment No. 1 and is situated between Flinders Parade, Adelaide Crescent, Marine terrace and Barnett Street. The LSP project area includes the site of the former Esplanade Hotel. It provides a detailed framework for the provision of at least 295 residential dwellings, three mixed use lots, one hotel lot and public open space.

Approximately 0.5 ha of foreshore public open space is provided for in the LSP, which is situated adjacent to the existing Middleton Beach foreshore reserve. Development in the combined foreshore reserve is to be for public use infrastructure and designed to limit disturbance while allowing people to experience the asset. Public access to the area is to be controlled via a designated and signposted path linking to the development from the west to the foreshore and beach.

## 2.4 State Planning Policy 2.6: State Coastal Planning Policy

SPP 2.6 establishes the requirement for setting coastal reserves in Western Australia through using a site-specific assessment. The Policy requires the area of foreshore reserve be sufficient to provide an allowance for coastal processes, protection of ecological values, landscape, visual amenity, indigenous and cultural heritage, public access, recreation and safety.

SPP 2.6 provides guidance for the assessment of coastal processes through consideration of the following key components:

- S1 Erosion: Allowance for the current risk of storm erosion
- S2 Erosion: Allowance for historic shoreline movement trends
- S3 Erosion: Allowance for erosion caused by future sea level rise
- S4 Inundation: Allowance for the current risk of storm surge inundation.

M P Rogers and Associates (2015) defines the physical processes allowance area consistent with the SPP 2.6 requirements. The identified coastal hazard lines for the Middleton Beach Activity Centre are presented in Figure D.

## 2.5 State Planning Policy 2.9: Water Resources

SPP 2.9: *Water Resources* (WAPC 2006) provides guidance for development abutting water resources or potentially impacting on water resources.

The objectives of SPP2.9 are to:

1. Protect, conserve and enhance water resources that have been identified as having significant economic, social, cultural and/or environmental values.
2. Assist in ensuring the availability of suitable water resources to maintain essential requirements for human and all other biological life with attention to maintaining or improving the quality and quantity of water resources.
3. Promote and assist in the management and sustainable use of water resources.

SPP 2.9 seeks improved outcomes such as reduction in nutrient export and improved water quality. Requirements for design and development proposals include:

- measures to achieve effective total water cycle management and integrated urban water management
- management of site constraints and hazards including slope stability and erosion hazards
- measures to manage and restore vegetation cover.

## 2.6 Albany Regional Vegetation Survey

The Albany Regional Vegetation Survey (ARVS) (Sandiford and Barrett 2010) provides a local and regional overview of the native flora and vegetation species present within the greater Albany area. Assessments of the extent, rarity, diversity and reservation status of vegetation units, their status as wetland / streamline / estuarine or coastal dune vegetation and threats to vegetation units are provided to assist in determining the local and regional conservation significance of the vegetation (EPA 2017).

The native vegetation to the east of the existing landscaped foreshore reserve and in close proximity to the Middleton Beach Activity Centre is mapped by the ARVS as Beach Herbland / Grassland.

## 2.7 Middleton Beach Tourist Precinct

The objectives of the CoA's Middleton Beach Tourist Precinct Policy are to:

1. Create a high quality and vibrant beachside tourist precinct.
2. Encourage the provision of a wide range of facilities and services to serve both visitors and the local community.
3. Encourage a more diverse range of housing and tourist accommodation.
4. Establish appropriate height limits for development within the precinct.

The Middleton Beach Activity Centre development and foreshore reserve is situated within The Beach Strip, which is described as an active beach front urban edge comprising restaurants, cafes, tourist accommodation and residential apartments.

## 2.8 Council Management Plan, Middleton Beach

The Council Management Plan, Middleton Beach (CoA 2010) provides the framework for the management and environmental protection of the Middleton Beach foreshore reserve.

Threats to conservation values are listed with proposed management strategies to address them. Key identified threatening processes are:

- physical disturbances including trampling and track creation
- environmental weeds.

Recommendations for management include constructing a formal pathway and conducting weed control programs in conjunction with rehabilitation programs.

## 2.9 Future Foreshore Planning and Environmental Approvals

Any proposed development, as part of the implementation of the Middleton Beach Foreshore Management Plan, requires the approval of the CoA.

The development works will be subject to the following planning and environmental approvals:

- Development Application (CoA)
- engineering / landscape construction design drawings (CoA)
- Purpose Permit clearing application approval (DWER).

### 3.0 Middleton Beach Context

Middleton Beach is Albany’s primary swimming and recreational beach and is considered to be one of the CoA’s premier coastal destinations Figure 4. The surrounding Middleton Beach suburb comprises of a mixture of primary residences as well as including an assortment of holiday accommodation, ranging from a caravan park to motels and independent ‘bed and breakfasts’ and private holiday houses.

The Middleton Beach foreshore serves as a popular destination for Albany’s local and broader communities, whilst functioning as a tourism destination for visitors to the Great Southern region.



(Source: AECOM 2017)

**Figure 4: Existing Middleton Beach Foreshore Environment**

The social, environmental, personal and economic value of the Middleton Beach coastline has been considered by the CoA’s Study of Coastal Values and Character Emu Point to Middleton Beach (Greenskills 2013). This document identifies the Middleton Beach coastal environment is highly valued by the local community for walking, swimming and reading, whilst the local cafes and restaurants provide local meeting points.

The development of the Middleton Beach Activity Centre will create a mixed use centre with tourist facilities, restaurants, cafés, shops, holiday and short stay accommodation and permanent residential apartments. Whilst the planned upgrades to the FMP area will ensure that the cultural and environmental attributes of Middleton Beach foreshore are maintained and enhanced to support the delivery of an outstanding foreshore precinct for the Albany’s local and broader communities.

## 4.0 Existing Environment

### 4.1 Topography

The Middleton Beach foreshore is situated on beach and dune deposits consisting of lacustrine deposits including lakes, playas and fringing dunes. The foreshore topography is generally flat with limited variation, ranging in elevation from a maximum height of approximately 2.6 metres Australian Height Datum (m AHD) to 0 m AHD along the coast (Figure E).

### 4.2 Geology

The 1:50,000 Environmental Geology Series identified the Middleton Beach foreshore consists predominantly of S2 (SAND) – white, medium to coarse-grained, moderately well sorted, quartz and shell debris (Gozzard 1989; Figure F).

#### 4.2.1 Soils

A geotechnical investigation has been completed for the Middleton Beach Activity Centre by Golder Associates (2015) and confirmed the soil profile to consist of the following:

- SAND (topsoil): fine to coarse grained sand, grey to yellow, with some plasticity silt, loose to medium dense, extending to depths of 0.2 metres (m) and 0.4 m overlying
- SAND (SP): fine to medium grained, sub-rounded to sub-angular, carbonate, pale yellow-white becoming grey, with trace shells and shell fragments at about 2.5 m depth, medium dense to dense, extending to depths of between 5.5 m and 6.9 m, overlying
- Sandy CLAY/Clayey SAND (C1/SC): medium plasticity, dark grey, fine grained sand, firm to stiff, typically 0.5 m to 1.5 m thick and extending to depths of 6.8 m and 7.6 m, overlying
- SAND (SP): medium dense to dense, variable thickness from 0.5 m to 11 m thick, extending to depths of between 7.2 m and 18.5 m, overlying
- Clayey SAND/Sandy CLAY (SC/CL): medium dense to dense, inferred extremely weathered to highly weathered granite, extending to a maximum depth investigated of 22.2 m.

The geotechnical assessment included drilling four boreholes to a depth of 6.0 m, with two of these (BH01 and BH04) being developed as groundwater monitoring bores. The locations of the boreholes are shown on Figure G. Permeability testing by the inverse auger hole method was also completed at two locations at a depth of 1 m and found that the soil permeability was approximately 40 m/day and 60 m/day (Golder Associates 2015).

### 4.3 Groundwater

Groundwater flows is in an easterly direction towards the coast, discharging to the Southern Ocean.

#### 4.3.1 Aquifers

The Middleton Beach foreshore lies within the Karri groundwater area and the Karri sub-area. The DWER's Hydrogeological Atlas has classified the area as having local fractured and weathered rock aquifers of low permeability (Department of Water 2017).

The aquifers within the Karri groundwater sub-area include the Bremer West Superficial, Bremer West Sedimentary and the Bremer West Fractured Rock Aquifers.

The Bremer West Superficial Aquifer occurs in sand and calcarenite dunes along the coast with the salinity ranging from fresh to brackish, overlying salt water that connects to the ocean. The Bremer West Sedimentary Aquifer occurs in Pallinup Siltstone and Werillup Formation and is typically brackish or saline, although freshwater is present in high recharge areas. The underlying Bremer West Fractured Rock Aquifer consists of granite and gneiss, and has been identified to be low yielding with high salinities. There is limited information on water availability in these aquifers.

### 4.3.2 Groundwater Levels

A groundwater monitoring program for the Middleton Beach Activity Centre commenced in August 2015 to inform the preparation of the Urban Water Management Plan (UWMP) (RPS 2017).

Groundwater pressure transducers were installed in the two shallow monitoring bores, which were set to log every 15 minutes commencing in September 2015 until they were removed in January 2017 (Figure G). Groundwater levels measured from the loggers ranged from 0.848 m AHD (11/04/2016) to 1.805 m AHD (09/10/2016) from BH01 and from 0.591 m AHD (11/04/2016) to 1.307 m AHD (05/10/2016) from BH04, with the shallowest depths to groundwater occurring in October 2016.

The Maximum Groundwater Level (MGL) for the Middleton Beach Activity Centre was 1.307 m AHD for BH04 and 1.805 m AHD for BH01. The MGL decreases from west to east across the foreshore reserve to be 0 M AHD at the coast.

## 4.4 Flora and Vegetation

### 4.4.1 Albany Regional Vegetation Survey

The Middleton Beach foreshore is mapped by the ARVS as Beach Herbland/Grassland vegetation association ‘...a colonising unit that occurs on beaches above the high-water mark and on some foredunes. This unit is transitional, subject to erosion by storm wave action or invasion by secondary successional species and changing to Coastal Limestone Heath. The unit varies from an open herbland to a closed grassland with most species present introduced. Common species include *Spinifex hirsutus*, *Lepidosperma gladiatum*, \**Spinifex sericeus*, \**Ammophila arenaria*, \**Lagurus ovatus*, *Ficinia nodosa*, \**Cakile maritima*, \**Arctotheca calendula*, *Carpobrotus* sp., \**Pelargonium capitatum* and \**Euphorbia paralias*. Occasional shrubs may be present. Species present are salt tolerant and many were only recorded in this unit.’ (Sandiford and Barrett 2010; Figure 5).

The ARVS notes that this vegetation association has high numbers of introduced species and is widespread along beaches in south-west Western Australia (Sandiford and Barrett 2010).



(Source: AECOM 2017)

**Figure 5: Herbland/Grassland Vegetation Association within Middleton Beach Foreshore**

Bushland extents associated with Mount Clarence A Class Reserve (2682) in the south of the FMP area are inferred as a mixture of Jarrah Woodland and Coastal *Banksia ilicifolia*/Peppermint Low Woodland vegetation associations.

The Jarrah Woodland vegetation association 'is relatively open with *Banksia ilicifolia* and *Corymbia calophylla* occasionally present. The understorey is often a *Taxandria parviceps* tall shrubland above one or two lower open shrub layers, an *Anarthria scabra*/*Hypolaena exsulca* Sedgeland and mixed open herbland dominated by *Dasyopogon bromeliifolius*, and/or *Patersonia umbrosa* and *Pteridium esculentum*. Common understorey shrubs include *Pultenaea reticulata*, *Melaleuca thymoides*, *Acacia pulchella*, *Bossiaea praetermissa*, *Leucopogon rubricaulis*, *Xanthosia rotundifolia* and *Boronia crenulata*'.

The Coastal *Banksia ilicifolia*/Peppermint Low Woodland vegetation association 'A canopy of *Banksia ilicifolia* and *Agonis flexuosa* is characteristic of this unit with *Banksia attenuata* and *Allocasuarina fraseriana* co-dominant in some areas. The understorey species include *Jacksonia horrida*, *Pultenaea reticulata*, *Melaleuca thymoides*, *Adenanthos cuneatus*, *Leucopogon obovatus*, *Acacia pulchella*, *Astroloma baxteri*, *Bossiaea praetermissa*, *Hibbertia racemose*, *Anarthria scabra*, *Anarthria prolifera*, *Schoenus caespititius*, *Lyginia barbata*, *Mesomelaena gracilipes*, *Cyathochaeta equitans*, *Dasyopogon bromeliifolius* and *Amperea ericoides*.

#### 4.4.2 Flora and Vegetation and Fauna Review

A Flora and Vegetation and Fauna Review was undertaken by RPS to support the Middleton Beach Activity Centre LSP (RPS 2015). Flora database searches were undertaken using a 5 km buffer, whilst a field investigation was undertaken to review the vegetation within the Middleton Beach Activity Centre site.

##### 4.4.2.1 Threatened and Priority Flora

*Poa billardierei* (Priority 3) was recorded within the existing Middleton Beach foreshore reserve to the north of the FMP area (Figure H).

##### 4.4.2.2 Threatened and Priority Ecological Communities

The following two Threatened Ecological Communities (TECs), listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), were recorded within 5 km of the FMP area:

- Proteaceae Dominated Kwongan Shrublands of the Southeast Coastal Floristic Province of Western Australia
- subtropical and temperate Coastal Saltmarsh.

The key diagnostic characteristics of these TECs are not representative of the ARVS' description of the Beach Herbland/Grassland, Jarrah Woodland or Coastal *Banksia ilicifolia*/Peppermint Low Woodland vegetation associations.

## 4.5 Terrestrial Fauna

### 4.5.1 Flora and Vegetation and Fauna Review

Database searches, a desktop habitat assessment for conservation fauna and field investigation was undertaken for the Middleton Beach Activity Centre site (RPS 2015).

The Blue-billed duck (Priority 4) was recorded within the Middleton Beach Activity Centre site by the database searches. Additionally, Hutton's Shearwater, a listed marine species under the EPBC Act, and southern brown bandicoot (Priority 5) were also recorded within the existing Middleton Beach foreshore reserve to the north of the FMP area by the database searches (Figure I). No native fauna was recorded within the Middleton Beach Activity Centre site by the field investigation (RPS 2015).

#### 4.5.2 Database Records

The Blue-billed duck is likely to be a resident in the wetland environments of the Lake Seppings Nature Reserve. The recording within the Middleton Beach Activity Centre site is likely to be representative of an individual traversing the local Middleton Beach landscape as there is no habitat with the site upon which the Blue-billed duck would be reliant upon to maintain a local population (RPS 2015).

Hutton’s Shearwaters travel from their breeding grounds in New Zealand across the Southern Ocean south of Australia and up the west coast to spend the non-breeding season in the Kimberly before retracing this flight path before the next breeding season (Birdlife Australia 2017). The recording within the existing Middleton Beach foreshore is representative of an individual migrating between New Zealand and the Kimberly.

Southern brown bandicoot is likely to be resident within the Mount Clarence environments and landholdings the adjacent the existing Middleton Beach foreshore reserve (Lots 3000 and 1523 Emu Point Drive) (RPS 2015; EPA 2011). The Middleton Beach foreshore reserve may serve as a linkage between these key habitats and it is likely that this recording is representative of an individual traversing from one of these surrounding habitats.

There is limited habitat for native fauna species within the portion of the Middleton Beach foreshore subject to this FMP. Given the substantial extent of coastal habitats available in Albany, and the broader Great Southern region, the risk of a significant impact occurring to any native fauna species as a result of the proposed development of the Middleton Beach foreshore is considered to be low.

### 4.6 Coastal Processes

The potential future vulnerability of the coastline and the subsequent risk to the community, economy and the environment, needs to be considered for the Middleton Beach foreshore area. In particular, temporal changes to the risk profile need to be understood to ensure that appropriate decisions can be made, and steps taken, to respond to this changing risk – particularly in response to potential climate induced change.

Effective management of coastal processes requires assessment of the asset specific risk exposure, identification of risks that require management and development of suitable management practices and adaptation techniques that the management authority considers to be acceptable in response to the present and future risks.

#### 4.6.1 Coastal Hazard Risk Management and Adaption Plan

The CHRMAP assesses the coastal processes potentially affecting the Middleton Beach foreshore environments over a 100 year planning period in accordance with SPP 2.6 requirements (Appendix B; MP Rogers and Associates 2015).

This work has identified the coastal processes allowance line over 25, 50, 75 and 100 year planning increments, to provide an understanding of potential coastal hazard risk over the 100 year planning period (Table 1).

**Table 1: Coastal Processes Summary**

Time Period	S1 – Allowance Severe Storm Erosion (m)	S2 Allowance Historic Shoreline Movement (m)	S3 – Climate Change (m)	Factor of Safety	Total Coastal Processes Allowance
25 years	15	-10	12	5	23
50 years	15	-20	33	10	41
75 years	15	-30	60	15	62
100 years	15	-40	90	20	85

MP Rogers and Associates (2015) identifies that it is possible for the existing foreshore reserve to be impacted by coastal erosion within 50 years. It is almost certain that the Albany Surf Lifesaving Club, Three Anchors restaurant, Flinders Parade Car-park and Middleton Beach Activity Centre will be impacted by coastal erosion after 100 years, should no prior management action(s) be implemented to mitigate this risk (Figure D).

Additionally, MP Rogers and Associates (2015) identifies that it is possible for coastal inundation to impact the existing foreshore reserve over the 100 year timeframe, whilst it is almost certain that the Three Anchors restaurant will also be impacted by coastal inundation over the same planning timeframe.

The potential coastal hazard risk management actions identified by MP Rogers and Associates (2015) to protect the existing foreshore reserve, associated infrastructure and the Middleton Beach Activity Centre were:

1. Accommodate the risk of coastal erosion and inundation by increasing the elevation of the beach.
2. Protect valuable infrastructure with a coastal protection structure.

The long-term coastal processes are considered further in Section 6.0 of this FMP, having regard for proposed community infrastructure and the risk management approach to be employed.

#### 4.7 Land Use History

A review of the historical aerial images reveals that the existing Middleton Beach foreshore reserve, adjacent to the Middleton Beach Activity Centre, has remained consistent in its extent and land use since at least 1954. The construction of the Ellen Cove jetty and early Norfolk pine plantings are visible from 1954 with the construction of the present-day alignment of Flinders Parade, the Albany Surf Lifesaving Club and Three Anchors restaurant occurring between 1961 and 2001.

Within the Middleton Beach Activity Centre, the demolition of the Esplanade Hotel is observable between 2004 and 2007.

## 5.0 Foreshore Design and Function

The Middleton Beach Landscape Management Plan (Appendix D; AECOM 2018) has been completed to ensure the Middleton Beach foreshore provides the required level of amenity for Albany's local and broader communities. In particular, the Landscape Management Plan has also sought to address existing issues that are currently experienced with the foreshore, such as windblown sand and stormwater drainage.

The CoA will be responsible for the implementation of the Landscape Management Plan which is expected cost in the order of \$4.5 million (excl. GST) excluding any contingencies and maintenance.

### 5.1 Design Philosophy

The Landscape Management Plan design philosophy is underpinned by the following key principles:

1. Establish a strong connection to the previous geomorphology and ecological histories of the foreshore and surrounding environments and in this way establish an urban ecology within the foreshore precinct.
2. Where appropriate, create a uniform 'shared public domain' where the distinction between trafficable and pedestrian spaces is only subtly defined.
3. Provide a public domain that responds to the climate conditions of Albany through the provision of shaded and comfortable areas.
4. Ensure that there is seamless integration between interior and exterior spaces, expressed primarily through ground plane materiality, texture, colour and pattern.
5. Ensure that there is a strong connection to the broader Middleton public domain through the connection of view lines and selection of details, material and vegetation.
6. Integrate art work consistent with landscape themes.
7. Provide flush pedestrian oriented surfaces.

### 5.2 Structural Elements

A key component of the Middleton Beach Landscape Management Plan (Appendix D; AECOM 2018) is the protection of the existing foreshore area through the construction of a coastal protection structure. Section 6.5.1 provides further detail on the coastal protection structure, whilst the following Sections 5.2.1 to 5.2.5 provide a high order description of the remaining key structural elements of the foreshore design.

#### 5.2.1 Landscaping Coastal Protection Elements

##### 5.2.1.1 Vegetation Protection

Strategically placed, isolated pockets of suitable planting will enable an additional layer of subsurface strength to the foreshore's edge. Networks of interlaced root systems will provide a subsurface adhesive assisting the rock armour barrier, hardscape and sacrificial sand layer.

##### 5.2.1.2 Surface Treatments

Hardscape surface treatments, including the promenade walkway, provide an additional layer of strength to the coastal protection armoury. Whilst transitioning the grade change from the adjacent activity nodes, landscape wall terracing systems will assist the stabilisation of the foreshore during coastal storm events.

### 5.2.1.3 Retained Levels

Intentionally retaining and protecting the existing, forged ground levels will add further structural stability to the foreshore's edge. The retention of adjacent levels will also provide stability to tree health and assist the vegetative protection component via maintained subsurface root systems.

## 5.2.2 **Drainage and Water Quality**

A high level description of drainage structural controls in the FMP area has been provided below. These elements have been addressed in greater detail in the UWMP for the Middleton Beach Activity Centre (RPS 2017).

### 5.2.2.1 Channel System

Utilising the existing subsurface stormwater infrastructure, the proposed channel system, via the use of a 1,200 millimetre (mm) high concrete box culvert, conceals, stores, and disperses the collective discharge from the existing system's outlets during heavy rain events. Water volumes are initially stored within the culvert system before filtering through a drainage media of limestone rock particles. Stormwater is then dispersed into the groundwater.

### 5.2.2.2 Groundwater

Excess groundwater will be controlled by the proposed channel system via the granite/limestone rock filter media and drainage channel system. Within its current condition, surface water is distributed onto the beach foreshore, causing erosion, hazardous pollutant deposits and potential safety risks to the public. The proposed channel system will remove the risk of pollutant exposure to beachfront users.

### 5.2.2.3 Water Quality

The structural rock armouring and box culvert will retain, filter and redistribute excess ground and surface water into the wider water table system. Strategic planting and existing tree vegetation will benefit from enhanced filtration of groundwater, whilst the augmentation of the vegetative layer will provide further filtration to the groundwater system.

## 5.2.3 **Passive Amenity**

### 5.2.3.1 Promenade Treatments

Varied surface material treatments to the promenade walkway will enhance visual amenity, activate activity and enhance the overall landscape user experience. Utilising a material palette sympathetic to the vernacular surroundings, the promenade will offer a variety of passive and active recreational; usages through consolidated furniture fittings and equipment suite. This suite will integrate concrete and timber surface treatments of the promenade.

### 5.2.3.2 Seating Wall

Seating opportunities will be offered along the western edge of the promenade, allowing for passive surveillance of the surrounding pathways and open spaces. Utilising a selection of concrete and timber, the seating nodes will offer views either side of the promenade, either out to Ellen Cove or back towards the Middleton Beach Activity Centre.

### 5.2.3.3 Tree Retention

The retention and augmentation of the existing tree structure will soften the proposed hardscape treatments, and complement and enhance the user experience the user experience through shade and visual connections to the surrounding landscape and proposed urban tree canopy.

#### 5.2.3.4 Environmental Rehabilitation

Environmental enhancements such as tree structure and coastal re-vegetation and rehabilitation will form a key component of the proposed landscape scheme. These enhancements will assist in coastal protection, water quality, user comfort and visual amenity, but also provide ecological enrichment through the expansion and protection of habitat.

### 5.2.4 **Place Activation**

#### 5.2.4.1 Event Spaces

Proposed open grassed spaces situated along the promenade's western edge will be designed not only to offer opportunities for both passive and active recreation, but also for the facilitation of larger community events. Assisted by the wind and sun protection the existing and enhanced tree structure, activated events spaces will instil a 'strong sense of place' through positive experiences assisted by the optimised landscape surroundings.

#### 5.2.4.2 Active Edge

The promenade edge will encourage a variety of passive and active recreational opportunities. Passive recreation such as picnicking, gathering and seated surveillance will be assisted by strategically placed furniture situated under existing shade trees. Spaces for dynamic activities including jogging, walking and cycling will be offered along the promenade, as well as group fitness activities within the event spaces and activity nodes.

#### 5.2.4.3 Beach

The foreshore enhancements will enable further encouragements of beach side activities such as swimming, volleyball, and picnicking, lending to a more memorable experience for the Albany community and tourists.

### 5.2.5 **Access and Linkages**

#### 5.2.5.1 Pedestrian Access

Within the wider pedestrian circulation network, the promenade walkway will encourage circulation away from Flinders Parade and Marine Drive and redistribute pedestrians into adjacent Middleton Beach urban surroundings. The promenade, in association with further pathways and pedestrian connections, will aid accessibility to all existing adjacent facilities including car parking facilities and the Albany Surf Lifesaving Club.

#### 5.2.5.2 Public Transport

The enhanced pedestrian circulation network will assist the proposed prioritisation of public transport connections the foreshore and surrounding areas. Currently positioned within the northern surface carpark, the prioritised bus stop will distribute users from a wider town loop distribution route. The continuation of the promenade will collect these users, allowing for an uninterrupted approach toward the beach and adjacent activity nodes.

#### 5.2.5.3 Vehicular Circulation

The promenade and collective shared pathway networks will be designed to facilitate vehicular traffic such as maintenance, delivery and emergency vehicles. Adjacent facilities such as the Albany Surf Lifesaving Club will receive operational benefit from enhanced hard paved connections (pedestrian and vehicular), stemming from the Flinders Parade carpark.

## 6.0 Coastal Hazard Risk Management and Adaptation

### 6.1 Coastal Hazard Risk

The CHRMAP assesses the coastal processes potentially affecting the Middleton Beach foreshore environments over a 100-year planning period in accordance with SPP 2.6 requirements (Appendix B; MP Rogers and Associates 2015).

This work identifies coastal hazard vulnerability over 25, 50, 75 and 100 year planning increment to provide an understanding of potential coastal erosion and inundation risk over the 100 year planning period. The projected long term coastal hazard, as measured from the established Horizontal Setback Datum, is summarised as follows:

- 25 years – 23 m
- 50 years – 41 m
- 75 years – 62 m
- 100 years – 85 m.

The projected long term coastal hazard, at each of these interval periods, is illustrated with respect to the FMP area and the Middleton Beach Activity Centre site in Figure D.

#### 6.1.1 Consideration of SPP 2.6

SPP 2.6 incorporates a justifiably conservative methodology to ensure that the siting of future development or assets is cognisant of potential future hazards, even those with a very low likelihood of occurrence. As a result, it is important to understand that the coastal hazard lines provided in MP Rogers and Associates (2015) are not predictions of the future shoreline location. In this regard, the full requirements for maintaining the coastal reserve will need to be informed by ongoing coastal monitoring.

This coastal monitoring will inform both the requirements for the maintenance of the beach in front of the Middleton Beach Activity Centre, as well as the requirements of the ongoing protection of the landscaped foreshore area behind the coastal protection.

### 6.2 Management and Adaptation Planning

SPP 2.6 outlines a hierarchy of risk management measures and adaptation options available in the coastal planning process. There are four broad categories of management/adaptation approaches, generally described as follows:

- Avoid – locating development to avoid coastal hazards and risks. Planned or Managed Retreat – locating low-cost / sacrificial public infrastructure within the physical processes allowance area, which can be removed/demolished as they become at risk of coastal hazards over time.
- Retreat – the relocation or removal of assets within an area identified likely to be subject to intolerable risk of damage from coastal hazards.
- Accommodate – The use of regulatory tools (notifications, easements on title), evacuation plans and/or a variety of physical measures to best accommodate physical processes on privately owned properties.
- Protect – the use of hard infrastructure/physical works (e.g. sea walls, groynes) to defend and protect public/private land from physical processes.

### 6.2.1 Coastal Management Strategy

In consideration of the identified coastal hazard risk, the CoA, as the authority responsible for the current and future management of the Middleton Beach foreshore, has undertaken an assessment of the future requirements for the FMP area. This assessment highlighted that the Middleton Beach foreshore reserve represents a significant community asset within an important coastal precinct within the greater Albany area.

In recognition of these above key factors, the CoA has determined that the significant recreational and amenity values of the foreshore reserve require future protection from the identified coastal erosion and inundation hazards.

Coastal management strategies for the Middleton Beach Activity Centre need to be sensitive to the constraints associated with the development of the foreshore. The significance of the Norfolk Pines and the requirement for them to be retained limits what can be done in terms of increasing the elevation of the foreshore. Furthermore, the requirement for a high aesthetic value and for a continuous access to the beach that isn't interrupted by an emergent and cumbersome coastal protection structure limits the available coastal protection options. The requirement to be able to assist in the management of windblown sand also needs to be considered.

Consistent with the Middleton Beach Coastal Management Strategy (MP Rogers and Associates 2018), the approach proposed in this FMP to protect the foreshore reserve, and Middleton Beach Activity Centre, comprises the following key elements:

- staged construction of an overall coastal protection structure that predominately provides protection against coastal erosion
- increasing the elevation of the foreshore area (where possible) and finished floor levels of new development to minimise the future risk of inundation
- ongoing management of beach levels and windblown sand to prevent significant adverse impacts from windblown sand on the foreshore area
- importing beach nourishment material to replenish the beach if needed in the future.

These management requirements can be spilt into two categories, those that are capital requirements and those that are operational or maintenance requirements. Construction of the coastal protection structure and the increase in the elevation of the foreshore are capital requirements, while the management of the beach and windblown sand and the potential requirement for beach nourishment are both operational or maintenance requirements.

The proposed approach to coastal management responds to potential risks associated with coastal erosion and inundation hazards over at least the next 50 years. Thereafter, a retrofit of the coastal protection could provide protection for the ensuing period. Using this approach the usefulness of the foreshore, and the more intimate relationship with the beach and ocean, is maximised in the short, medium and long term. This approach also provides the necessary level of protection for the proposed development (for the Middleton Beach Activity Centre and the Middleton Beach foreshore) in response to coastal hazard risk.

### 6.3 Consultation with Department of Planning, Lands and Heritage and Department of Transport

The Middleton Beach Coastal Management Strategy (Appendix C; MP Rogers and Associates 2018) was presented to the DPLH and Department of Transport (DoT) in March 2017 for review.

The following comments were received:

- Middleton Beach Coastal Management Strategy should form part of the overall FMP for the Middleton Beach Activity Centre

- FMP was required to be prepared in accordance with and addressing all relevant matters as set out in CoA's LPS No.1, SPP 2.6: State Coastal Planning Policy (WAPC 2013a), State Coastal Planning Policy Guidelines (WAPC 2013b) and inclusive of the key landscape and foreshore enhancement works undertaken for the Middleton Beach Landscape Management Plan (Appendix D; AECOM 2018) and the coastal hazard risk analysis provided in MP Rogers and Associates (2015)
- proposed coastal protection structure will have a design life of approximately fifty years and accommodate fifty year (2065) coastal vulnerability
- design of the proposed coastal protection structure is adequate and will support future augmentation, as required beyond 2065
- inundation diagrams accurately demonstrate that inundation impacts to future hotel site over 100 year planning horizon have been avoided.

The key points to be addressed in the FMP were:

- identification of the party responsible for the coastal protection structure and funding mechanism for their construction, ongoing care, control and maintenance
- inclusion of suitable plans and drawings indicating what augmentation the coastal protection structure will need and what they will look like between 2065 and 2115
- inclusion of an indicative cost and timing of the augmentation works and identification of the party responsible for their implementation
- inclusion of an indicative cost and timing of the future beach nourishment works, identification of the party responsible for their implementation, the amount of sand required for the beach nourishment works and the location where the sand will be reliably sourced from
- inclusion of a detailed coastal monitoring framework for Middleton Beach, in order to determine the actual sediment volumes required to maintain the beach level and coastal protection structure integrity after large storm events
- identification of the portion of Middleton Beach to be subject to the beach nourishment works and determination of the timeframe for the beach nourishment works over the 100 year planning horizon.

The information presented in Section 6.5 (below) addresses the identified key points.

## 6.4 Coastal Inundation Risk Management

To overcome the risk associated with coastal inundation, the elevation of the foreshore area will be increased to minimise the potential for inundation. Nevertheless, this increase in the foreshore elevation is limited by the elevation of the Norfolk Pines. Therefore, proposed development areas, such as the hotel site will be increased to a level beyond what is possible for the foreshore to meet the requirements of SPP 2.6 for inundation.

Whilst this strategy means that the foreshore area will have a higher risk of inundation than would ideally be achieved based on SPP 2.6 requirements, the potential for inundation will still be quite low, with only small areas of the foreshore potentially inundated during the 0.2% Annual Encounter Probability event in 2065.

This is considered to be an acceptable outcome, as short-term inundation of the foreshore area is not expected to result in any significant issues. Furthermore, over the course of the coming half a century, it is anticipated that the foreshore would be upgraded again and such an upgrade would provide an opportunity to further increase the elevation, particularly since the areas surrounding the Norfolk pines may have naturally increased in level, as has been observed historically.

## 6.5 Coastal Erosion Risk Management

Management of the foreshore is required to mitigate the risk of future coastal erosion. The management requirements are twofold. First, there is a requirement to protect the valuable foreshore area from the impacts of erosion – particularly that associated with severe storm erosion. Second, there is the requirement to manage the beach itself so that a recreational beach area can be maintained into the future.

### 6.5.1 Coastal Protection Design

To provide the best outcome for the foreshore area, a concept design for the coastal protection has been prepared that also integrates stormwater drainage infrastructure and a pedestrian promenade. This innovative design approach incorporates a main vertical wall section along the beach that would be part of a stormwater drainage culvert. This culvert would ultimately seek to divert and/or infiltrate stormwater drainage that would otherwise flow over the beach (subject to detailed design).

Additionally, to minimise the height of the main vertical wall, and promote the relationship with the beach, it is proposed that an initial low level promenade be provided along the top of the culvert which would be backed by a seating wall. This seating wall would double as a small wave deflector that would ultimately help to reduce the extent of wave overtopping. Minimisation of the wave overtopping is important, to minimise the potential for damage to the adjacent foreshore and development areas. This will be the critical issue for the design of the coastal protection given the elevation limitations of the foreshore previously discussed.

The coastal protection design would also incorporate a rock revetment portion of the structure which would be buried under the beach and would provide a last line of defence, akin to an insurance policy, against severe storm erosion and beach scour.

A cross section of the proposed coastal protection structure is presented in Figure 2.

The following are the key elements of the coastal protection design that are to be incorporated into the detailed design:

- The foundation level of the culvert must extend sufficiently below the crest elevation of the coastal protection structure to prevent scour of the foundation.
- The toe of the revetment shall be deep enough to prevent undermining during the design event.
- The seating/wave deflector wall shall have an appropriate foundation to prevent overturning if exposed to wave impact.
- The pathway section from the culvert to the seating/wave deflector wall must form a continuous defence against wave action.
- All reinforced concrete products need to meet the durability requirements as outlined in the relevant Australian Standards for the expected design life of the structure.

An added benefit of the proposed coastal protection structure is that the vertical wall adjacent to the beach and the seating wall at the rear of the promenade would both assist in the management of windblown sand from the beach.

The responsibility for the implementation of the staging plan is proposed in the following way:

- The CoA and LandCorp will jointly be responsible for Stage 1 (buried sea wall to 1.1m AHD and drainage culvert installation) to be completed within 5 years. The CoA will be responsible for Stages 2, 3, and 4.
- The CoA and LandCorp will be jointly responsible for the detailed design and project management for construction of Stage 1 works. The CoA will be solely responsible as project manager for construction of future stages as required.
- The CoA and LandCorp will be jointly responsible for any maintenance requirements for a period of 5 years following the Practical Completion of Stage 1 construction. Maintenance costs will be apportioned on the basis of the original funding contribution made by each party.

Preferably, funding could be obtained to complete a large project incorporating Stages 1 to 3 within the next 5 years. This would bring the foreshore to the standard desired to attract a 5 star hotel. It is anticipated that the cost of the coastal protection structure, which would extend along the entire length of the FMP area, would be in the order of \$4.2 million (excl. GST) including contingencies (CoA 2018).

It is not anticipated that any maintenance would be required in the short to medium term, given that it is expected to remain buried. Nevertheless, it may be prudent to allow for maintenance works to be completed after 30 and 40 years in case the wall is exposed. Based on MP Rogers and Associates recent experience with other similar structures, the cost of these maintenance works is estimated to be around 5% of the capital cost per occasion (Appendix F).

## 6.5.2 Future Shoreline Monitoring and Management

### 6.5.2.1 Beach Nourishment Requirements

The Middleton Beach shoreline within Ellen Cove is a modified shoreline. The natural dune system has been removed in this area and an artificially wide flat section of beach has been created. As a result of this modification to the natural beach profile, active management of this area is required to maintain its elevation.

The portion of Middleton Beach shoreline which is currently under active management is identified in Figure D.

It is important to ensure that the elevation of the beach is maintained to:

- Ensure an adequate level of sand cover over the buried revetment wall.
- Minimise the increase in the level of the beach against the vertical wall to prevent significant increases in windblown sand over the initial vertical wall.
- Ensure that the elevation difference between the top of the vertical wall and the beach does not reach a point where the fall is so great that a handrail would be required along the edge of the vertical wall.

It is noted that the above points are conflicted in terms of there being requirements to both increase and decrease the elevation of the beach depending on which aspect is being considered. The corollary of this is that a balanced outcome must be achieved. The future management of the beach will therefore need to maintain the beach elevation within a range that is deemed acceptable.

As part of this ongoing maintenance of the beach level, it is noted that, in the future, there may be the requirement for nourishment of the beach to occur in response to shoreline erosion. Presently, as outlined in MP Rogers and Associates (2015), the shoreline within Ellen Cove and the area to the north has experienced a chronic accretion trend. The CoA has therefore been using beach material from this area to nourish the Emu Point Beach, which has been eroding.

In light of the approval of the Middleton Beach Activity Centre Development, it is recommended that the practice of extracting sand from Ellen Cove for the nourishment of Emu Point be reviewed, as continued extraction may impact the stability of the Ellen Cove shoreline in the medium to long term. This is on the basis that the shoreline is expected to begin to erode in response to sea level rise, so the greater the buffer (i.e. the wider the beach) that can be formed before sea level rise may become more of an issue, the less future management will be required.

### 6.5.2.2 Coastal Monitoring Framework

The requirement for beach nourishment will ultimately be informed by beach monitoring. Beach monitoring is already completed by the CoA on a quarterly basis at selected profiles along the coastal compartment between Middleton Beach and Emu Point. Analysis of this monitoring will enable the early identification of changes in beach widths that can be used to determine when remedial actions may be required. The locations of the CoA's current Middleton Beach monitoring transects are presented in Appendix C.

Nevertheless, the number of beach monitoring transects within Ellen Cove should ideally be increased to monitor the area immediately in front of the Middleton Beach Activity Centre. An additional 4 profiles should be monitored within Ellen Cove, using around 50 m spacing between transects. Ideally, monitoring of these additional profiles should begin prior to the commencement of the foreshore works in order to establish a baseline.

If sand nourishment is to be completed, the nourishment material should be assessed to ensure that it is of sufficient size and character to prevent it being eroded more readily than the native material. The aesthetics of the nourishment material should also be consistent with the natural environment. Placement of the material should also be completed in a manner that ensures minimisation of any losses due to reworking.

With regard to beach nourishment, the extent of nourishment that could be required in the future is impossible to predict with any certainty. The SPP 2.6 assessment methodology provides a justifiably conservative assessment of potential shoreline erosion so that future risks to assets can be avoided and/or managed. However, this is very different to a prediction of future shoreline location. As such, whilst the coastal protection would provide protection to the assets, the requirement for sand nourishment will be informed by the observed shoreline response, together with the CoA's appetite to maintain a beach in this area. Beyond the identification of potential sources for the nourishment (to confirm that they are available) and provision of details regarding monitoring requirements, it is not considered practicable to provide further details with regard to potential sand nourishment at this stage. Any future decision on sand nourishment sources should be made after completion of a multi-criteria assessment that considers the unit cost of the material relative to the overfill factor (an estimate of the volume of nourishment material required to replace a unit of the native beach material) for the respective grain size. Other factors such as material colour and aesthetics should also be considered within the assessment.

### 6.5.2.3 Coastal Protection Structure Augmentation

The future augmentation of the coastal protection structure, beyond 2065, may be required to increase the crest elevation of the structure in order to account for potential sea level rise. It is expected that this increase in the crest elevation would occur in unison with an increase in the elevation of the foreshore. Such an increase may be required to reduce the frequency and severity of inundation beyond 2065 due to rising sea levels. In this regard, the details of the future augmentation of the structure will be intimately linked to the future changes to the foreshore area. As a result, it is considered impractical to provide an augmented design at this stage, as to do so may reduce potential opportunities for future foreshore enhancement. Therefore, rather than being prescriptive in terms of the design of future augmentation, key design element (akin to a performance specification) have been outlined below and should be followed in future design processes to ensure that adequate future protection of the foreshore is achieved.

The design of future coastal protection structures must achieve the following:

- Provide inundation protection for the foreshore area to achieve a level of risk mitigation that is acceptable to the CoA.
- Review the current and potential future exposure of the foreshore to severe storm erosion and ensure that the design adequately accounts for potential changes in the shoreline profile.
- Ensure the design wave conditions used for the coastal protection structure design considers the impacts of sea level rise and changes to the beach profile over the expected design life of the structure.
- Use the design wave height and water level in the design of all elements of the coastal protection (rock armour, filter layers, vertical walling, etc.).
- Ensure the overtopping levels associated with the structure are suitable to enable all of the proposed uses in the foreshore and to prevent damage to existing and proposed infrastructure.
- Ensure the structure will help to manage issues associated with windblown sand.

Regardless of when the future augmentation of the structure occurs, there will be an ongoing requirement to monitor and maintain the coastal protection structure in perpetuity. Monitoring of the structure would need to include an annual review of the structural condition, noting that this would relate mainly to the vertical wall (culvert) and the small seating/overtopping wall at the rear of the promenade. The focus would be on these areas as the coastal protection structure is likely to remain buried for a significant period of time, meaning that inspections and maintenance would not be required.

Annual inspections would be completed by the CoA, however it may be prudent to allow for one detailed review per decade. It is anticipated that the cost for these inspections would total around \$15,000 (excl. GST) per decade (assume \$1,000 (excl. GST) per annual inspection completed by the CoA and \$5,000 (excl. GST) for each more detailed inspection) (Appendix F). Provision should also be made for maintenance of these emergent structures.

The CoA and LandCorp are jointly responsible for any maintenance requirements for a period of 5 years following the Practical Completion of Stage 1 construction. Maintenance costs will be apportioned on the basis of the original funding contribution made by each party (CoA 2018). Given these structures will be either precast concrete or masonry structures and would be designed to a high standard, it is not anticipated that there would be significant maintenance requirements other than those caused by vandalism. As a result, it is recommended that around \$25,000 (excl. GST) per decade be allowed, noting that this does not account for the effects of vandalism, or works associated with the management and cleaning of drainage infrastructure (Appendix F).

## 7.0 Foreshore Rehabilitation

Rehabilitation of natural dunes and bushland areas within the FMP area will assist in protecting the foreshore from wind and unintended foot traffic erosion. Reinforcing surrounding natural areas with full vegetative cover will not only improve amenity, it will improve potential for habitat to support biodiversity, help guide people to their destinations and assist in controlling weeds to improve ecological values associated with this iconic tourism precinct generally.

### 7.1 Revegetation Strategy

The Revegetation Strategy has been based on the Albany Regional Vegetation Survey (Sandiford and Barrett 2010) and will be implemented by the CoA. The indicative locations to be subject the Revegetation Strategy are presented in Appendix D.

#### 7.1.1 Weed Management

Weed management is an important component for the establishment of native vegetation. However, in some locations weeds are also providing stabilisation functions, and selective management will be required to balance site stability with revegetation. In other sections, weed control will be achieved through herbicide application. Herbicides will be selected for the target species, taking into account the surrounding environment and the constraints this may present. Amongst remnant native vegetation, selective herbicides (i.e. grass or broadleaf-specific) will be favoured over general knockdown herbicides, to keep off-target damage to a minimum. To ensure that off-target damage is minimised, herbicide spraying operators will only be engaged if they:

- are appropriately qualified and licensed in herbicide application
- have demonstrated experience in the ability to identify, and distinguish between, native and weed species
- are familiar with the most appropriate control measures, timing, herbicides, and application rates for the target species.

The approach to controlling the weed species likely to be encountered in the FMP area is provided in Appendix G.

#### 7.1.2 Surface Preparation

Compacted vehicle tracks will be ripped to a depth of approximately 40 centimetres to loosen the soil. This will optimise moisture infiltration rates, and allow for faster and easier root development of planted seedlings.

#### 7.1.3 Revegetation

##### 7.1.3.1 Species Selection

Planting and seeding are the key methods to be employed in the revegetation areas within the FMP area. Selection of appropriate species is the key to reaching a successful outcome for the revegetation works. Revegetation species have been carefully selected based on the existing floristic community type(s), topography and hydrology to ensure species are located in the areas in which they are most likely to survive in both short and long-term. The indicative revegetation sites as shown in Figure J are based upon AECOM's Enhancement Plan (within the Landscape Management Plan – Appendix D).

Revegetation species have been subdivided into 3 areas and 6 subcategories (Figure J):

1. Dunal Revegetation (Beach Herbland / Grassland vegetation association).
  - a. Beach grasses and herbaceous species adopted for the most exposed locations.
  - b. Semi-stable dune colonisers adapted to partially protected areas.

- c. Set back / less-exposed dunal situations and swales.
2. Bushland Revegetation (Jarrah Woodland and Coastal *Banksia ilicifolia*/Peppermint Low Woodland vegetation associations).
  - a. Low growing colonisers adapted to more exposed areas. (Lower slopes).
  - b. Plants of protected well stabilised and vegetated areas. (Upper slopes).
3. Mass Planting.
  - a. Re-established planting areas throughout the parkland requiring higher density planting and irrigation.

The proposed dunal and bushland revegetation species are listed in Appendix H, with the suite of revegetation species used for the mass plantings being derived from the dunal list.

#### 7.1.3.2 Planting Method

Seedlings will be directly planted using planting tubes, which negates the need for repeated bending for excavation of planting holes. Seedlings will be watered before delivery to site on the day of planting to reduce the potential for transplant shock, and provided the soil is moist no other watering is considered necessary.

#### 7.1.4 **Scheduling**

Tube stock used in the revegetation program will be sourced from local accredited nurseries.

Planting will be carried out from May – July when the soil moisture content is high enough for optimum seedling growth, without irrigation, and after the existing weeds have germinated and have been sprayed. Each tube stock will be planted with a plastic guard to prevent rabbits feeding on plant stock and to protect from strong winds. Tube stock will be planted at a density of 1, 2 or 4 plants per m<sup>2</sup> (area and species dependent) for rehabilitation.

Rabbit guards will be used (where required) for tube stock in the revegetation areas.

#### 7.1.5 **Watering**

Some tube stock will be planted with tablets / water crystals during planting to help improve survival rates. The coastal plant species to be used in the revegetation of the foreshore area are typically drought tolerant and therefore it is not anticipated these coastal natives will require irrigation or extensive hand watering.

#### 7.1.6 **Seed Treatment and Direct Seeding**

All seed to be utilised will be pre-treated prior to seeding to break dormancy factors. This will include aerosol smoke treatment, mechanical scarification, or hot water treatment as appropriate to individual species. Seed will then be combined with a bulking agent to facilitate even distribution across the site. Clean yellow sand provides good mixing and distribution properties for this purpose. Hand broadcasting will be the application technique as this will permit even dispersal of all seed sizes, which can be an issue with some types of mechanical spreaders.

#### 7.1.7 **Site and Plant Protection**

All planted seedlings will be initially protected with corflute tree guards held in place with hardwood stakes. Once the plants are large enough to survive without the guards, they will be removed.

A rabbit control program may also be initiated to provide longer term protection to seedlings if required. This will include a combination of warren destruction, rabbit haemorrhagic disease virus release. Pindone baiting is not recommended given domestic pets may be affected by this approach. Virus release will only be undertaken during certain times of year relating to weather and animal growth stages where these treatments are effective. Warren destruction will be employed between these periods.

A proportion of the revegetation works will be undertaken on current access tracks. These tracks are to be blocked at both ends using immovable objects like logs and boulders to prevent future access in these areas. Some tracks will be left open and fenced where necessary to allow access through the area, discouraging users from creating new access tracks. Where erosion is limited temporary protective fencing will not be placed around the revegetation areas as they are already deemed to be suitably protected thus minimising visual impact.

### 7.1.8 Post Instalment Management

To ensure longer-term project success, the site will be monitored and maintained by local coast care groups following initial installation, to ensure the completion targets are met and will continue to be met in the future.

#### 7.1.8.1 Completion Criteria and Success Targets

The key actions / target completion criteria to monitor the success of the revegetation efforts are specified in Table 2. Revegetation efforts will be undertaken and monitored for a period of two years from the commencement of the revegetation plantings. If the completion criteria are not met, further action will be undertaken to improve the condition to the required standards.

**Table 2: Revegetation and Weed Management Key Actions**

Year After Planting	Year 1	Year 2
Survival of planted seedlings	75%	90%
Minimum plant diversity (% of original number of planted species in project area that have survived)	70%	70%
Plant coverage (% area of visual ground cover measured by a botanist/revegetation consultant)	25%	50%
Weeds coverage	20% cover	10% cover

#### 7.1.8.2 Vegetation Monitoring and Performance Criteria

At the end of the installation, a report will be provided detailing the actual quantities of seedlings installed and seed broadcast, and any variations from the original revegetation plan. This will be used as baseline data for comparison in future monitoring assessments.

The revegetation areas will be formally monitored biannually (includes weed monitoring) each spring and autumn, for a two year period after installation. A monitoring report will be prepared by / provided to the CoA following each formal monitoring event, to assess if there are any issues requiring attention. The season has been nominated rather than a specific month, as the timing of these assessments should be related to plant growth cycles, which in turn is influenced by the weather conditions at the time.

One monitoring plot of 5 m x 5 m will be established per revegetation area as well as one permanent photograph reference point at each monitoring plot. Photographic records will be captured prior to construction and annually to qualitatively assess density, diversity and weed cover. The first assessment in spring will assess the developing threats, the stabilisation of each area and the short-term survival of the seedlings and weed cover. Any problems will be identified early so that comprehensive treatment(s) of the issue can be undertaken and additional seedlings propagated if required. The second assessment in the following autumn will determine if there are any losses over the dry summer period, and this will form the basis for the maintenance winter program. The first summer is the expected period of greatest mortality, and plants that survive this period are generally hardy and more likely to survive in the longer term. The emergence of summer weeds will also be assessed, so that control can be scheduled as required.

After the third and subsequent assessments, the long term success of the revegetation operation will be indicated. This will determine whether any further remedial works are required. This may include:

- additional revegetation works
- weed management
- other general maintenance activities
- additional monitoring requirements.

Informal assessments will also be undertaken between formal assessments. The purpose of these assessments is to visually monitor progress, and to identify and counter emerging issues before they have a chance to become significant. Timing of the assessments will be adjusted to the appropriate stages of plant growth, which are influenced by annual weather conditions. The results of each monitoring assessment will be compared to determine germination and establishment rates and provide a quantitative measure of progress. The final monitoring inspection will be held to certify that the completion criteria have been met.

### 7.1.9 Site Maintenance

If planting success falls below 90% of original numbers in two consecutive monitoring events, contingency measures will be implemented to increase the success of the revegetation program. The monitoring program will identify issues to any plant success rates so they can be dealt with in an appropriate and timely manner.

Maintenance activities may include:

- re-brushing
- ongoing weed management
- re-planting in areas
- tree guard repair / replacement
- undertake fence, sign and pathway maintenance (as required).

All the contingency measures listed in Table 3 will be reviewed if the target completion criteria fall below 90% in two consecutive events.

**Table 3: Revegetation and Weed Management Contingency Measures**

Item	Issue	Contingency Action
Plants	Plant death, Storm/wind damage Vandalism	Plant additional tube stock in subsequent plantings.
Weeds	Excessive weeds in revegetation areas	Undertake weed control measures. e.g. weed spraying.
Erosion	Erosion, Storm damage	Apply brushing, hydromulch (with no seed) and/or matting over the surface of any eroded areas.
Revegetation Success	Plant survival does not meet completion criteria	Replant seedlings and replace plant guards.

## 7.2 Drainage

Drainage management is important to protect infrastructure, prevent erosion, protect rehabilitation and prevent the spread of weeds. In particular, design for stormwater management is a critical factor in protecting dune vegetation and coastal infrastructure. Water sensitive design measures focus on the effective and improved management of drainage of stormwater from paths, car parks, hardstand areas around building and roadsides.

Drainage design elements considered in design for redevelopment of the foreshore are based on principles including:

- use of Water Sensitive Urban Design (WSUD) elements to support local infiltration and recharge as well as slowing the flow of stormwater
- use of bio-filtration areas to assist erosion control, maintain soil infiltration, restrict water flows and remove particulate and soluble pollutants.

These principles have been addressed in greater detail in the UWMP for the Middleton Beach Activity Centre (RPS 2017).

## 8.0 Implementation and Responsibility

Life cycle/asset management indicative cost estimate for the works proposed in this FMP have been provided in Appendix F, whilst Appendix I indicates the spatial extent of the various maintenance elements.

### 8.1 Implementation

LandCorp will contribute \$1.15 million (excl. GST) towards the Middleton Beach Activity Centre coastal infrastructure.

In February 2018, the CoA resolved the following in regards to the funding and implementation of the Middleton Beach Activity Centre coastal infrastructure (Appendix A):

- that the CoA will undertake works in timed stages to protect the Middleton Beach Foreshore, associated infrastructure and the Middleton Beach Activity Centre. The staging plan shows
  - > Stage 1 - Construction of buried sea wall and culvert within 5 years
  - > Stage 2 - Construction of promenade and seating/deflection wall within 10 years
  - > Stage 3 - Construction of foreshore improvements within 25 years
  - > Stage 4 - Assessment and possible construction of coastal protection additions after 50 years
- that the CoA will accept the funding contribution from LandCorp for the purpose of implementing the works required in the Middleton Beach Activity Centre FMP - Adaptation Plan
- the CoA will seek State and Federal funds to complete works on the Middleton Beach Foreshore
- the CoA will approve the advertisement of the completed Draft Middleton Beach Activity Centre FMP (which includes the agreed Adaptation Plan) for the purpose of public consultation (CoA 2018).

An implementation schedule, which includes management responsibilities and detailed cost estimation for this FMP is provided in Table 4. The timing for the implementation of the FMP will be dependent upon when the external government funding is realised, however it is anticipated that the foreshore works will be completed prior to 2028.

### Responsibility

The responsibility for the implementation of the staging plan has been agreed between the CoA and LandCorp:

- The CoA and LandCorp will jointly be responsible for Stage 1 (buried sea wall to 1.1m AHD and drainage culvert installation) to be completed within 5 years. The CoA will be responsible for Stages 2, 3, and 4.
- The CoA and LandCorp will be jointly responsible for the detailed design and project management for construction of Stage 1 works. The CoA will be solely responsible as project manager for construction of future stages as required.
- The CoA and LandCorp will be jointly responsible for any maintenance requirements for a period of 5 years following the Practical Completion of Stage 1 construction. Maintenance costs will be apportioned on the basis of the original funding contribution made by each party.

It is anticipated that the cost of the coastal protection structure, which would extend along the entire length of the FMP area, would be in the order of \$4.2 million (excl. GST) including contingencies.

The CoA will be responsible for the implementation of the Middleton Beach Foreshore Landscape Management Plan (Appendix D; AECOM 2018), which is expected to cost in the order of \$4.5 million (excl. GST) excluding any contingencies and maintenance.

With the exception of the \$1.15 million (excl. GST) contributed by LandCorp towards the construction of the coastal protection structure, the remaining FMP budget (approximately \$7.6 million [excl. GST]) is planned to be sourced from State and Commonwealth Governments.

Should the additional \$3.08 million (excl. GST) of funding not be forthcoming by 2048 to complete the coastal protection structure, LandCorp proposes to utilise the \$1.15 million to construct an appropriate structure to protect the hotel lot within the Middleton Beach Activity Centre site as shown in Figure K - Esplanade Hotel Sea Wall Structure.

**Table 4: Implementation Schedule**

Objective / Parameter	Description	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Responsibility
<b>Legislation and Policy Context</b>					
Comply with the purpose of the reserve under the LPS No. 1		<ul style="list-style-type: none"> <li>■ Preparation of a detailed FMP that reflects the following objectives               <ul style="list-style-type: none"> <li>&gt; The approved Middleton Beach Activity Centre.</li> <li>&gt; The requirements under Schedule 4 – Special Uses Zones of LPS No. 1.</li> <li>&gt; Objectives of the “Parks and Recreation” Reserve under the LPS No. 1.</li> <li>&gt; Development Applications to demonstrate design life of the Middleton Beach Landscape Management Plan’s key assets.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ Installation approved Middleton Beach Landscape Management Plan key assets in accordance with approved Development Applications.</li> <li>■ Implement UWMP actions, where applicable to FMP area, and Revegetation Strategy.</li> </ul>	<ul style="list-style-type: none"> <li>■ Monitoring and reporting on Revegetation Strategy.</li> <li>■ Review integrity of Middleton Beach Landscape Management Plan key assets as per the Development Application approval.</li> <li>■ Implement CHRMAP.</li> </ul>	CoA, LandCorp*
Comply with the objectives and requirements of SPP2.6		<ul style="list-style-type: none"> <li>■ Preparation of a detailed FMP that reflects the CHRMAP and requirements of the requirements of the State Coastal Policy, SPP2.6.</li> <li>■ Development Applications to demonstrate design life of the Middleton Beach Landscape Management Plan’s key assets.</li> </ul>	<ul style="list-style-type: none"> <li>■ Installation approved Middleton Beach Landscape Management Plan key assets in accordance with approved Development Applications.</li> <li>■ Implement Revegetation Strategy.</li> </ul>	<ul style="list-style-type: none"> <li>■ Monitoring and reporting on Revegetation Strategy.</li> <li>■ Review integrity of Middleton Beach Landscape Management Plan key assets as per the Development Application approval.</li> <li>■ Implement requirements of the CHRMAP / FMP inclusive of the following elements               <ul style="list-style-type: none"> <li>&gt; Construction of the Coastal Protection Structure.</li> <li>&gt; CoA to review the practice of extracting sand from Ellen Cove for the nourishment of Emu Point.</li> </ul> </li> </ul>	CoA, LandCorp*

Objective / Parameter	Description	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Responsibility
				<ul style="list-style-type: none"> <li>&gt; CoA to continue with the current Middleton Beach monitoring program and increase the monitoring transects in Ellen Cove.</li> <li>&gt; CoA's abridged Middleton Beach monitoring program to inform the requirement for beach nourishment.</li> <li>&gt; Ongoing monitoring and maintenance of the coastal protection structure.</li> <li>&gt; A review, and update if required, to this CHRMAP should be completed on approximately five yearly intervals.</li> </ul>	
<b>Middleton Beach Landscape Management Plan</b>					
Support public recreational uses of the foreshore	<ul style="list-style-type: none"> <li>■ Improve public facilities and recreational amenity.</li> <li>■ Provide facilities to support public recreational uses for all ages.</li> <li>■ Provide for safe visitor experiences.</li> </ul>	<ul style="list-style-type: none"> <li>■ Master planning and detailed design stages will ensure design for a range of recreational activities including zones for active sports and play, event spaces, beach promenades and lookouts, picnic and barbecue areas, and facilities for beach users.</li> <li>■ Development Applications to demonstrate design life of the Middleton Beach Landscape Management Plan's key assets.</li> <li>■ Civil engineer to implement Construction Management Measures to the satisfaction of the CoA.</li> <li>■ Construction fencing of the foreshore subject to the engineering works areas.</li> <li>■ Signage to ensure pedestrians are warned not to enter the construction areas.</li> </ul>	Installation approved Middleton Beach Landscape Management Plan key assets in accordance with approved Development Applications.	<ul style="list-style-type: none"> <li>■ Ensure that construction fencing and signs are removed.</li> <li>■ Undertaken beach monitoring in accordance with this FMP.</li> <li>■ Update the CHRMAP (MP Rogers and Associates 2015) every five years, inclusive of a reassessment of the coastal risks.</li> </ul>	CoA

Objective / Parameter	Description	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Responsibility
Access management	<ul style="list-style-type: none"> <li>■ Provide safe, user friendly and controlled access to and across the foreshore.</li> <li>■ Provide appropriate signage in accordance with CoA requirements.</li> </ul>	<ul style="list-style-type: none"> <li>■ Establish safe beach access pathways to the beach for the duration of the construction period. The access pathways are to be focused on using existing cleared tracks.</li> <li>■ Development Applications to demonstrate design life of the Middleton Beach Landscape Management Plan's key assets.</li> <li>■ Civil engineer to implement Construction Management Measures to the satisfaction of the CoA.</li> <li>■ Construction fencing around the area subject to the engineering works.</li> <li>■ Signage to ensure pedestrians are warned not to enter the construction area.</li> </ul>	<ul style="list-style-type: none"> <li>■ Installation approved Middleton Beach Landscape Management Plan key assets in accordance with approved Development Applications.</li> <li>■ Regularly inspect signage. Replace signage if vandalised or removed.</li> <li>■ Place appropriate signs at key beach access points.</li> </ul>	<ul style="list-style-type: none"> <li>■ Ensure that construction fencing and signs are removed.</li> <li>■ Update the CHRMAP every five years, inclusive of a reassessment of the coastal risks.</li> </ul>	CoA
<b>Coastal Processes</b>					
Coastal hazards	Design redevelopment so assets are not at risk of coastal hazards over their design life.	The CHRMAP assesses the risks to coastal assets from coastal hazards and proposes suitable management responses. This FMP has been developed in accordance with the CHRMAP.	Installation approved Middleton Beach Landscape Management Plan key assets in accordance with approved Development Applications.	<ul style="list-style-type: none"> <li>■ Implement requirements of the CHRMAP / FMP inclusive of the following elements                             <ul style="list-style-type: none"> <li>&gt; Construction of the Coastal Protection Structure.</li> <li>&gt; CoA to review the practice of extracting sand from Ellen Cove for the nourishment of Emu Point.</li> <li>&gt; CoA to continue with the current Middleton Beach monitoring program and increase the monitoring transects in Ellen Cove.</li> </ul> </li> </ul>	CoA, LandCorp

Objective / Parameter	Description	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Responsibility
				<ul style="list-style-type: none"> <li>&gt; CoA's abridged Middleton Beach monitoring program to inform the requirement for beach nourishment.</li> <li>&gt; Ongoing monitoring and maintenance of the coastal protection structure.</li> <li>■ A review, and update if required, to this CHRMAP should be completed on approximately five yearly intervals.</li> <li>■ Apply a proposed staged plan for the implementation of the Coastal Protection Structure (CoA 2018)                             <ul style="list-style-type: none"> <li>&gt; Stage 1 - Construction of buried sea wall and culvert within 5 years</li> <li>&gt; Stage 2 - Construction of promenade and seating/deflection wall within 10 years</li> <li>&gt; Stage 3 - Construction of foreshore improvements within 25 years</li> <li>&gt; Stage 4 - Assessment and possible construction of coastal protection additions after 50 years.</li> </ul> </li> </ul>	<p>CoA, LandCorp</p> <p>CoA</p> <p>CoA</p> <p>CoA</p>

Objective / Parameter	Description	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Responsibility
Stabilisation and erosion control	Stabilisation of foreshore areas requiring restoration to limit wind-blown sand and degradation of the foreshore area.	<ul style="list-style-type: none"> <li>Establish rehabilitation and weed management areas in the FMP area to inform the preparation of the Revegetation Strategy.</li> <li>Establish safe beach access pathways to the beach for the duration of the construction period. The access pathways are to be focused on using existing cleared tracks.</li> </ul>	<ul style="list-style-type: none"> <li>Installation approved Middleton Beach Landscape Management Plan key assets in accordance with approved Development Applications.</li> <li>Revegetation will be undertaken as detailed in the Revegetation Strategy.</li> </ul>	<ul style="list-style-type: none"> <li>CoA to continue with the current Middleton Beach monitoring program and increase the monitoring transects in Ellen Cove.</li> <li>CoA's abridged Middleton Beach monitoring program to inform the requirement for beach nourishment.</li> <li>Ongoing monitoring and maintenance of the coastal protection structure.</li> <li>Update the CHRMAP (MP Rogers and Associates 2015) every five years inclusive of a reassessment of the coastal risks.</li> <li>Revegetation and monitoring will be undertaken as detailed in the Revegetation Strategy.</li> </ul>	CoA
<b>Vegetation Management</b>					
Revegetation	Restore vegetation condition in defined areas of foreshore.	<ul style="list-style-type: none"> <li>Map the revegetation and weed management areas.</li> </ul>	Revegetation will be undertaken as detailed in the Revegetation Strategy.	Revegetation and monitoring will be undertaken as detailed in the Revegetation Strategy	CoA
Weed management	Manage the introduction, spread and concentration of weed species.	<ul style="list-style-type: none"> <li>Weed management will be undertaken as part of revegetation activities.</li> </ul>	Weed management will be detailed in the Revegetation Strategy.	Revegetation and weed monitoring will be undertaken as detailed in the Revegetation Strategy.	CoA

\*LandCorp has provided assistance to the CoA in preparing this FMP.

## 9.0 References

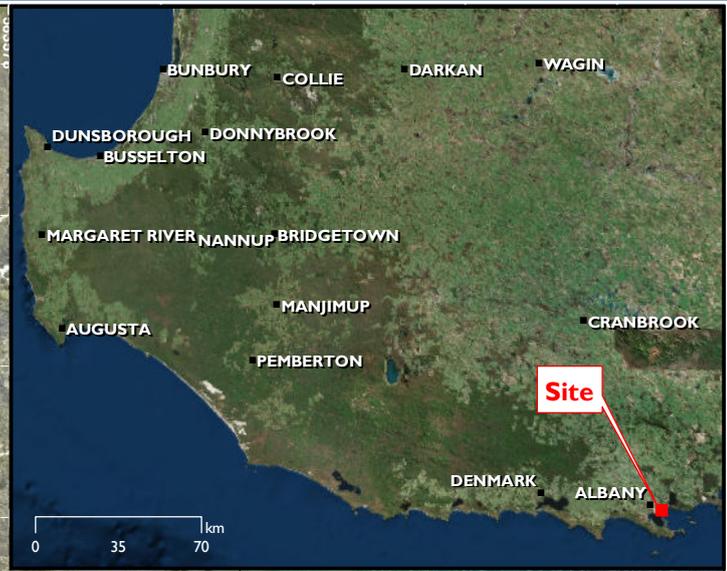
- AECOM. 2018. Middleton Beach Landscape Management Plan. Report prepared for LandCorp, Great Southern Development Commission and the City of Albany.
- Birdlife Australia. 2016. Seabird surprises off the Kimberley Coast. Accessed 06 June 2017 <http://www.birdlife.org.au/australian-birdlife/detail/north-west-frontier>
- City of Albany. 2010a. Activity Centres Planning Strategy. Accessed 01 June 2017 <http://albany.wa.gov.au/residents/building-planning/planning-strategies/>
- City of Albany. 2010b. Council Management Plan, Middleton Beach (Including Emu Point Foreshore). Albany: Western Australia.
- City of Albany 2017. Ordinary Council Meeting, Middleton Beach Foreshore - Foreshore Management Plan. Albany, Western Australia.
- City of Albany 2018. Foreshore Management Plan for Middleton Beach - Council Resolution. Albany, Western Australia,
- Department of Planning, Lands and Heritage. 2014. City of Albany, Local Planning Scheme No. 1. Accessed 01 June 2017 [https://www.planning.wa.gov.au/LPS/DATA/Local%20Planning%20Schemes/Albany%20-%20City%20of%20\(Scheme%201\)/Scheme%20Text.pdf](https://www.planning.wa.gov.au/LPS/DATA/Local%20Planning%20Schemes/Albany%20-%20City%20of%20(Scheme%201)/Scheme%20Text.pdf)
- Department of Water. 2017. Hydrogeological Atlas. Accessed 07 June 2017 <http://atlases.water.wa.gov.au/idelve/hydroatlas/>.
- Environmental Protection Authority. 2011. Residential Subdivision Lots 3000 (Formerly Lot 1512) and 1523 Emu Point Drive, Albany. Accessed 06 June 2017 [http://www.epa.wa.gov.au/sites/default/files/EPA\\_Report/Rep%201392%20Emu%20Point%20PER%2018411.pdf](http://www.epa.wa.gov.au/sites/default/files/EPA_Report/Rep%201392%20Emu%20Point%20PER%2018411.pdf)
- Environmental Protection Authority. 2017. Albany Regional Vegetation Survey: Extent, type and status. Accessed 02 June 2017 <http://www.epa.wa.gov.au/albany-regional-vegetation-survey-extent-type-and-status>
- Golder Associates. 2015. Geotechnical Investigation, Preliminary acid sulfate soils investigation and dewatering investigation, Middleton Beach Activity Centre, Marine Terrace, Albany. Golder Associates. Perth, Western Australia.
- Gozzard, J.R. 1989. Albany 1989 Environmental Geology Map. Geological Survey of Western Australia.
- Greenskills. 2013. Study of Coastal Values and Character, Emu Point to Middleton Beach, September 2013. Report prepared for the City of Albany
- LandCorp. 2016. Middleton Beach Activity Centre Structure Plan. Accessed 01 June 2017 [http://www.landcorp.com.au/Documents/Projects/Regional%20Commercial/Middleton%20Beach%20Albany/1.%20Middleton%20Beach%20Activity%20Centre%20Structure%20Plan%20document%202016\\_reduced.pdf](http://www.landcorp.com.au/Documents/Projects/Regional%20Commercial/Middleton%20Beach%20Albany/1.%20Middleton%20Beach%20Activity%20Centre%20Structure%20Plan%20document%202016_reduced.pdf)
- MP Rogers and Associates. 2015. Middleton Beach Activity Centre, Coastal Hazard Risk Management and Adaptation Plan. Report prepared for LandCorp.
- MP Rogers and Associates. 2018a. Middleton Beach Activity Centre, Coastal Management Strategy. Report prepared for LandCorp.

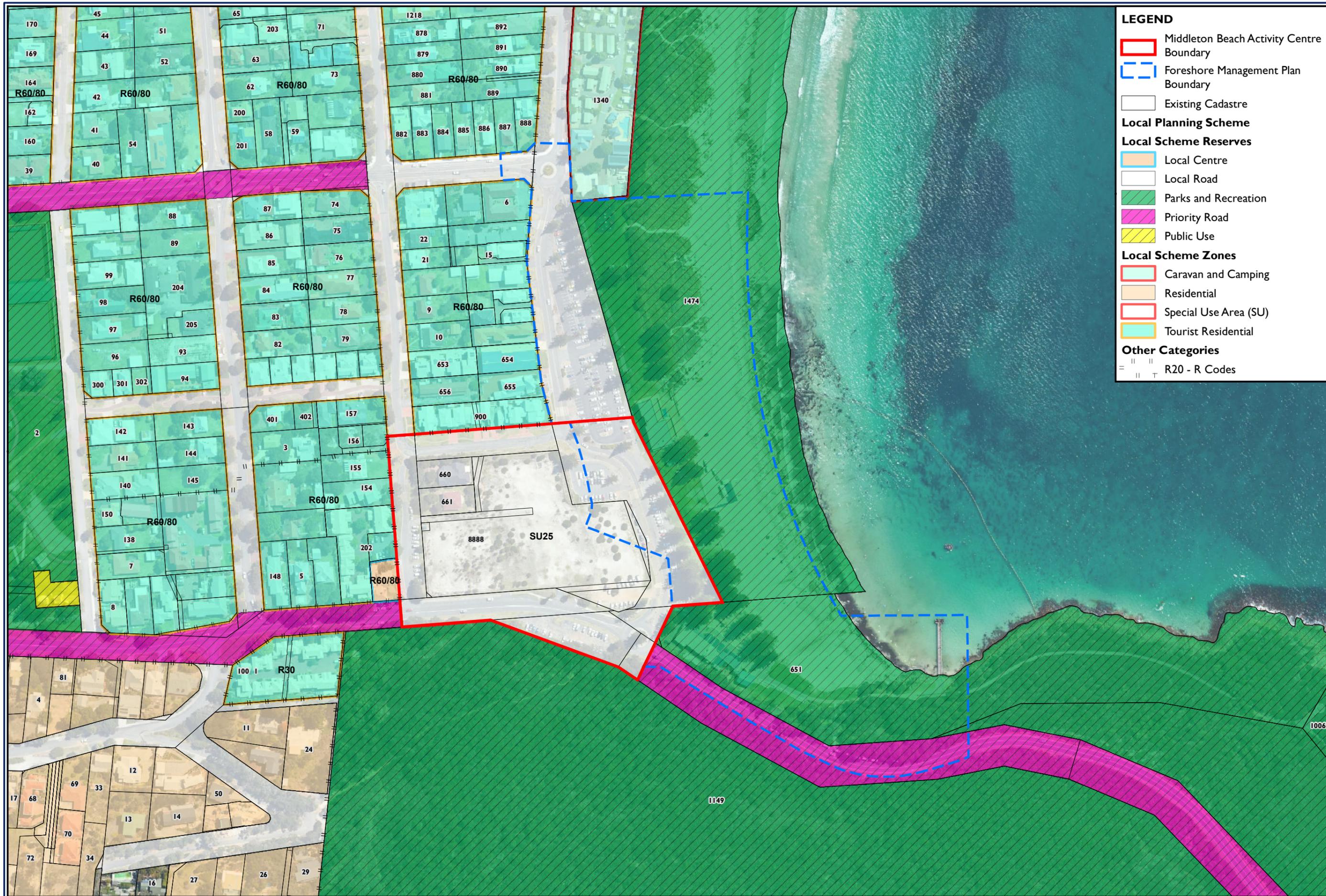
- MP Rogers and Associates. 2017b. Inputs to the Middleton Beach Foreshore Management Plan. Report Prepared for RPS.
- RPS. 2015. Flora and Vegetation and Fauna Review, Middleton Beach Activity Centre, Albany. Report prepared for LandCorp.
- RPS. 2017. Urban Water Management Plan, Middleton Beach Activity Centre, Albany. Report prepared for LandCorp.
- Sandiford, E.M. and S. Barrett. Albany Regional Vegetation Survey, Extent, Type and Status. Kensington: Perth.
- Western Australian Planning Commission. 2006. State Planning Policy 2.9, Water Resources. Accessed 01 June 2017 <https://www.planning.wa.gov.au/publications/742.aspx>
- Western Australian Planning Commission. 2013a. State Planning Policy No. 2.6, State Coastal Planning Policy. Accessed 01 June 2017 [https://www.planning.wa.gov.au/dop\\_pub\\_pdf/SPP2.6\\_Policy.pdf](https://www.planning.wa.gov.au/dop_pub_pdf/SPP2.6_Policy.pdf)
- Western Australian Planning Commission. 2013a. State Coastal Planning Policy Guidelines. Accessed 08 June 2017 [https://www.planning.wa.gov.au/dop\\_pub\\_pdf/State\\_Planning\\_Policy\\_No\\_\\_2\\_6\\_State\\_Coastal\\_Planning\\_Policy\\_Guidelines.pdf](https://www.planning.wa.gov.au/dop_pub_pdf/State_Planning_Policy_No__2_6_State_Coastal_Planning_Policy_Guidelines.pdf)
- Western Australian Planning Commission. 2014. *Coastal Hazard Risk Management and Adaption Planning Guidelines*. Accessed 08 June 2017 [https://www.planning.wa.gov.au/dop\\_pub\\_pdf/CHRMAP\\_Guidelines.pdf](https://www.planning.wa.gov.au/dop_pub_pdf/CHRMAP_Guidelines.pdf)
- Western Australian Planning Commission. 2015. State Planning Policy 3.7, Planning in Bushfire Prone Areas. Accessed 01 June 2017 [https://www.planning.wa.gov.au/dop\\_pub\\_pdf/SPP\\_3.7\\_Planning\\_in\\_Bushfire\\_Prone\\_Areas.pdf](https://www.planning.wa.gov.au/dop_pub_pdf/SPP_3.7_Planning_in_Bushfire_Prone_Areas.pdf)

# Figures

**LEGEND**

- Middleton Beach Activity Centre Boundary
- Foreshore Management Plan Boundary
- Cadastre





**LEGEND**

- Middleton Beach Activity Centre Boundary
- Foreshore Management Plan Boundary
- Existing Cadastre

**Local Planning Scheme**

**Local Scheme Reserves**

- Local Centre
- Local Road
- Parks and Recreation
- Priority Road
- Public Use

**Local Scheme Zones**

- Caravan and Camping
- Residential
- Special Use Area (SU)
- Tourist Residential

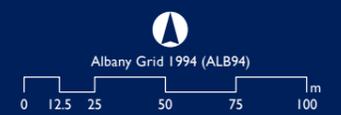
**Other Categories**

- R20 - R Codes

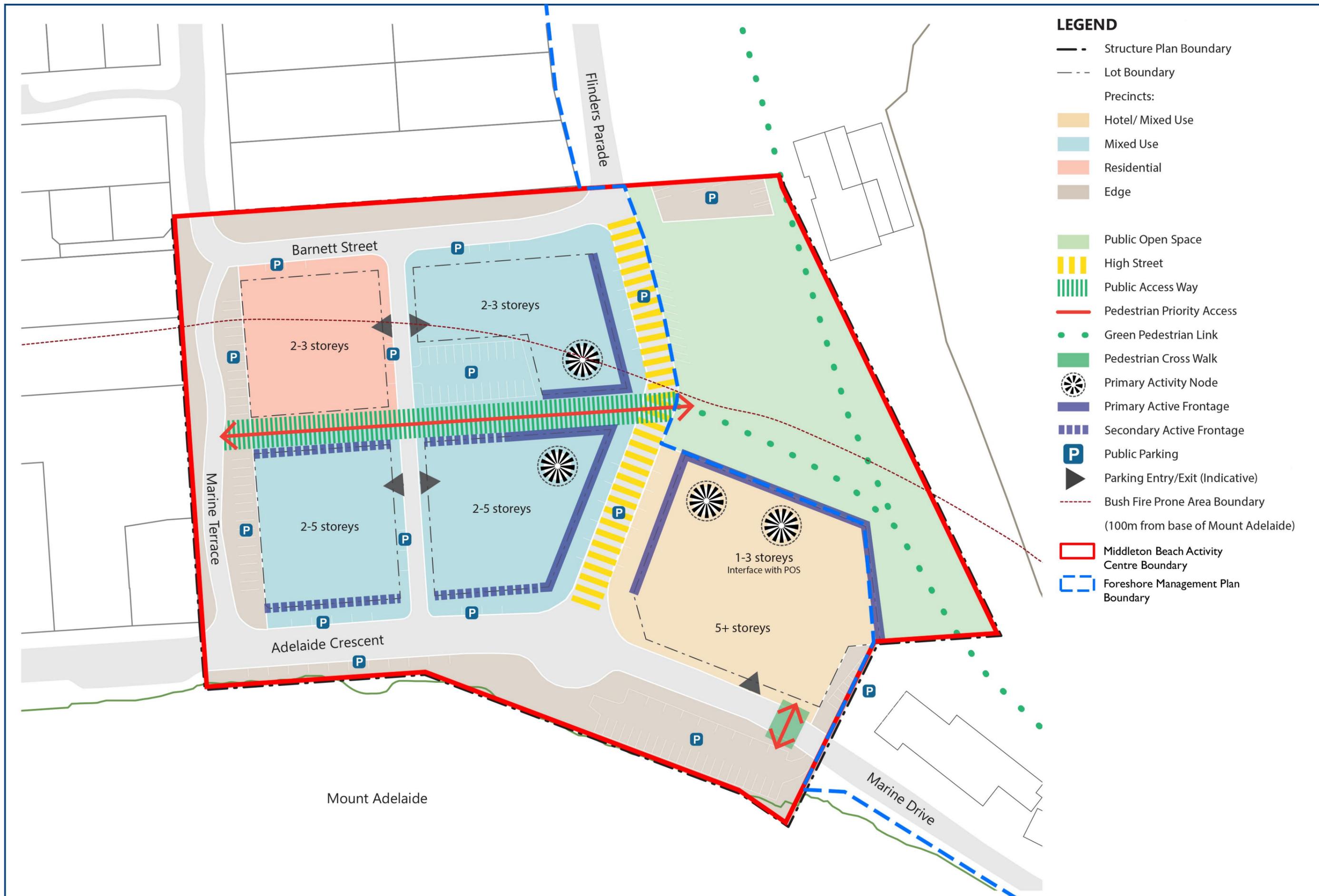
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 Doc Number: 002  
 Date: 15.03.18  
 Scale: 1:2,500 @ A3  
 Created by: MA



Source: Local Planning Scheme No.1, City of Albany Cadastre - Landgate, 2017 Aerial - Landgate, 2017



**Figure B**  
**City of Albany**  
**Local Planning Scheme No 1**



- LEGEND**
- - Structure Plan Boundary
  - - - Lot Boundary
  - Precincts:
  - Hotel/ Mixed Use
  - Mixed Use
  - Residential
  - Edge
  - Public Open Space
  - High Street
  - Public Access Way
  - Pedestrian Priority Access
  - Green Pedestrian Link
  - Pedestrian Cross Walk
  - Primary Activity Node
  - Primary Active Frontage
  - Secondary Active Frontage
  - Public Parking
  - Parking Entry/Exit (Indicative)
  - Bush Fire Prone Area Boundary (100m from base of Mount Adelaide)
  - Middleton Beach Activity Centre Boundary
  - Foreshore Management Plan Boundary





**LEGEND**

- Middleton Beach Activity Centre Boundary
- Foreshore Management Plan Boundary
- Cadastre

**Coastal Vulnerability**

- Current Horizontal Setback Datum (HSD)
- 25YR Vulnerability
- 50YR Vulnerability
- 75YR Vulnerability
- 100YR Vulnerability

Managed Section of Beach

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Job Number: L15141.006-FMP  
 Doc Number: 004  
 Date: 15.03.18  
 Scale: 1:1,000 @ A3  
 Created by: MA  
 Source: Coastal Hazard Mapping - MP Rogers 16.10.2015 Cadastre - Landgate, 2017 Aerial - Landgate, 2017

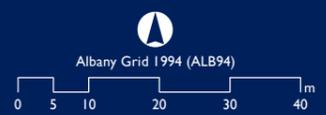


Figure D

Coastal Hazard Assessment



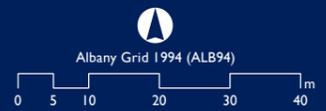
**LEGEND**

- Topographic Contours (mAHD)
- Foreshore Management Plan Boundary
- Middleton Beach Activity Centre Boundary
- Cadastre

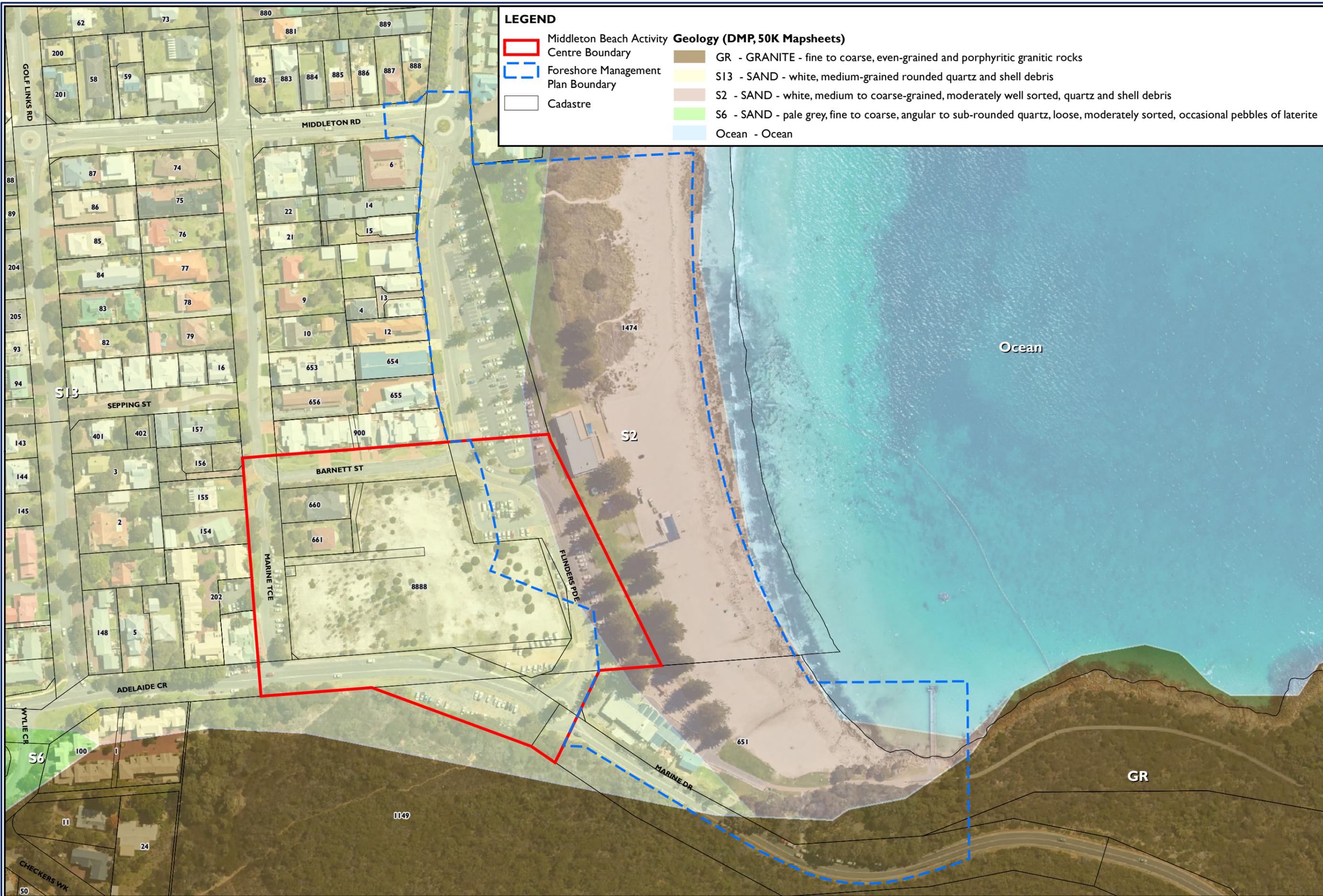
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**RPS**

Job Number: L15141.006  
 Doc Number: 006  
 Date: 15.03.18  
 Scale: 1:1,000 @ A3  
 Created by: MA  
 Source: Cadastre - Landgate, 2017 Aerial - Landgate, 2017 Topo - Harley Dykstra Dwg No: 20453-01A, 13.04.15



**Figure E**  
**Topography**



**LEGEND**

- Middleton Beach Activity Centre Boundary
- Foreshore Management Plan Boundary
- Cadastre

**Geology (DMP, 50K Mapsheets)**

- GR - GRANITE - fine to coarse, even-grained and porphyritic granitic rocks
- S13 - SAND - white, medium-grained rounded quartz and shell debris
- S2 - SAND - white, medium to coarse-grained, moderately well sorted, quartz and shell debris
- S6 - SAND - pale grey, fine to coarse, angular to sub-rounded quartz, loose, moderately sorted, occasional pebbles of laterite
- Ocean - Ocean



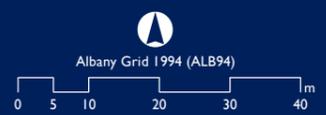
**LEGEND**

- Borehole
- ◆ Monitoring Bore
- Middleton Beach Activity Centre Boundary
- Foreshore Management Plan Boundary
- Cadastre

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**RPS**

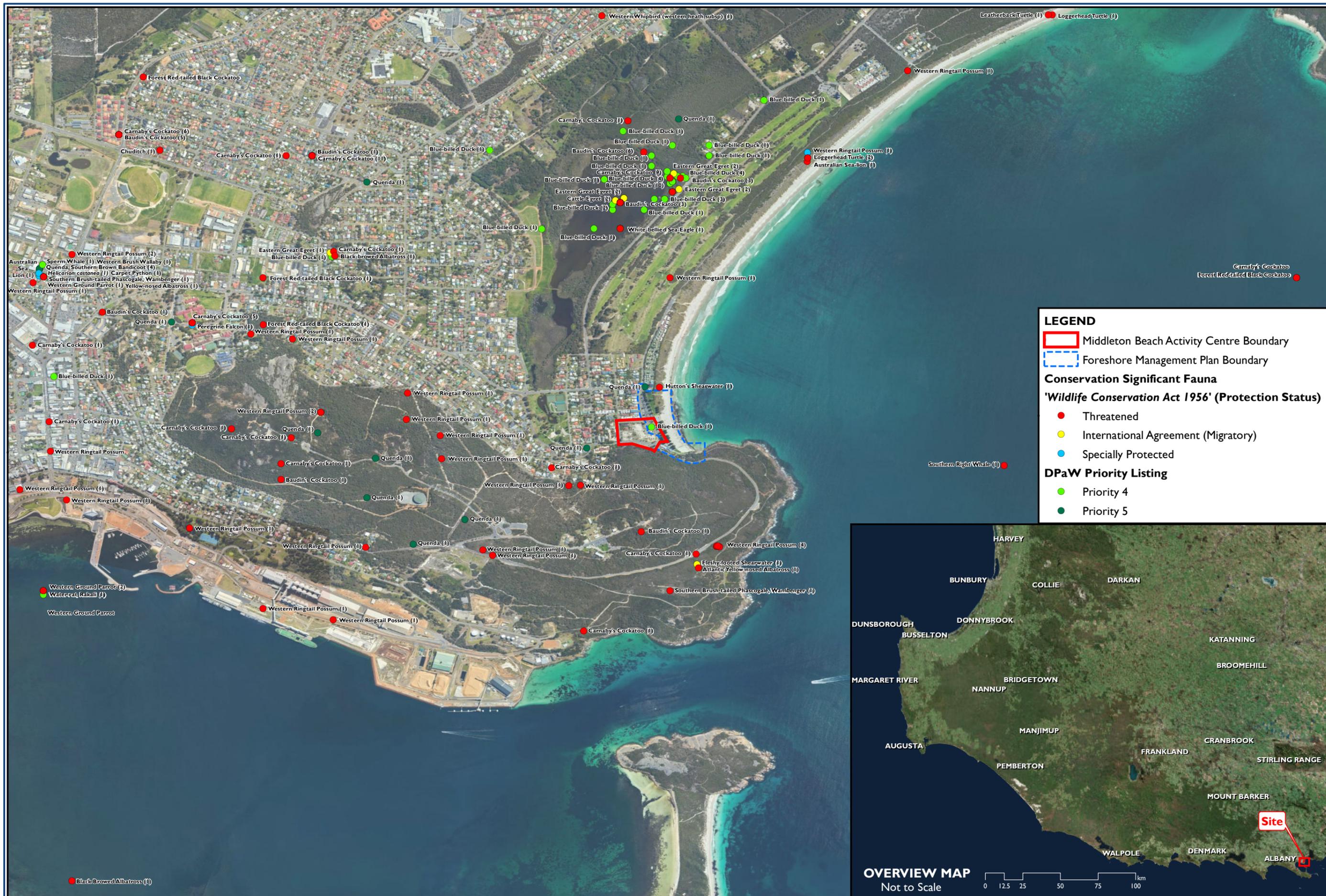
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 Doc Number: 007  
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 Created by: MA  
 Source: Cadastre - Landgate, 2017 Aerial - Landgate, 2017



**Figure G**

**Groundwater Monitoring Locations**





**LEGEND**

Middleton Beach Activity Centre Boundary  
 Foreshore Management Plan Boundary

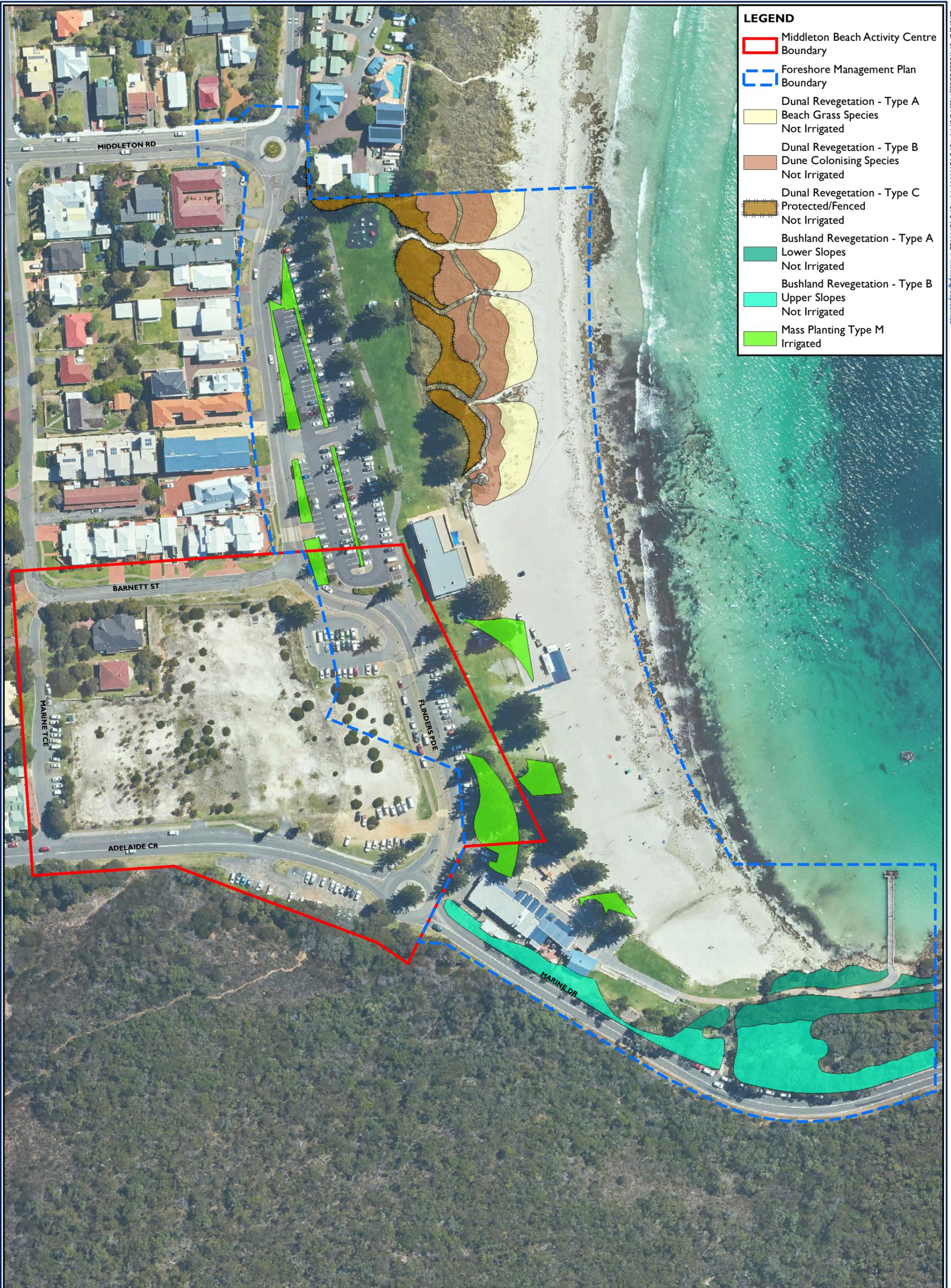
**Conservation Significant Fauna**  
**'Wildlife Conservation Act 1956' (Protection Status)**

- Threatened
- International Agreement (Migratory)
- Specially Protected

**DPaW Priority Listing**

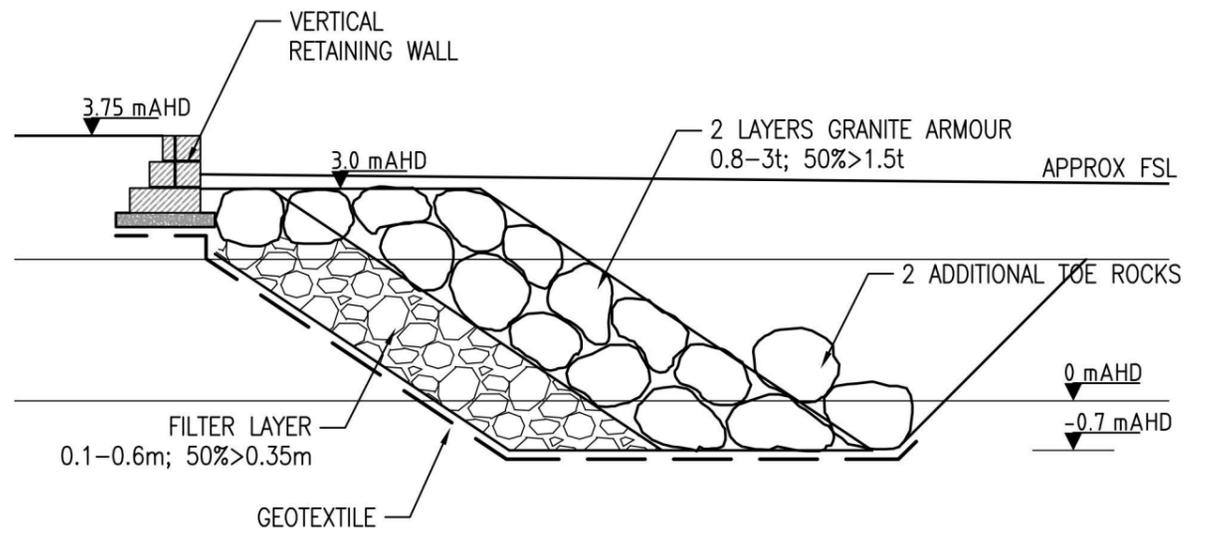
- Priority 4
- Priority 5



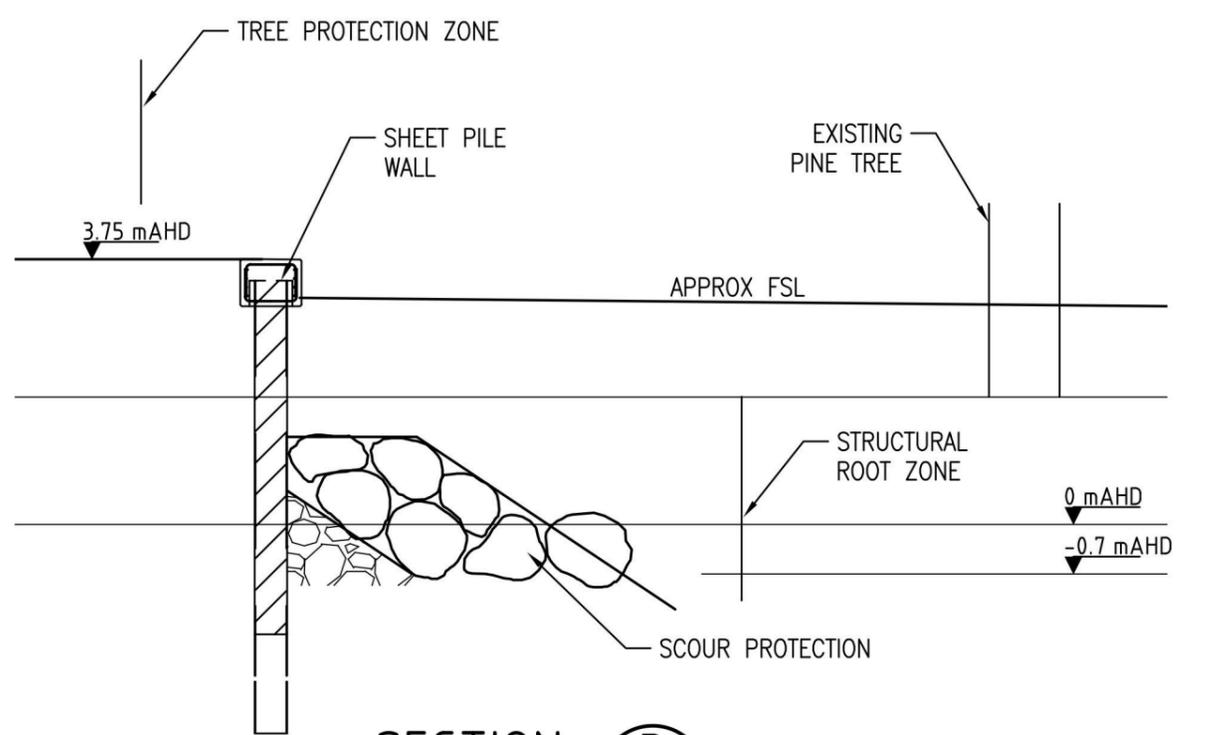


**LEGEND**

- Middleton Beach Activity Centre Boundary
- Foreshore Management Plan Boundary
- Dunal Revegetation - Type A
- Beach Grass Species  
Not Irrigated
- Dunal Revegetation - Type B
- Dune Colonising Species  
Not Irrigated
- Dunal Revegetation - Type C
- Protected/Fenced  
Not Irrigated
- Bushland Revegetation - Type A
- Lower Slopes  
Not Irrigated
- Bushland Revegetation - Type B
- Upper Slopes  
Not Irrigated
- Mass Planting Type M
- Irrigated



**SECTION A**  
1:100



**SECTION B**  
1:100

## Appendix A

# City of Albany Council Resolution 19 December 2017

**DIS065: MIDDLETON BEACH FORESHORE – FORESHORE  
MANAGEMENT PLAN**

<b>Land Description</b>	: Lot 1474 Flinders Parade, Middleton Beach on deposited plan 219850 comprised in Certificate of Title Volume 3111 Folio 83
<b>Owner</b>	: City of Albany (Management order or vest crown land)
<b>Attachments</b>	: <b>Commercial in Confidence: Middleton Beach Foreshore Briefing Note – Proposed Staging Plan.</b>
<b>Report Prepared By</b>	: Executive Director Development Services (P Camins)
<b>Responsible Officers:</b>	: Executive Director Development Services (P Camins)

**STRATEGIC IMPLICATIONS**

1. This item relates to the following elements of the City of Albany Strategic Community Plan or Corporate Business Plan informing plans or strategies:
  - a. **Key Themes:**
    - 2. Smart, Prosperous & Growing
    - 3. Clean, Green and Sustainable
    - 4. Community Health and Participation
    - 5. A Connected and Built Safe Environment
  - b. **Strategic Objectives:**
    - 2.1 To strengthen and grow our region’s economic base.
    - 2.3 To develop and promote Albany as a unique and sought-after visitor location
    - 3.1 To protect and enhance our natural and built environment in a changing climate
    - 3.2 To build, maintain and renew City assets sustainably
    - 4.2 To create interesting places, spaces and events that reflect our community’s identity, diversity and heritage.
    - 5.2 To advocate, plan and build friendly and connected communities.
  - c. **Community Priorities:**
    - 2.1.1 Work with business and other stakeholders to attract investment; diversify the economy; create jobs and support small business growth.
    - 2.3.1 Encourage, support and deliver significant events that promote our region and have a positive economic and social benefit.
    - 3.1.2 Sustainably protect and enhance our iconic coastline, reserves flora and fauna by delivering projects and programs that reflect the importance of our coastline and natural reserves.
    - 3.2.1 Deliver environmentally & financial sustainable long term planning for infrastructure via a forward capital works program that meets the needs of our community.
    - 4.2.2 Maintain infrastructure and deliver programs that promote Albany’s unique heritage, engender civic pride and leave a lasting memory.
    - 5.2.2 Create infrastructure and connected streetscapes that are consistent and reflect our unique heritage.

**Maps and Diagrams:**



**In Brief:**

- LandCorp is developing the Middleton Beach Activity Centre (MBAC) site and is required to undertake a Foreshore Management Plan (FMP) in conjunction with the City of Albany.
- The Foreshore Management Plan document required for the LandCorp development must also include an adaptation plan for the development site. This plan has to commit to some interventions in relation to Coastal Protection over the next 100 years (i.e. coastal adaptation pathway). It is unlikely that any adaptation plan for the entire foreshore could be achieved without additional funding from the City.
- The FMP must meet the requirements of State Planning Policy 2.6 including the requirement to protect the development from coastal processes for 100 years
- The City of Albany is currently undertaking a CHRMAP (coastal hazard risk management and adaptation planning) process for Emu Point to Ellen Cove that is required by the State for Coastal Communities.
- The CHRMAP process shows that the Middleton Beach Foreshore and associated infrastructure will be at risk within a 20 year time frame. The City will have to prepare an adaptation plan as part of this process for the areas that are at risk.
- Whilst LandCorp have some funding available for coastal protection it would be an opportune time for the City of Albany to commit to protection works to incorporate their requirements into a larger integrated plan.
- The City of Albany has previously and will continue to advocate for state and federal funds to complete works on the Middleton Beach Foreshore.
- The benefits of an integrated approach to coastal protection to the LandCorp development and the Middleton Beach foreshore include:
  - Coastal protection requirements are met for at least 50 years;
  - High quality community amenity improvements on the dilapidated foreshore;
  - Removal of drainage that currently flows directly onto the beach;
  - Creation of a new beach promenade over the buried seawall.

**RECOMMENDATION**

**DIS065: RESOLUTION (ALTERNATE MOTION BY COUNCILLOR STOCKS)  
VOTING REQUIREMENT: SIMPLE MAJORITY**

**MOVED: COUNCILLOR STOCKS  
SECONDED: COUNCILLOR HAMMOND**

**THAT Council:**

1. **NOTE** the proposed Adaptation Plan will require that the City of Albany undertake works in timed stages to protect the Middleton Beach Foreshore, associated infrastructure and the Middleton Beach Activity Centre.
2. **ACCEPT** the funding contribution from LandCorp for the purpose of implementing the works required in the Middleton Beach Activity Centre Foreshore Management Plan – Adaptation Plan (in accordance with the confidential briefing note).
3. Further to (2) above, request the Chief Executive Officer to **NEGOTIATE** further with LandCorp for an additional contribution to support protection and enhancement of the Middleton Beach Foreshore.
4. **Continue to ADVOCATE** for State and Federal funds to complete works on the Middleton Beach Foreshore.
5. **APPROVE** the **ADVERTISEMENTS** of the completed Draft Middleton Beach Activity Centre Foreshore Management Plan (which includes the agreed Adaptation Plan) for the purpose of public consultation.

**CARRIED 13-0**

**Councillor Reason:**

The amendment to item 2 and addition of item 3 allows the CEO some flexibility in negotiating for additional land or cash contribution from LandCorp to assist in supporting the implementation of the important foreshore development to benefit the MBAC, economic development and the community.

**Officer Comment (Executive Director Development Services):**

We are supportive of this amended motion as it provides scope for the Chief Executive Officer to negotiate a better outcome.

**DIS065: COMMITTEE RECOMMENDATION  
VOTING REQUIREMENT: SIMPLE MAJORITY**

**THAT Council:**

1. **NOTE** the proposed Adaptation Plan will require that the City of Albany to undertake works in timed stages to protect the Middleton Beach Foreshore, associated infrastructure and the Middleton Beach Activity Centre.
2. **ACCEPT** the funding contribution from LandCorp for the purpose incorporating a Middleton Beach Activity Centre Foreshore Management Plan – Adaptation Plan (*in accordance with the confidential briefing note*) and continue to advocate for State and Federal funds to complete works on the Middleton Beach Foreshore.
3. **APPROVE THE ADVERTISEMENTS** of the completed Draft Middleton Beach Activity Centre Foreshore Management Plan (which includes the Landcorp Adaptation Plan) for the purpose of public consultation.

DIS065: COMMITTEE RECOMMENDATION

MOVED: COUNCILLOR HAMMOND  
SECONDED: COUNCILLOR SUTTON

THAT the Responsible Officer Recommendation be ADOPTED.

CARRIED 11-0

DIS065: RESPONSIBLE OFFICER RECOMMENDATION

THAT Council:

1. NOTE the proposed Adaptation Plan will require that the City of Albany to undertake works in timed stages to protect the Middleton Beach Foreshore, associated infrastructure and the Middleton Beach Activity Centre.
2. ACCEPT the funding contribution from LandCorp for the purpose incorporating a Middleton Beach Activity Centre Foreshore Management Plan – Adaptation Plan (*in accordance with the confidential briefing note*) and continue to advocate for State and Federal funds to complete works on the Middleton Beach Foreshore.
3. APPROVE THE ADVERTISEMENT of the completed Draft Middleton Beach Activity Centre Foreshore Management Plan (which includes the Landcorp Adaptation Plan) for the purpose of public consultation.

**BACKGROUND**

2. LandCorp is developing the old Esplanade Site. The Structure Plan and Scheme Amendment have been completed and conditional subdivision approval has been obtained. The development is known as the MBAC.
3. LandCorp have committed funding to complete Stage 1 of the works, which will realign Flinders Parade and tie it into Adelaide Crescent.

**DISCUSSION**

**Development Conditions**

4. A number of conditions have been applied within the planning instruments for the Middleton Beach Activity Centre. Relevant to this item are condition 5 from the Scheme Amendment and condition 18 from the subdivision conditions. These are repeated below:

Local Planning Scheme 1 Condition:

“Foreshore Protection and Management

*5. Development within the Hotel/Mixed Use Precinct and/or creation of the Hotel/Mixed Use Lot will be subject to satisfactory arrangements for the implementation and ongoing management of coastal adaptation and protection measures consistent with State Planning Policy 2.6, including but not limited to—*

- *Public advertising, adoption and implementation of a Foreshore Management Plan that includes the existing foreshore reserve adjacent to the Special Use zone, prepared in conjunction with the City of Albany in accordance with SPP2.6 Sub-Clause 5.10 Coastal Strategies and Management Plans and endorsed by the WAPC; and*
- *Notification on Title stating that the lot is within a Vulnerable Coastal Area.”*

Subdivision Condition:

*“18. Prior to the commencement of subdivision works on Lot 'DA6' and any Public Open Space depicted on the approved plan of subdivision, a foreshore management plan in accordance with Condition 5 of Special Use Area 25 in Albany's Local Planning Scheme No. 1 is to be prepared and approved for the installation and ongoing management of coastal adaptation and protection measures, to the satisfaction of the Western Australian Planning Commission.”*

**Proposed Staging of the Integrated Approach**

5. It is expected that the independent CHRMAP process being undertaken for the City of Albany will indicate a higher likelihood of risk of inundation and/or erosion and a requirement for earlier intervention, than the CHRMAP prepared only for the Ellen Cove Foreshore Management Plan (by Landcorp). This is particularly so in regards to the Foreshore and Albany Surf Life Saving Club.
6. An integrated solution as recommended by the City of Albany incorporates coastal protection structures built further out on the foreshore / beach edge as part of a wider foreshore protection plan inclusive of the development which will include drainage infrastructure and landscaping works as well as the seawall.
7. A staging plan has been proposed for the implementation of the coastal protection works.

**GOVERNMENT & PUBLIC CONSULTATION**

8. The Middleton Beach Working Group consists of representative from Department of Planning, Lands and Heritage, GSDC, City of Albany and LandCorp. This group has been meeting regularly for more than 2 years and has had an input into and provided comment on the draft document.
9. The Coastal Parks Enhancement Plan prepared in 2014 involved significant community consultation. The landscaping and amenity elements associated with this updated plan will remain consistent.
10. SPP2.6 includes a requirement for community consultation ;  
*” Ensure that the coastal planning strategy or foreshore management plan is developed in consultation with the broad community and relevant public authorities, and achieve the approval of the local land manager and the WAPC if appropriate.”*
11. The Foreshore Management Plan will therefore be updated in accordance with the guiding principles (Should Council endorse them).The plan will then be advertised for public comment where after it will be presented to Council at another OCM for final endorsement.

**STATUTORY IMPLICATIONS**

12. Section 143 (1)(c) of the *Planning and Development Act 2005* allows WAPC to approve a subdivision with conditions. LandCorp are required to comply with the subdivision requirements including preparation of and commitment to a Foreshore Management Plan.
13. State Planning Policy No. 2.6 State Coastal Planning Policy and associated Guidelines is the most pertinent policy to inform and guide decision-making for coastal planning; including managing development and land use change; establishment of foreshore reserves; and to protect, conserve and enhance coastal values.
14. The most relevant section of the policy is section 5.5 and deals with Coastal hazard risk management and adaptation planning.
15. The Foreshore Management Plan and any solution needs to meet/address the requirements of this policy.

**POLICY IMPLICATIONS**

16. Nil

## RISK IDENTIFICATION & MITIGATION

17. The risk identification and categorisation relies on the City's Enterprise Risk and Opportunity Management Framework.

Risk	Likelihood	Consequence	Risk Analysis	Mitigation
<b>Property</b> <i>Risk: There is a risk that doing nothing will result in damage to the foreshore and infrastructure.</i>	<i>Possible in the short term</i>	<i>Moderate in the short term</i>	<i>High</i>	<i>Undertake precinct-wide coastal protection works</i>
<b>Financial</b> <i>Risk: There is a risk that doing nothing will result in damage to the foreshore and infrastructure.</i>	<i>Possible in the short term</i>	<i>Severe</i>	<i>Extreme</i>	<i>Undertake precinct-wide coastal protection works</i>
<b>Reputation</b> <i>Risk: There is a risk that by protecting only the hotel site the City will be criticised by the community.</i>	<i>Possible in the short term</i>	<i>Major</i>	<i>High</i>	<i>Undertake precinct-wide coastal protection works</i>
<b>Opportunity:</b> <i>There is an opportunity to receive a contribution from LandCorp for a precinct-wide protection strategy.</i>				

## FINANCIAL IMPLICATIONS

18. LandCorp have nominal funding available for the construction of a seawall around the hotel site.
19. LandCorp are prepared to make these funds their contribution to a precinct-wide protection strategy.
20. A commitment to the funding arrangements as discussed in the attached briefing paper.

## LEGAL IMPLICATIONS

21. Nil

## ENVIRONMENTAL CONSIDERATIONS

22. Nil.

## ALTERNATE OPTIONS

23. That the City not commit to develop the Middleton Beach Foreshore and allow LandCorp to find alternate means to protect the Middleton Beach Activity Centre. Note that this would lose any contribution available to achieve a precinct-wide solution.

## CONCLUSION

24. A decision on providing a commitment within the Foreshore Management Plan is required to complete the Draft Plan for advertising. Officers recommend that the benefits of a precinct-wide proposal being implemented in a staged approach over appropriate time-frames will give the City some time to advocate for funding to complete this important project.

<b>Consulted References</b>	:	<i>Local Government Act 1995, Planning and Development Act 2005. State Planning Policy No. 2.6 State Coastal Planning Policy and Guidelines and Local planning Scheme 1</i>
<b>File Number (Name of Ward)</b>	:	Frederickstown
<b>Previous Reference</b>	:	Nil

# Appendix B

## Coastal Hazard Risk Management and Adaption Plan

**R684 Rev 0**

**November 2015**

**RPS / LandCorp**

**Middleton Beach Activity Centre  
Coastal Hazard Risk Management & Adaptation Plan**

marinas  
boat harbours  
canals  
breakwaters  
jetties  
seawalls  
dredging  
reclamation  
climate change  
waves  
currents  
tides  
flood levels  
water quality  
siltation  
erosion  
rivers  
beaches  
estuaries

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## K1265, Report R684 Rev 0

### Record of Document Revisions

Rev	Purpose of Document	Prepared	Reviewed	Approved	Date
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0	Issued for Client use	T Harding	C Doak	C Doak	13.11.15

Form 035 18/06/2013

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## 1. Introduction

The proposed Middleton Beach Activity Centre is to be located on what is known as the “Esplanade Hotel” site, situated adjacent to Middleton Beach approximately 4 km to the east of Albany’s Central Business District (refer Figure 1.1).

Planning for the development of the Middleton Beach Activity Centre is currently underway. The proposed development of the area is being led by LandCorp, who acquired the site in 2014. The current development plan is shown in Figure 1.2.

As part of the planning process, there is a requirement to understand the potential risks posed to development by coastal hazards. Specialist coastal and port engineers M P Rogers & Associates Pty Ltd (MRA) were engaged by LandCorp, as a sub-consultant to RPS, to complete a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) for the Middleton Beach Activity Centre. The requirements and framework for a CHRMAP are established within SPP2.6, but are outlined more specifically in the *CHRMAP Guidelines* (WAPC, 2014).

This CHRMAP has been completed in accordance with the requirements of these documents and covers the following key items.

- Establishment of the context.
- Coastal hazard assessment.
- Risk analysis and evaluation.
- Risk management and adaptation planning.
- Monitoring and review.

Details regarding each of these items will be provided in this report.



Figure 1.1 Location Plan (Nearmap, 2014)

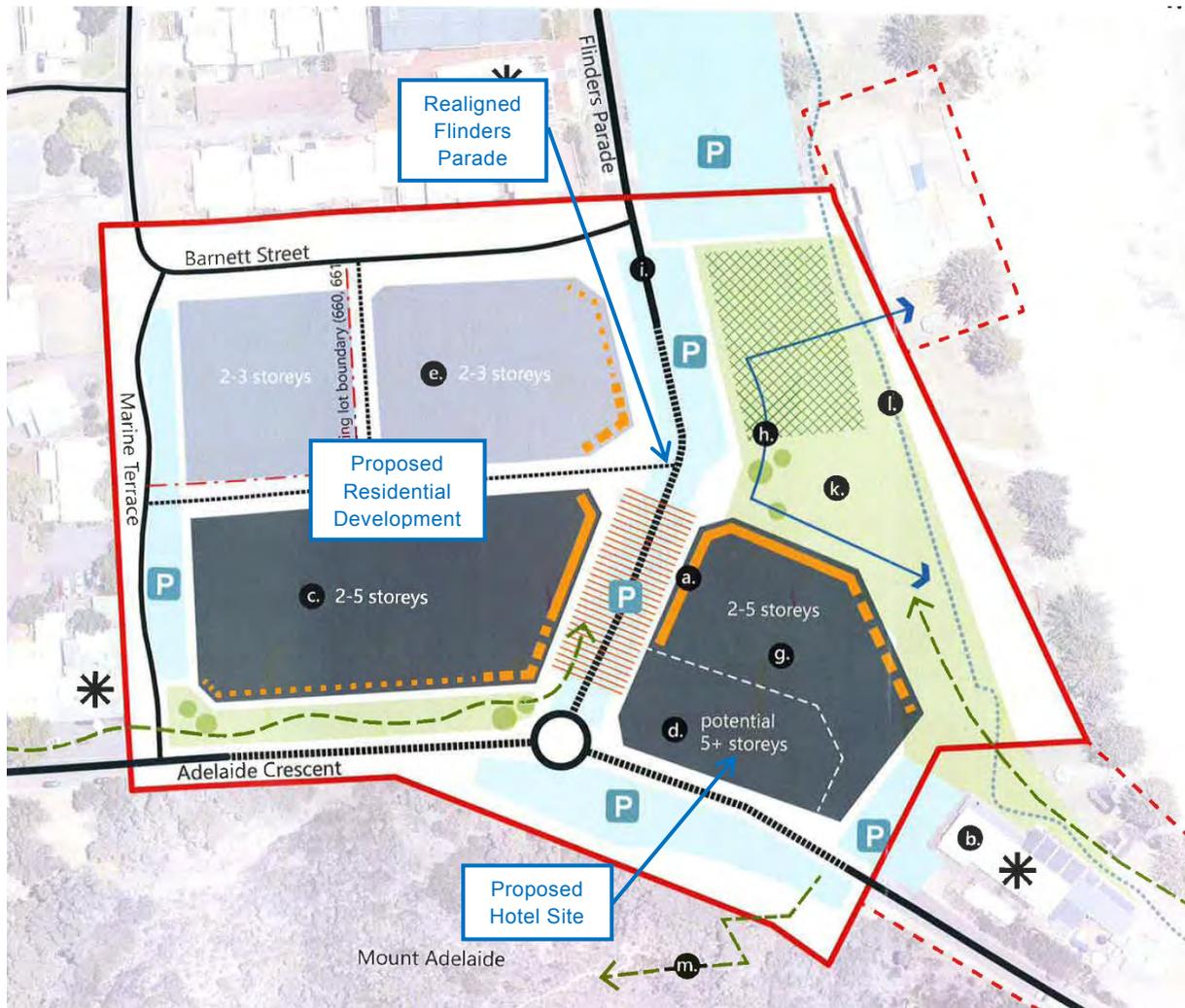


Figure 1.2 Proposed Development Plan

## 2. Context

### 2.1 Purpose

The potential future vulnerability of the coastline and the subsequent risk to the community, economy and the environment needs to be considered for the development of the proposed Middleton Beach Activity Centre. A key component of this risk analysis will be to identify any escalation of this risk over time, particularly in response to potential climate induced change.

Preparation of this plan is consistent with the requirements of SPP2.6, which requires that a CHRMAP be prepared by/for the responsible management authority to cover areas where existing or proposed development could be at risk from coastal hazards over the planning timeframe. The main purpose of a CHRMAP is to define areas of the coastline that could be vulnerable to coastal hazards and to outline the preferred approach to the monitoring and management of these hazards where required.

A CHRMAP can be a powerful planning tool and help to provide clarity to existing and future developers, users, managers or custodians of the coastline. This is done by defining levels of risk exposure, management practices and adaptation techniques that the management authority considers to be acceptable in response to the present and future risks posed by coastal hazards.

Specifically, the purpose of this CHRMAP is as follows.

- Confirm the potential extent of coastal hazard impact surrounding the proposed Middleton Beach Activity Centre.
- Outline the risks associated with the proposed development and how this risk may change over time.
- Establish the basis for present and future risk management and adaptation.
- Provide guidance on appropriate management and adaptation planning for the future, including monitoring.

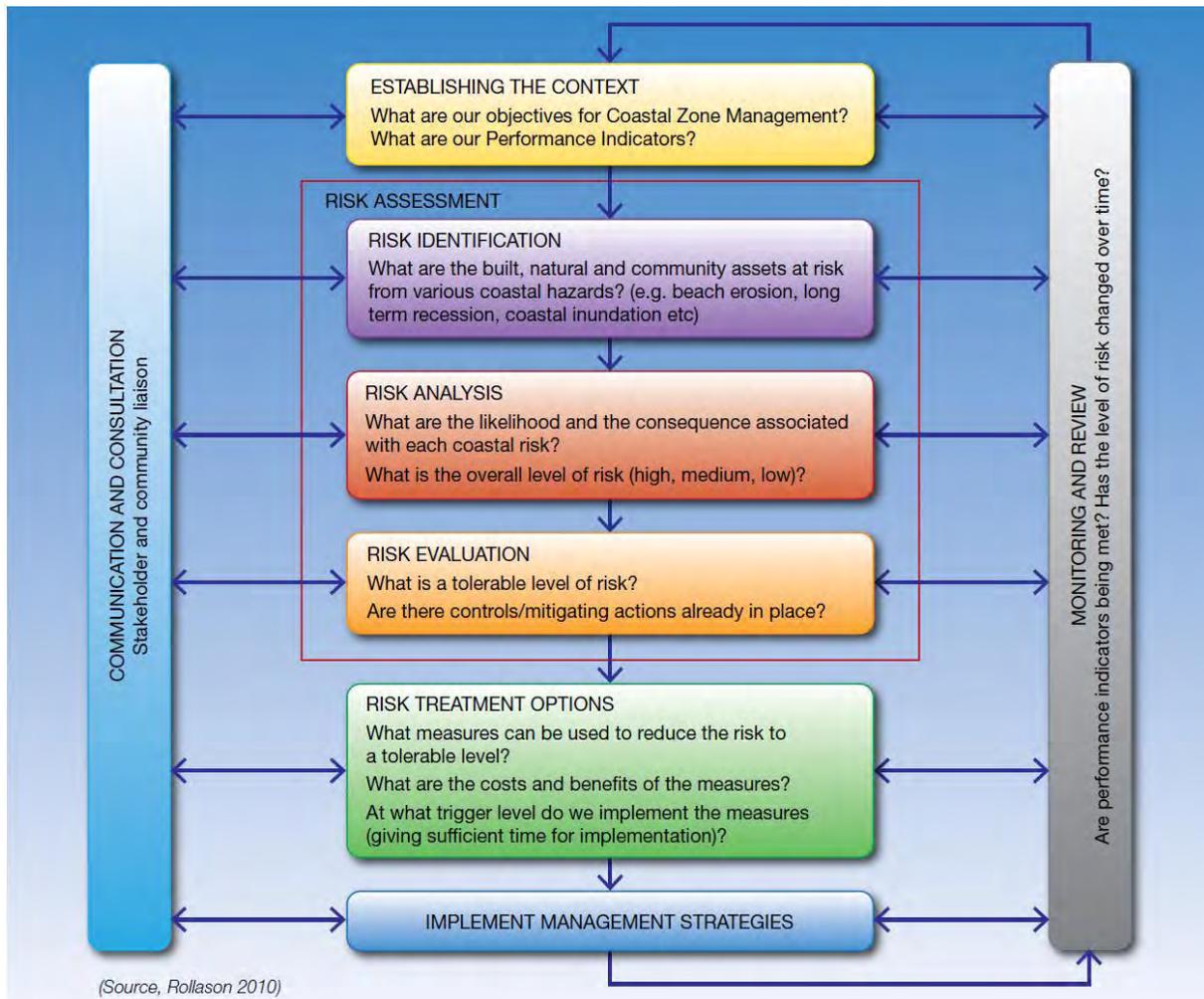
### 2.2 Objectives

The key objective of this plan is to assess the risks associated with the development of the Middleton Beach Activity Centre and how these risks may change over time. Once these risks have been assessed, adaptation strategies can be developed, where necessary, to help mitigate the risks. However, consideration of the risks posed to the proposed development need to be considered in the context of the risks posed to existing assets in the area, as future risk mitigation strategies for existing assets could impact the proposed development.

Whilst the risks of coastal hazards are to be considered for different timeframes, the future behaviour of the shoreline could be variable for a variety of reasons. As a result, the requirement to consider the implementation of future adaptation strategies should be informed by an ongoing coastal monitoring regime. A recommended monitoring regime is included within this report.

### 2.3 Scope

The 2014 WAPC *CHRMAP Guidelines* provide a specific framework for the preparation of a CHRMAP. Figure 2.1 presents a flowchart for the risk management and adaptation process, as outlined within the *CHRMAP Guidelines*.



**Figure 2.1 Risk Management & Adaptation Process Flowchart**

As presented in the flowchart, the process for the development of a meaningful CHRMAP requires a number of fundamental inputs. These inputs enable the assessment and analysis of risk to help shape the subsequent development and any required adaptation strategies. This process should ultimately be informed by input received from key stakeholders and the community. Members of the Middleton Beach Working Group will be the key stakeholder in this initial process, with wider community consultation having previously occurred, with further consultation proposed in the future. The Working Group includes the following key stakeholders.

- Department of Planning.
- City of Albany.
- Great Southern Development Commission.
- Department of Lands.
- LandCorp.

To properly assess the risk posed by coastal hazards, an assessment of the potential vulnerability of the shoreline will need to be completed. Assessment of the coastal vulnerability and the

resultant coastal hazard mapping is to be completed in accordance with the general requirements of Schedule One of SCPP. This schedule provides a framework for the assessment of the potential impacts of coastal hazards on the shoreline for a variety of coastal forms.

The extent of impacts caused by coastal hazards will vary with the coastal form and geomorphology, however for the general case the following factors need to be considered.

- (S1 Erosion) Allowance for the current risk of storm erosion.
- (S2 Erosion) Allowance for historic shoreline movement trends.
- (S3 Erosion) Allowance for erosion caused by future sea level rise.
- (S4 Inundation) Allowance for the current risk of storm surge inundation.

The results of this assessment will form the basis of this assessment of coastal hazard risk.

This CHRMAP will consider the potential risks posed by coastal hazards over a range of timeframes covering a 100 year planning horizon. Intermediate planning horizons will be considered in order to assess how risk profiles may change in the future. Intermediate planning horizons that will be considered include 25, 50 and 75 year horizons.

Based on the results of the risk assessment, risk mitigation strategies will be developed, where required, in order to provide a framework for future management. However, it is important to realise that the risk assessment will be based on the outcomes of the coastal vulnerability assessment, which, by their nature, are justifiably conservative. As a result, the framework for future risk management strategies should be considered to be a guide of future requirements.

The actual requirement for implementation of these management actions should ultimately be informed by a coastal monitoring regime. The purpose of this coastal monitoring regime would be to identify changes in the shoreline or sea level that could alter, either positively or negatively, the risk exposure of the proposed infrastructure. A recommended coastal monitoring regime has been provided within this plan.

## **2.4 Key Assets**

Key assets within the Middleton Beach Activity Centre area and surrounds have been summarised in Table 2.1. The risk assessment will focus on these assets in order to identify their vulnerability and consequently the requirement for risk management. For this type of assessment it is not considered necessary to break down this list of assets any further into their component parts, as it is the vulnerability of the overall assets that is the important factor.

**Table 2.1 Key Assets within the Middleton Beach Activity Centre Area**

Key Assets
<b>Environment</b>
Middleton Beach
<b>Social</b>
Middleton Beach Foreshore Park
Albany Surf Life Saving Club
3 Anchors Restaurant
Flinders Parade Car-Park
Residential Development (Existing)
Residential Development (Proposed)
<b>Economic</b>
Flinders Parade (Realigned)
Hotel Site (Proposed)

## 2.5 Success Criteria

The success criteria for the CHRMAP will ultimately be as follows.

- To determine appropriate allowances for the future action of coastal processes and inundation.
- To understand the potential/likelihood of infrastructure within and surrounding the Middleton Beach Activity Centre being impacted by coastal hazards over each planning horizon.
- To understand the consequences of infrastructure being exposed to the different coastal hazards.
- To determine total risk ratings for each item of infrastructure.
- Development of an acceptable risk management and adaptation strategy for the proposed development whilst considering the reasonable likelihood of protection for existing infrastructure.
- Development of a coastal monitoring strategy to review the actual changes in risk levels over time.

### 3. Hazard Identification

An understanding of potential future coastal hazards and risks is critical for the assessment and determination of management and adaptation actions.

SPP2.6 provides guidance on the assessment criteria and methodology required to determine the potential extent of coastal hazard impacts, whilst incorporating a level of conservatism deemed appropriate for coastal planning. This assessment methodology seeks to incorporate allowances for landform stability, natural variability and climate change over the proposed planning period. Specifically, the following items are considered in order to assess the appropriate allowances for coastal processes and climate change over the proposed planning timeframes.

- Severe storm erosion (S1 Allowance).
- Historical shoreline movement (S2 Allowance).
- Climate change induced sea level rise (S3 Allowance).
- Storm surge inundation (S4 Allowance)

These criteria are discussed in further detail in the following sections of this report. This coastal hazards assessment has been completed for a 100 year planning horizon in accordance with SPP2.6 requirements. Interim planning horizons of 25, 50 and 75 years have also been considered in order to assess the changes to coastal vulnerability over time.

#### 3.1 Severe Storm Erosion (S1 Allowance)

SPP2.6 outlines that the S1 allowance should provide an adequate buffer to accommodate the potential erosion caused by a storm with an annual encounter probability (AEP) of 1%. This is equivalent to a 100 year average recurrence interval (ARI) storm.

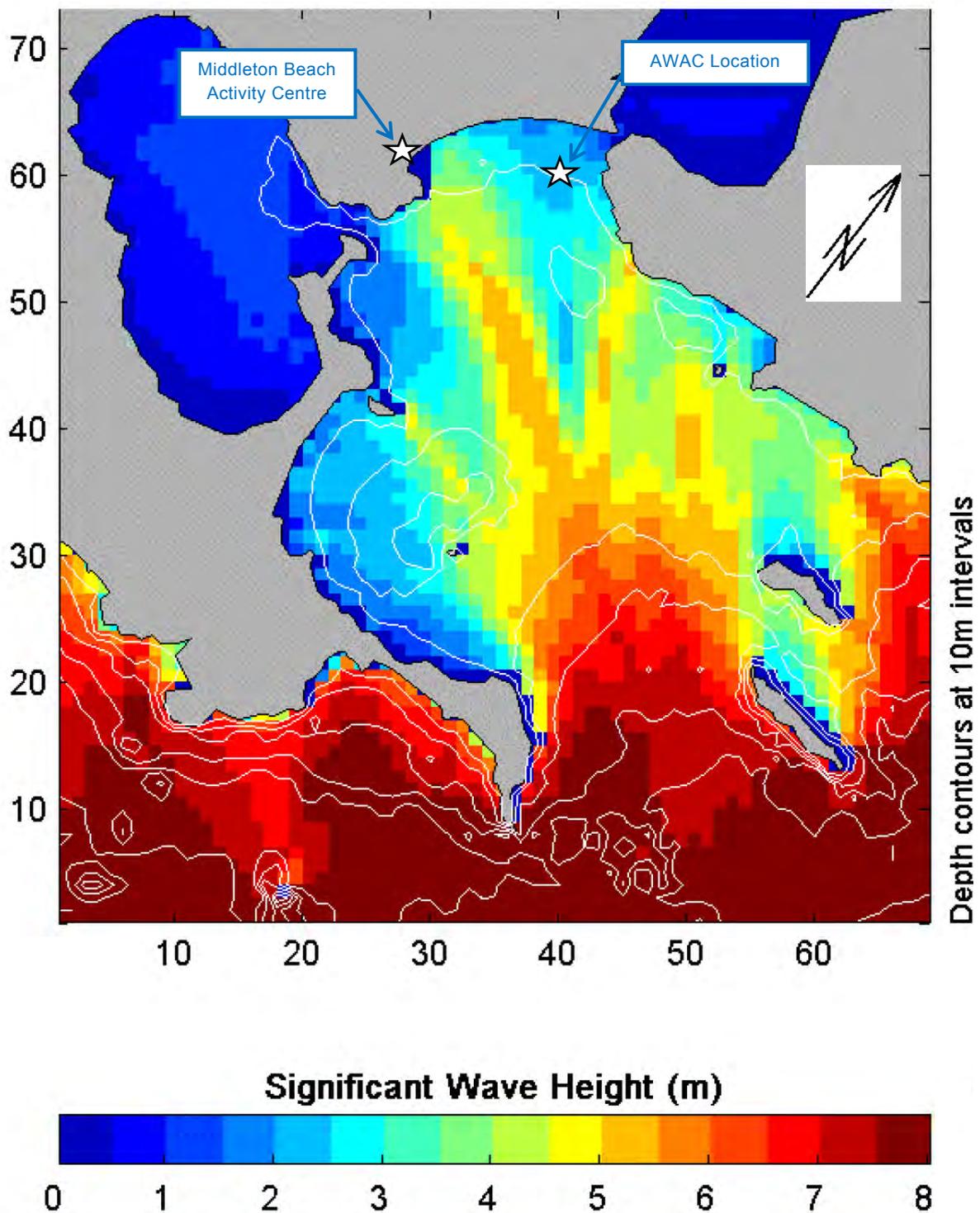
In order to estimate the S1 Allowance at the Middleton Beach Activity Centre site, design wave and water level conditions were analysed for use in the beach profile evolution model, SBEACH. The following sections detail the design conditions used and the modelling and calibration procedures undertaken to determine the S1 Allowance.

##### 3.1.1 Previous Wave Modelling

MRA has developed a sophisticated wave model capable of properly modelling the changes in wave conditions as waves travel from deep water to the shore. This model is called 2GWave, and is a modified version of Prof Ian Young's ADFA1 model. The modifications to ADFA1 ensure that 2GWave properly accounts for the complex changes in wave conditions caused by reefs, banks, seagrass meadows, nearshore bathymetry and atmospheric input.

Since the development of the 2GWave model for the Perth Metropolitan Region, MRA has set up numerous models along the Western Australian coastline. In 2006 a model was developed for King George Sound and the surrounding Albany region. The details of this model are presented in MRA (2011).

An analyses of extreme events showed that storms from a south easterly direction propagate the largest waves to the Middleton Beach Activity Centre site. Modelling results of the 100 year ARI wave event are presented in Figure 3.1.



**Figure 3.1 100 Year ARI South Easterly Storm**

Figure 3.1 shows that, offshore from the proposed activity centre, wave heights in 10 m of water are approximately 50% of the offshore wave heights.

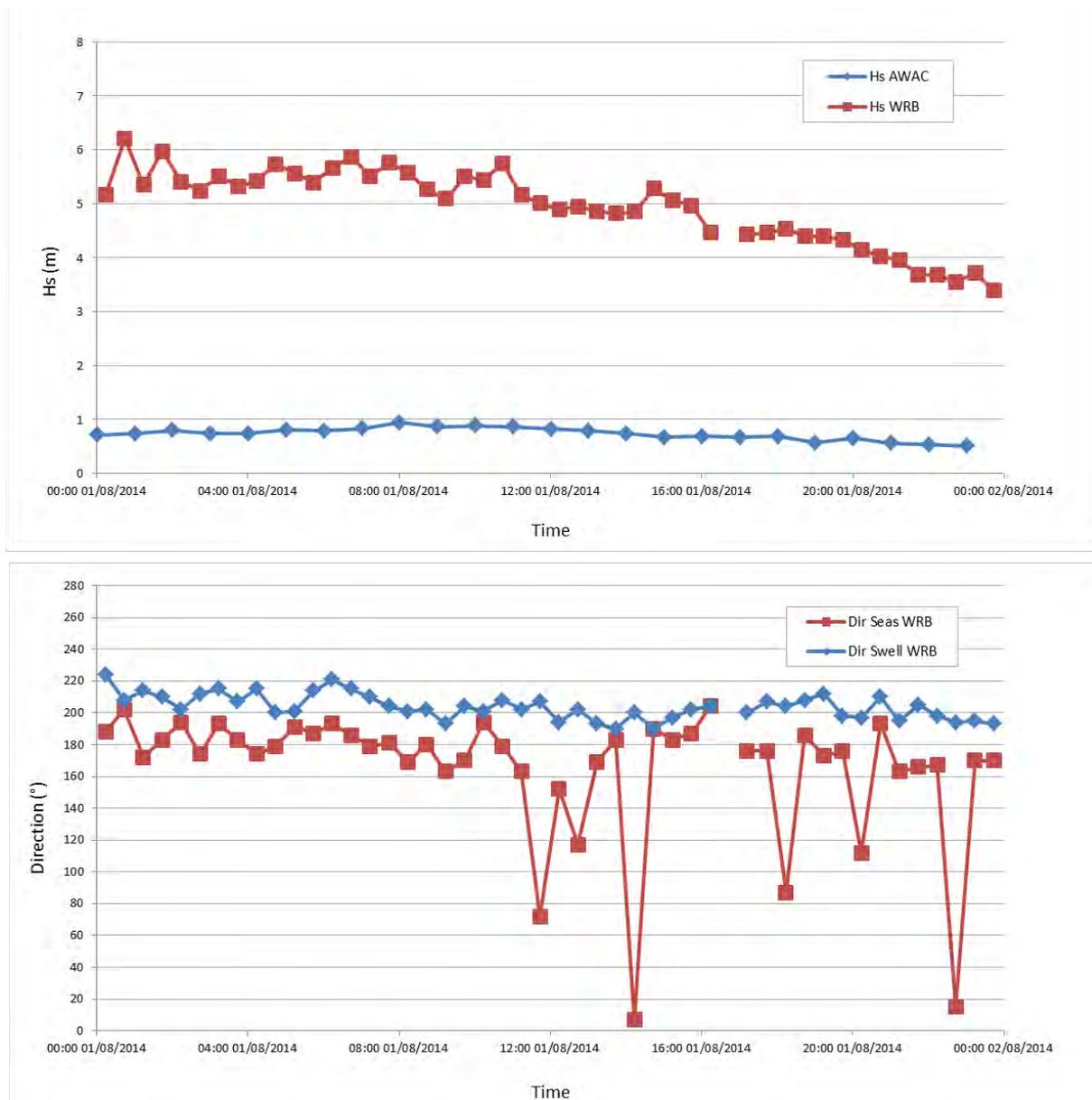
**3.1.2 Recent Model Validation**

There are two wave recording devices located in the Albany region. The locations and details of these devices are presented in Table 3.1.

**Table 3.1 Wave Recording Device Locations**

Location	Deployment	Latitude (S)	Longitude (E)	Depth (m)
Bald Head (Wave Rider Buoy - WRB)	June 2005 - present	35°11'53"	117°43'19"	60
Emu Point (AWAC)	December 2013 - present	35°00'39"	117°56'39"	10

Data from December 2013 to September 2015 was sourced from the DoT from both wave recording devices. This data was used to confirm the previous validation of the 2GWave model, as outlined in MRA (2011). Figure 3.2 shows a time history of the significant wave heights and directions during a south to south easterly storm which occurred during this data period.



**Figure 3.2 Wave Conditions Recorded During South to South Easterly Storm on 1 August 2014**

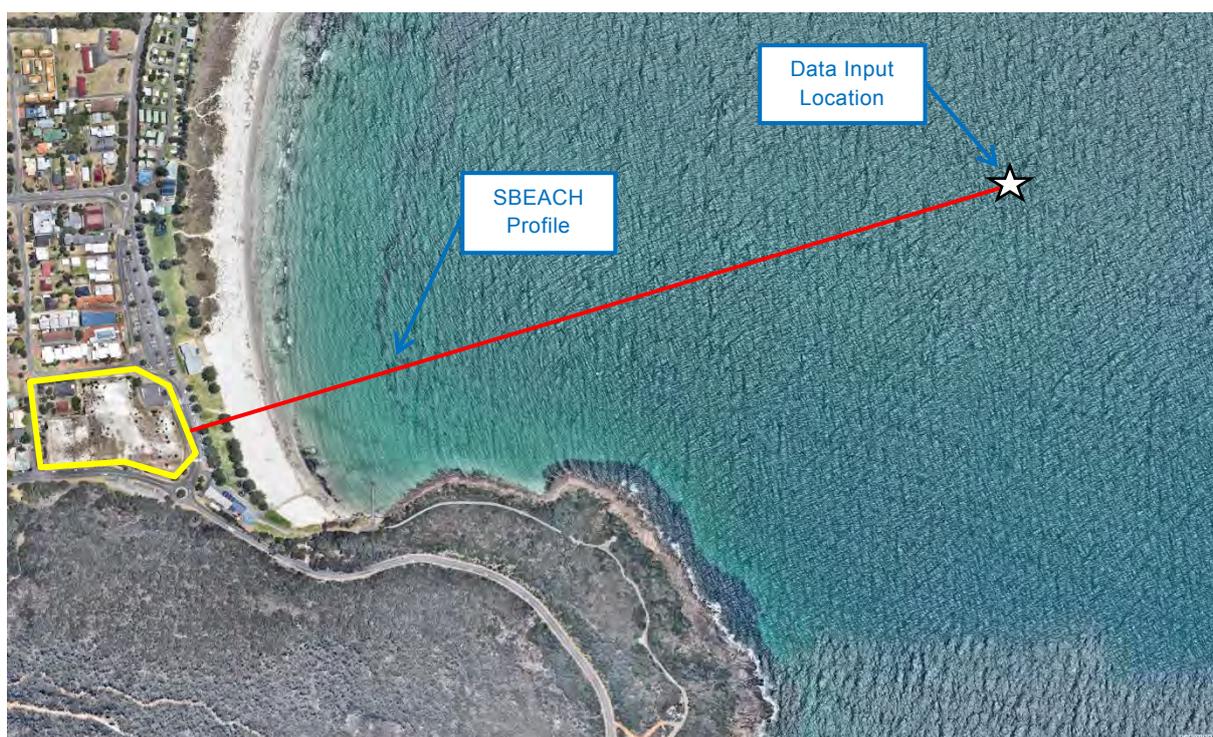
An analysis of the wave measurements show that the significant wave heights at the AWAC are approximately 20% of those experienced offshore, during south to south easterly storms. The 2GWave model predicted waves at the location of the AWAC to have a similar wave attenuation coefficient compared to the offshore wave heights. This result, combined with the previous validation of the 2GWave model, shows that during storm events the 2GWAVE model accurately attenuates wave conditions from offshore to the nearshore area surrounding Middleton Beach.

### 3.1.3 SBEACH Modelling

The SBEACH computer model was developed by the Coastal Engineering Research Centre (CERC) to simulate beach profile evolution in response to storm events. It is described in detail by Larson & Kraus (1989). Since this time the model has been further developed, updated and verified based on field measurements (Wise et al 1996, Larson & Kraus 1998, Larson et al 2004).

MRA has validated SBEACH for use on sandy coasts in Western Australia (Rogers et al 2005). This validation has shown that SBEACH can provide useful and relevant predictions of the storm induced erosion, provided the inputs are correctly applied and care is taken to ensure that the model is accurately reproducing the recorded wave heights and water levels. Primary inputs include time histories of wave height, period and water elevation, as well as pre-storm beach profile and median sediment grain size.

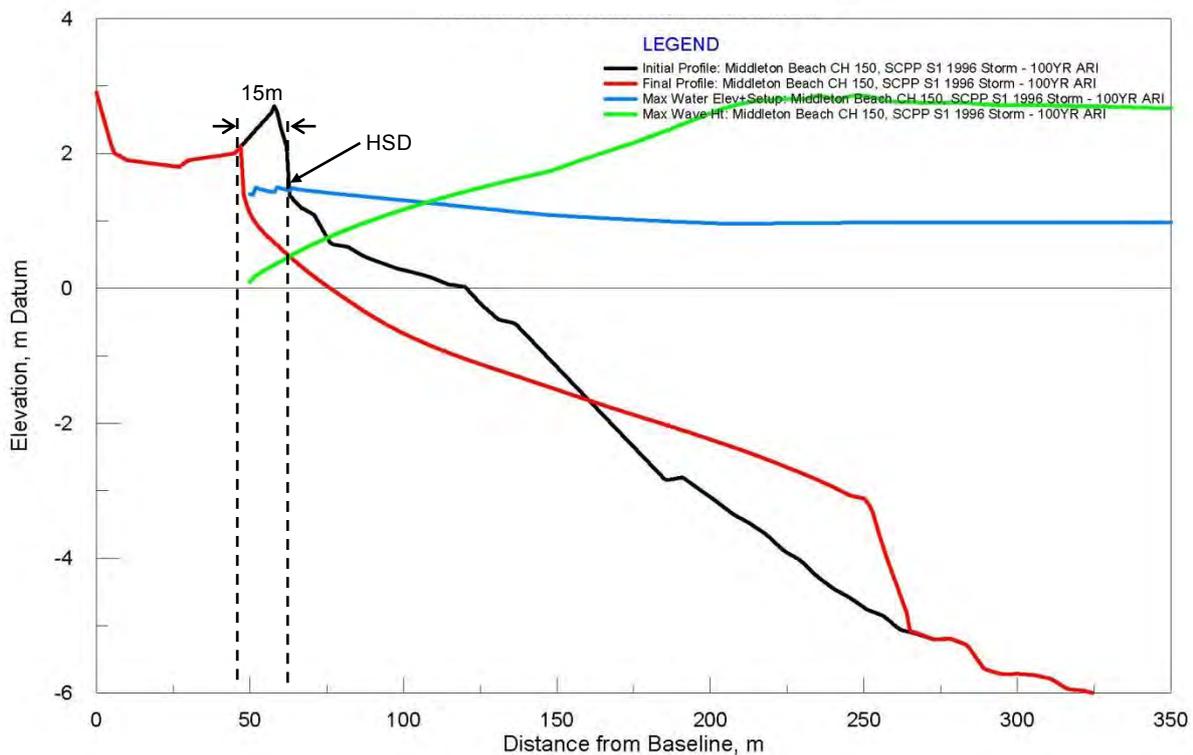
The input beach profile for the model was taken from a land survey completed by Harley Dykstra in 2015 and a hydrographic survey undertaken by the Department of Transport (DoT) in 2014 out to approximately 500m offshore. The profile was then extended to 10 m of water using nautical charts of the area. The nearshore alignment of the profile is shown in Figure 3.3.



**Figure 3.3 SBEACH Profile – Nearshore Alignment**

It is common practise in Western Australia to use three repeats of the severe storm sequence experienced in the south west of Western Australia during July 1996 to represent the 100 year ARI beach erosion event. This event had a duration of approximately 111 hours, as a result, three repeats of this storm have a total duration of 333 hours. The full duration of this storm sequence was used in this modelling study and is believed to conservatively represent the 100 year ARI event for beach erosion for the southwest of Western Australia.

The attenuation factor previously discussed was used to scale the nearshore conditions for input into the SBEACH model. These wave conditions, combined with the water levels recorded during the July 1996 event, were used to simulate the erosion that could occur in front of the Middleton Beach Activity Centre during the 100 year ARI storm erosion event. The result of this simulation is shown in Figure 3.4. The Figure shows the initial and final beach profiles, peak water levels and peak wave heights.



**Figure 3.4 SBEACH Severe Storm Erosion – 100 year ARI**

The severe storm erosion allowance is determined as the extent of erosion behind the Horizontal Shoreline Datum (HSD). The HSD corresponds to the seaward shoreline contour representing the peak steady water level of the modelled event. In this instance, the HSD is located at the base of the existing retaining wall at the rear of Middleton Beach as shown in Figure 3.5. The fact that the HSD is located at the base of the retaining wall and is not simply a continuation of the alignment on the beach and dunes to the north is an artefact of the artificial beach management that occurs in this area and results in a lower beach elevation. This beach management (discussed in further detail in Section 3.2) is therefore having an effect on the vulnerability of the shoreline and adjacent assets in this area.

No design information or as-constructed drawings of the existing retaining wall are available. Without further investigation of its extent and current condition, there is no compelling evidence that suggests the existing retaining wall is founded adequately to be able to withstand the design severe storm event. Therefore, it has been assumed that the existing retaining wall does not provide any protection during the event.



**Figure 3.5 Location of Horizontal Shoreline Datum (HSD)**

The results of the SBEACH modelling show that the severe storm erosion allowance for the Middleton Beach Activity Centre should be 15 m behind the HSD. This estimate includes a maximum avalanching slope of 30° to the horizontal. To put this result in context, a severe storm from the south east was experienced in Albany in 1984. This storm caused up to 35 m of erosion on the section of Middleton Beach approximately 2 km north east of the site, however at the proposed Activity Centre site the erosion was less than around 10 m. An allowance of 15 m for the 100 year ARI event therefore seems appropriate.

#### **3.1.4 S1 Allowances**

The S1 Allowances for each of the planning timeframes are presented in Table 3.2. It should be noted that the same allowance has been allocated to all planning timeframes as SPP2.6 specifies that the design storm should have an AEP of 1%, therefore the storm severity is the same, regardless of the timeframe being considered.

**Table 3.2 S1 Erosion Allowances**

Planning Timeframe	S1 Allowance (m)
Present day (2015)	15
2040	15
2065	15
2090	15
2115	15

**3.2 Historical Shoreline Movement (S2 Allowance)**

Historically, changes in shoreline positions occur on varying timescales from storm to post storm, seasonal and longer term (Short, 1999). The severe storm erosion allowance accounts for the short term storm induced component of beach change. The long term trends allowed for in the Historical Shoreline Movement (S2) Allowance account for the movement of the shoreline that may occur within the planning timeframes. To estimate the S2 Allowance, long term historical shoreline movement trends are examined and likely future shoreline movements predicted.

Historical vegetation lines dating back to 1943 were provided by DoT. The accuracy of the position of these vegetation lines is believed to be in the order of ±5 m, depending on the resolution of the aerial photographs and the rectification process. An additional vegetation line from 2014 aerial imagery was also mapped by MRA in accordance with DoT’s methodology and specification for mapping coastal demarcation lines (DoT, 2009).

Review of the local geomorphology shows that the section of shoreline extending from Middleton Beach to Emu Point is essentially a closed sediment cell, with minimal sediment exchange, if any, expected to occur past the rocky shorelines to the east and west. As a result, consideration of the changes in the historical shoreline position should be considered in the context of changes observed over the entire beach. Using the vegetation lines, the position of the shoreline was determined at 100 to 200 m intervals across the sediment cell. Figure 3.6 shows the chainages assigned for this assessment.



**Figure 3.6 Shoreline Movement Chainages – Middleton Beach to Emu Point**

When considering the historical changes to the shoreline it is important to understand any anthropogenic influences or management actions that could have had an impact on the behaviour of the beach. The City of Albany has provided information regarding the management of the beach in front of the proposed Middleton Beach Activity Centre. The City and the Surf Life Saving Club remove seaweed and vegetation from the beach on a regular basis. Additionally, sand that builds up against the base of the existing retaining wall at the rear of the beach is removed. Such management procedures can influence the assessment of historical shoreline movement trends at the location of the managed area. In particular, the cleaning of the beach and removal of vegetation makes assessment of the historical changes in beach location (usually measured by reviewing the location of the ephemeral vegetation line) impossible.

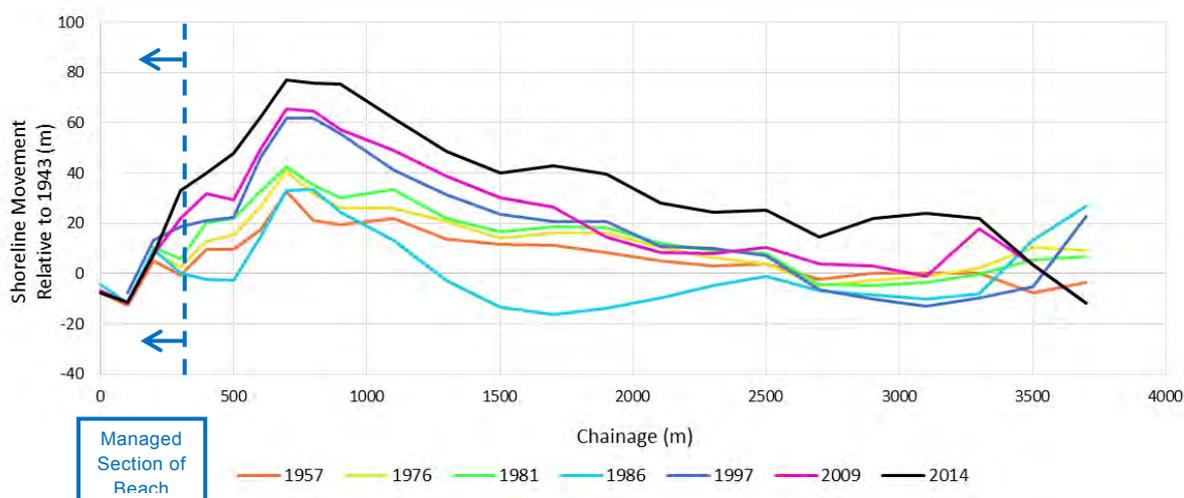
Furthermore, the City of Albany has also advised that sand nourishment completed at Emu Point during May 2014 was sourced from the beach in front of the proposed Middleton Beach Activity Centre. A total of 10,000 m<sup>3</sup> was extracted from the area. The removal of this volume of sand would affect the position of the shoreline. Additionally, to reach equilibrium sediment from further along the beach would migrate into the extraction area. This would therefore cause recession of the vegetation line, or at least narrowing of the beach on the adjacent shoreline.

In order to combat the influence of these management procedures and gain an understanding of the likely historical shoreline movement at the site if no management was undertaken, the S2 Allowance was assessed at the location shown in Figure 3.7. It is noted that the extraction of the 10,000 m<sup>3</sup> of material would have influenced the beach in this location, however it is expected that the impact on the ephemeral vegetation line would have been minimal in the context of the overall assessment.



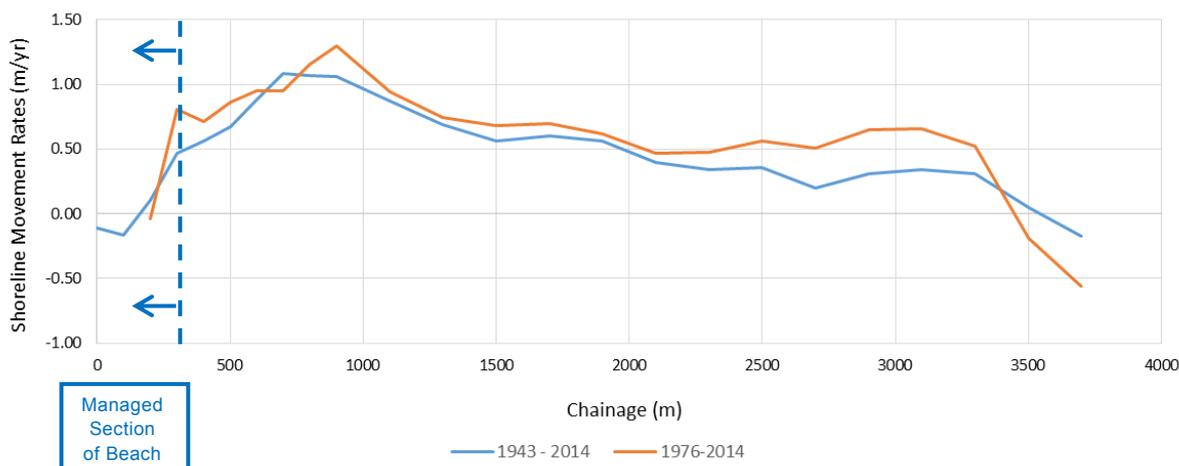
**Figure 3.7 S2 Allowance Assessment Profile (Nearmap, 2014)**

Remaining mindful of the beach management works, the shoreline movements, relative 1943, are presented in Figure 3.8.



**Figure 3.8 Historical Shoreline Movement Relative to 1943 Baseline**

The results of this analysis shows that Middleton Beach generally accreted between 1943 and 2014. The rate of shoreline movement over this period has been determined from these shoreline movement measurements and is presented in Figure 3.9. For the purposes of comparison of shoreline movement rates throughout the period the rate of shoreline movement between 1976 and 2014 has also been included.



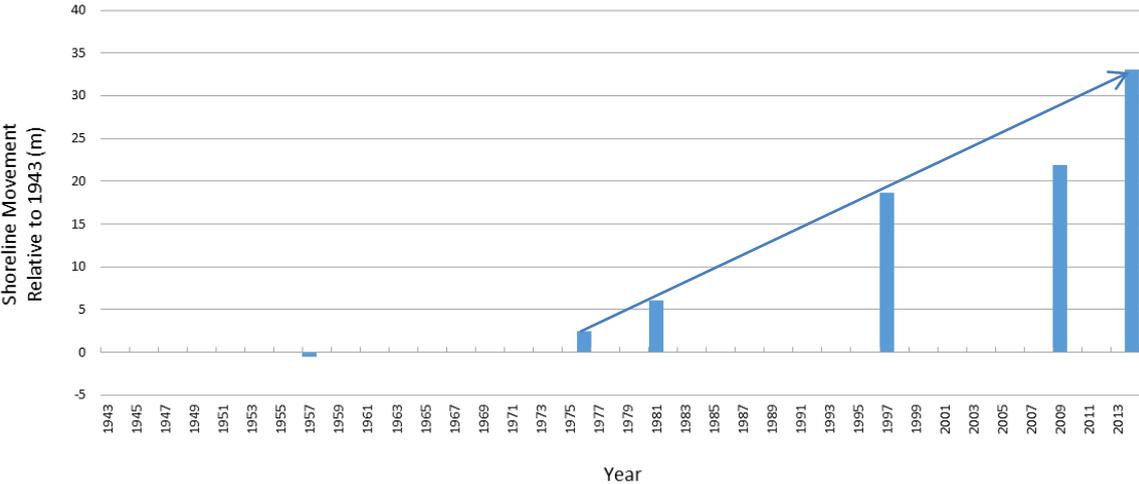
**Figure 3.9 Shoreline Movement Rates**

The shoreline movement and shoreline movement rate plots both show that almost the entire shoreline within the sediment cell has accreted over the longer term. The obvious exception to this is the shoreline at Emu Point, which has experienced erosion and is subject to ongoing coastal protection works. Interestingly, the accretion rates appear to be higher towards the south western end of the beach, however they apparently decrease at the very south western end. This is expected to be the result of the beach management works that occur in this area and is therefore not considered to be representative of the overall sediment dynamics.

The fact that almost the entire shoreline has accreted at an average rate of between 0.5 to 1 m per year over the long term means that the shoreline must be fed by a source of sediment. The source of this sediment is difficult to determine without further, more detailed investigation, however the expectation is that this sediment could be deposited on the shoreline as a result of

sediment outflow from Oyster Harbour or through onshore feed of sediment driven by persistent swell energy, or a combination of the two. Regardless of the actual source, given the persistence of this trend it is considered unlikely that the source will dissipate within the foreseeable future.

More specifically for the Activity Centre, an analysis of the historical shoreline movement at the profile location shown in Figure 3.6 shows a general accretion trend since 1943, however a more significant accretion trend is observed since 1976. The accretion of the shoreline at the profile analysed can be seen in the time history plot in Figure 3.10.



**Figure 3.10 Historical Shoreline Movement Time History**

The time history plot shows that there has been sustained accretion since 1976 with accretion rates of the vegetation line in the order of 0.8 m/yr. This is slightly less than the long term accretion rates observed on the beach to the north east (refer Figure 3.8) that are outside of the management area. Peak shoreline accretion rates in these areas are between 1.0 to 1.3 m/yr.

The SPP2.6 states that if there is compelling evidence that accretion is likely to continue into the future for a period of at least 50 years, then a reduction in the coastal setback distance is warranted. The S2 Allowance can therefore be calculated at a rate of minus 0.5 times the assessed likely future rate of accretion. For this assessment, even though it is likely that the beach management actions are reducing the shoreline accretion rate in front of the proposed Middleton Beach Activity Centre, a future accretion rate of 0.8 m/yr will be adopted. As a result, S2 Allowances will be determined as -0.4 m/yr for each of the different planning horizons. The resultant S2 Allowances are presented in Table 3.3.

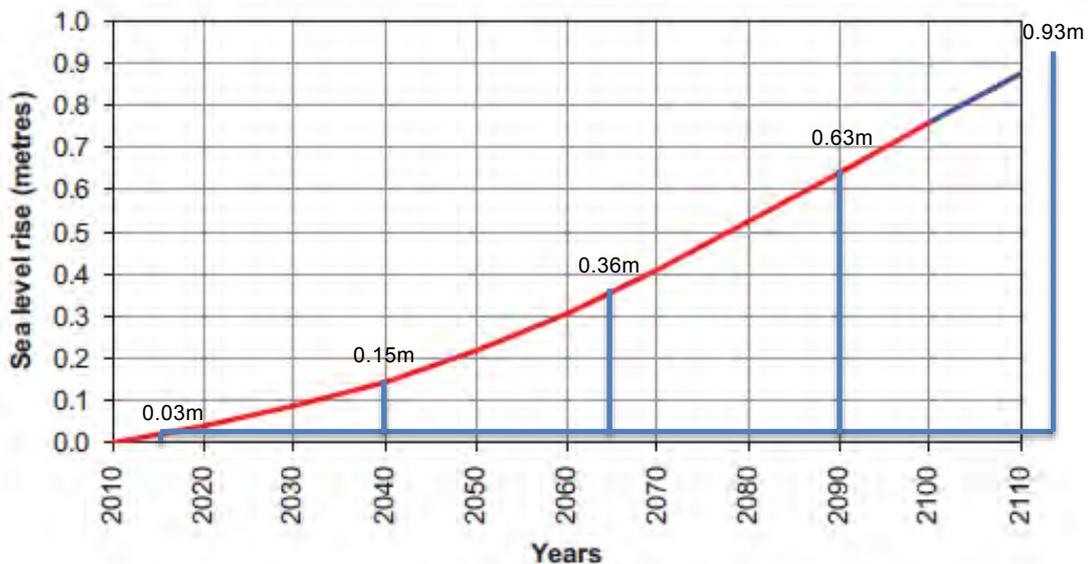
**Table 3.3 S2 Allowances**

Planning Timeframe	S2 Allowance (m)
Present day (2015)	0
2040	-10
2065	-20
2090	-30
2115	-40

Notes 1. Negative allowances are taken as reductions in coastal setback distances.

### 3.3 Sea Level Rise (S3 Allowance)

The Department of Transport released recommendations on the appropriate allowances for climate change and sea level rise to be used for coastal planning in Western Australia (DoT 2010). This sea level rise scenario has been adopted within SPP2.6 and is presented in Figure 3.11.



**Figure 3.11 Recommended Sea Level Rise Allowance (DoT 2010)**

The recommended allowances for sea level rise for each of the planning horizons have been determined based on the graph in Figure 3.11. The sea level rise allowances for each of the planning timeframes are presented in Table 3.4. All values of sea level rise were estimated relative to the predicted 2015 level.

**Table 3.4 Sea Level Rise Allowances**

Planning Timeframe	Sea Level Rise Allowance
Present day (2015)	0.00 m
2040	0.12 m
2065	0.33 m
2090	0.60 m
<b>2115</b>	<b>0.90 m</b>

The effect of sea level rise on the coast is difficult to predict. Komar (1998) provides a reasonable treatment for sandy shores, including examination of the Bruun Rule (Bruun 1962). The Bruun Rule relates the recession of the shoreline to the sea level rise and slope of the nearshore sediment bed:

$$R = \frac{1}{\tan(\theta)} S$$

where: R = recession of the shore.

$\theta$  = average slope of the nearshore sediment bed.

S = sea level rise.

Komar (1998) suggests that the general range for a sandy shore is  $R = 50S - 100S$ . SPP2.6 recommends that for sandy coasts the recession be taken as 100 times the estimated rise in sea level. Therefore, the recommended allowances for shoreline recession due to sea level rise are presented in Table 3.5 or each of the different planning horizons.

**Table 3.5 Allowances for Shoreline Recession Due to Sea Level Rise (S3)**

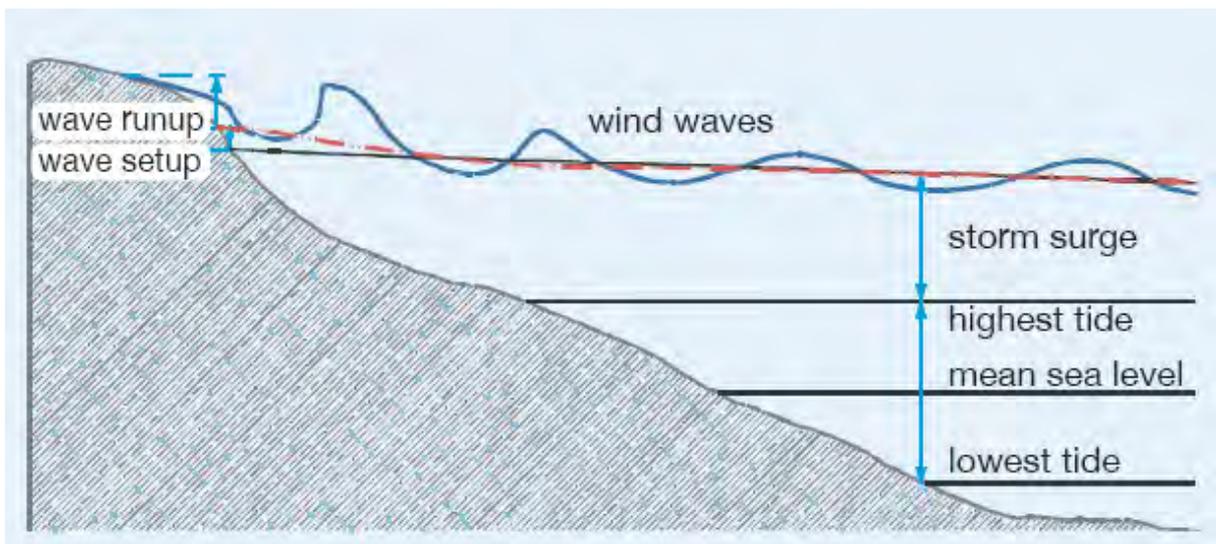
Planning Timeframe	Sea Level Rise Allowance
Present day (2015)	0 m
2040	12 m
2065	33 m
2090	60 m
<b>2115</b>	<b>90 m</b>

### 3.4 Storm Surge Inundation (S4 Allowance)

With respect to inundation, SPP2.6 requires that development consider the potential effects of an event with an Annual Encounter Probability (AEP) of 0.2% per year. This is equivalent to an inundation event with an Average Recurrence Interval (ARI) of 500 years.

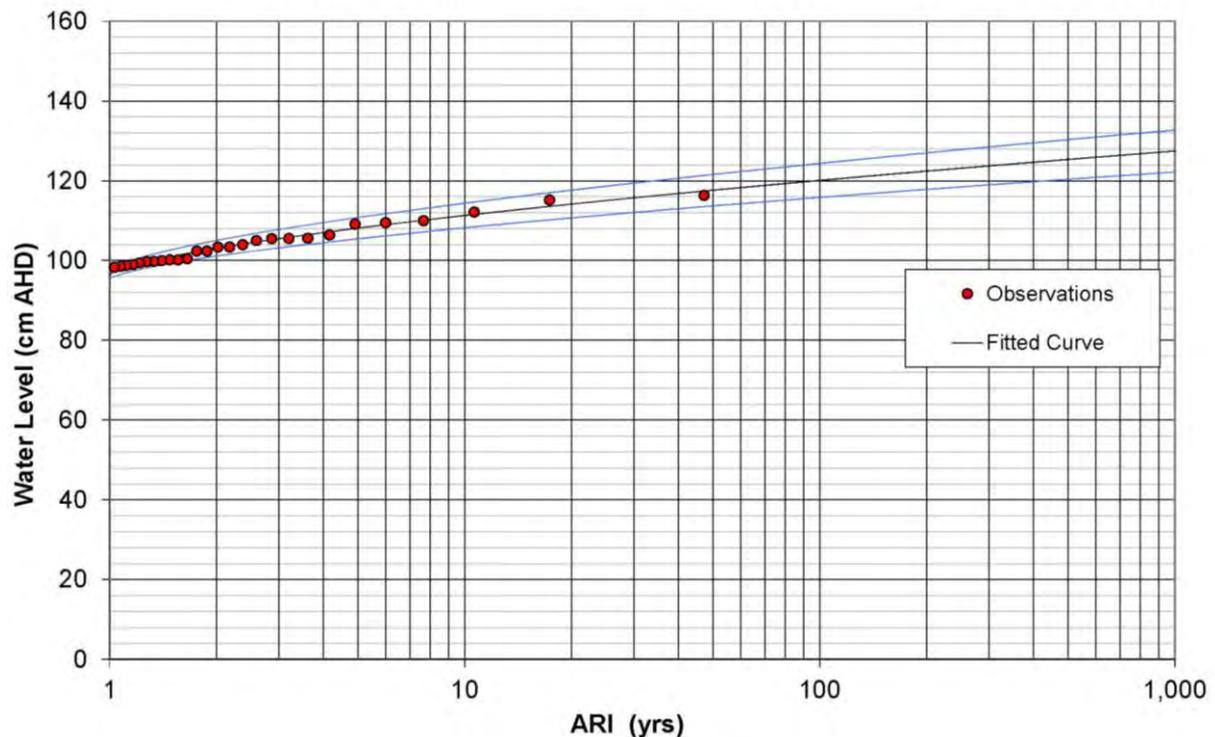
Assessment of the inundation level requires consideration of peak storm surge, including wave setup. A storm surge occurs when a storm with high winds and low pressures approaches the coastline (refer Figure 3.12). The strong, onshore winds and large waves push water against the coastline (wind and wave setup) and the barometric pressure difference creates a region of high water level. These factors acting in concert create the storm surge. The size of the storm surge is influenced by the following factors.

- Wind strength and direction.
- Pressure gradient.
- Seafloor bathymetry.
- Coastal topography.



**Figure 3.12 Storm surge components**

A long term water level record is available for Albany. MRA has previously reviewed this water level record and completed an extreme analysis on the data. MRA used 26 years of data from DoT records to assess the design water levels. These records are considered to be applicable in 10 m of water because of the locations of the tide gauge. An ARI curve of the extreme analysis of the water level data is presented Figure 3.13.



**Figure 3.13 Albany Water Level Analysis**

This extreme analysis provides an estimate of the peak water levels observed within the Port of Albany; however on an exposed coastline (i.e. Middleton Beach) other processes act to increase the peak steady water level – such as wave setup.

Dean and Walton (2008) provide a comprehensive review of investigations into the extent of wave setup on beaches. The review includes work by Hansen (1978); Guza and Thornton (1981); Holman and Sallenger (1985); Nielsen (1988); Davis and Nielsen (1988); King et al (1990); Yanagishima and Katoh (1990); Greenwood and Osborne (1990); Hanslow and Nielsen (1993); Lentz and Raubenheimer (1999); Raubenheimer, Guza and Elgar (2001) and Stockdon et al (2006). These investigations were completed on a variety of different beach types throughout the world, including in the North Sea, Japan, USA and Australia.

Results from each of the different investigations show varying levels of wave setup for a variety of reasons, including measurement difficulties. However, each of the studies indicated that wave setup does occur in the nearshore area. In particular, findings from many of the studies show that the majority of this setup occurs on the beachface.

Given the findings of the aforementioned investigations show that the majority of wave setup occurs on the beachface, this wave setup is not expected to be included in the water levels that have been recorded within the Inner Harbour. This is due to the fact that the water level records within the Port of Albany have been recorded within waters that are sheltered from wave breaking effects, particularly those on a beachface. As a result, these recorded water levels would not include the nearshore wave effects. The effects of nearshore wave setup should therefore be added to the extreme water level determined from the Port of Albany records to provide a reasonable estimate of the peak steady water levels at the site.

From this assessment, the 500 year ARI water levels in 10 m of water were estimated to be 1.24 mAHD. SBEACH (previously outlined in Section 3.1.1) was used to translate the water levels to the nearshore area to incorporate the effects of nearshore setup. It was found that wave setup in the order of 0.65 m could be expected at the site. As a result, the following potential inundation levels should be considered as part of the coastal hazard risk management and adaptation planning in order to comply with the requirements of SPP2.6. It should be noted that these levels do not include the potential effects of wave run-up, which may need to be considered for infrastructure located close to the beach face.

**Table 3.6 500 year ARI inundation levels for each of the planning timeframes**

Component	2015	2040	2065	2090	2115
500 yr ARI peak steady water level within Port of Albany (mAHD)	1.24	1.24	1.24	1.24	1.24
Allowance for nearshore setup (wind and wave) (m)	0.65	0.65	0.65	0.65	0.65
Allowance for Sea Level Rise (m)	0.00	0.12	0.33	0.60	0.90
<b>Total Water Level (mAHD)</b>	<b>1.89</b>	<b>2.01</b>	<b>2.22</b>	<b>2.49</b>	<b>2.79</b>

### 3.5 Coastal Hazard Mapping

The allowances for coastal processes, as determined in the preceding sections are presented in Table 3.7. It should be noted that a 0.2 m/yr allowance for uncertainty has also been included in the total coastal processes allowances as required by SPP2.6. The total vulnerability allowances should be measured from the HSD.

**Table 3.7 Summary of Vulnerability Allowances Coastal Processes**

Timeframe	Severe Storm Erosion (m)	Historic Shoreline Movement Trends (m)	Recession due to Sea Level Rise (m)	Allowance for Uncertainty (0.2 m/yr)	Vulnerability Allowance (m)
<b>2040</b>	15	-10	13	5	<b>23</b>
<b>2065</b>	15	-20	36	10	<b>41</b>
<b>2090</b>	15	-30	62	15	<b>62</b>
<b>2115</b>	15	-40	90	20	<b>85</b>

Notes: 1.Allowances are relative to the HSD.

The sum of each of the allowances outlined in the above table provides an indication of the areas that could be at risk from erosion over the different planning timeframes. The areas that could be affected relative to the current HSD are shown in the Drawing attached as Appendix A.

## 4. Risk Analysis

In accordance with WAPC (2014) a risk based approach has been used to assess the potential for coastal hazards to impact existing assets as well as those assets and development areas proposed as part of the Middleton Beach Activity Centre. As coastal hazards are the focus of this assessment, it is the likelihood and consequences of these coastal hazards that need to be considered.

### 4.1 Likelihood Rating

WAPC (2014) defines the likelihood as the chance of erosion or storm surge inundation occurring or how often they impact on existing and future assets and values. This requires consideration of the frequency and probability of the event occurring over a given horizon.

The probability of an event occurring is often related to the Annual Encounter Probability (AEP) or the Average Recurrence Interval (ARI). The use of the AEP to define impacts of coastal hazards over the planning timeframe assumes that events have the same probability of occurring each year. However, given the potential impact of climate change and sea level rise, which has a large influence on the assessed coastal hazard risk, this is not true. A scale of likelihood has therefore been developed, which follows the Australian Standard Risk Management Principles and Guidelines (AS/NZS ISO 31000:2009). This is presented in Table 4.1.

**Table 4.1 Scale of Likelihood**

Rating	Description / Frequency
Almost Certain	There is a high possibility the event will occur as there is a history of frequent occurrence 90-100% probability of occurring over the timeframe.
Likely	It is likely the event will occur as there is a history of casual occurrence 60-90% probability of occurring over the timeframe.
Possible	The event may occur 40-60% probability of occurring over the timeframe.
Unlikely	There is a low possibility that the event will occur 10-40% probability of occurring over the timeframe.
Rare	It is highly unlikely that the event will occur, except in extreme / exceptional circumstances. 0-10% probability of occurring over the timeframe.

The likelihood and consequence of coastal hazards is different for erosion and inundation. As a result, the likelihood and consequence of erosion and inundation should be considered separately. The likelihood of coastal hazard impacts are discussed in the following sections.

#### 4.1.1 Coastal Erosion

An assessment of the relative likelihood of each of the identified key assets being impacted by coastal erosion hazards has been completed and is presented in Table 4.2. This assessment was completed using the coastal vulnerability lines presented Appendix A.

**Table 4.2 Assessment of Likelihood of Coastal Erosion Impact**

Key Assets	Present Day	2040	2065	2090	2115
<b>Environment</b>					
Middleton Beach	Rare	Unlikely	Possible	Almost Certain	Almost Certain
<b>Social</b>					
Middleton Beach Foreshore Park	Rare	Unlikely	Possible	Almost Certain	Almost Certain
Albany Surf Life Saving Club	Rare	Unlikely	Almost Certain	Almost Certain	Almost Certain
3 Anchors Restaurant	Rare	Rare	Likely	Almost Certain	Almost Certain
Flinders Parade Car-Park	Rare	Rare	Rare	Possible	Almost Certain
Residential Development (Existing)	Rare	Rare	Rare	Rare	Rare
Residential Development (Proposed)	Rare	Rare	Rare	Rare	Rare
<b>Economic</b>					
Flinders Parade (Realigned)	Rare	Rare	Rare	Rare	Rare
Hotel Site (Proposed)	Rare	Rare	Rare	Likely	Almost Certain

Key points to note regarding the assessment of likelihood of coastal erosion impact on each of the key assets are summarised below.

- The assessed likelihood of coastal erosion impact on the different items of infrastructure was completed by assessing the potential for impacts caused by longer time shoreline movements (such as the allowances for long term shoreline movement and coastal erosion caused by sea level rise) combined with the likelihood of severe storm erosion. For instance, it was assessed that the longer term shoreline movement allowances would be realised for the respective planning horizons, while the actual probability of a severe storm

event being experienced within that period was used (i.e. there is a 1% chance of the 100 year ARI event being experienced in 2015).

#### **4.1.2 Coastal Inundation**

Assessment of the likelihood of coastal inundation is slightly different to that for coastal erosion, for a couple of reasons.

Firstly, the potential for coastal inundation will change in the future as the sea level rises. This means that an area that would only be inundated during a very severe event in the present day could potentially be inundated by a much less severe event in the future. Assessment of the probability of an area being inundated within a given planning horizon therefore needs to consider the changing probability of event occurrence throughout that planning horizon.

As an example, an area with an elevation of 1.89 mAHD would just be inundated by the 500 year ARI event in 2015. However, it would be inundated by approximately the 15 year ARI event in 2040, but by less than the 1 year ARI event in 2070. Combining all of these probabilities of occurrence on an annual basis would mean that the actual chance of an area with an elevation of 1.89 mAHD being inundated over a planning horizon to 2115 would be around 94%. Similar probabilities of occurrence can be determined for other development levels and planning horizons. These probabilities have been used to determine the likelihood of each of the key assets being impacted by inundation for each planning horizon.

It should be noted, that this assessment has been completed on the basis that any new development (the hotel and residential) within the Middleton Beach Activity Centre will be at a level above 3.0 mAHD, as is understood to be required for servicing.

**Table 4.3 Assessment of Likelihood of Coastal Inundation Impact**

Key Assets	Present Day	2040	2065	2090	2115
<b>Environment</b>					
Middleton Beach	Almost Certain				
<b>Social</b>					
Middleton Beach Foreshore Park (2.2mAHD)	Rare	Rare	Rare	Unlikely	Possible
Albany Surf Life Saving Club (2.5mAHD)	Rare	Rare	Rare	Rare	Unlikely
3 Anchors Restaurant (2.15mAHD)	Rare	Rare	Possible	Almost Certain	Almost Certain
Flinders Parade Car-Park (2.2mAHD)	Rare	Rare	Rare	Unlikely	Possible
Residential Development (Existing) (4.0mAHD)	Rare	Rare	Rare	Rare	Rare
Residential Development (Proposed) (>3.0mAHD)	Rare	Rare	Rare	Rare	Rare
<b>Economic</b>					
Flinders Parade (Realigned) (>3.0mAHD)	Rare	Rare	Rare	Rare	Rare
Hotel Site (Proposed) (>3.0mAHD)	Rare	Rare	Rare	Rare	Rare

## 4.2 Consequence Rating

The second part of the risk assessment is determining the consequence of the coastal hazards. A scale of consequence has been developed which provides a range of impacts and is generally consistent with the Australian Greenhouse Office (AGO 2006).

**Table 4.4 Scale of Consequence**

Rating	Social	Economic	Environment
Catastrophic	Loss of life and serious injury. Large long term or permanent loss of services, employment wellbeing, finances or culture (75% of community affected), international loss, no suitable alternative sites exist	Damage to property, infrastructure or local economy > \$20M	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage
Major	Serious injury. Medium term disruption to services, employment wellbeing, finances or culture (<50% of community affected), national loss, limited alternative sites exist	Damage to property, infrastructure or local economy > \$5M to \$20M	Severe loss of environmental amenity and a danger of continuing environmental damage
Moderate	Minor injury. Major short or minor long term disruption to services, employment wellbeing, finances or culture (<25% of community affected), regional loss, many alternative sites exist	Damage to property, infrastructure or local economy > \$500,000 to \$5M	Isolated but significant instances of environmental damage that might be reversed with intensive efforts. Recovery may take several years.
Minor	Small to medium disruption to services, employment wellbeing, finances or culture (<10% of community affected), local loss, many alternative sites exist	Damage to property, infrastructure or local economy > \$50,000 to \$500,000	Minor instances of environmental damage that could be reversed. Consistent with seasonal variability, recovery may take one year.
Insignificant	Minimal short-term inconveniences to services, employment, wellbeing, finances or culture (<5% of community affected), neighbourhood loss, many alternative sites exist	Damage to property, infrastructure or local economy < \$50,000	Minimal environmental damage, recovery may take less than 6 months.

Similar to the assessment of likelihood, the consequence rating has been completed separately for coastal erosion and coastal inundation. The main reason for this is because, typically, the consequences associated with coastal erosion are more significant than those associated with coastal inundation. This arises due to the fact that coastal erosion is generally more permanent and often less easy to overcome than coastal inundation. An example of this would be if the

foundations of a house were undermined by erosion it is likely that the structure would fail, however if a house was inundated, structural failure would reasonably be expected to be less likely.

The consequence ratings for coastal erosion and coastal inundation are outlined below.

#### 4.2.1 Coastal Erosion

The assessed consequences of coastal erosion for each of the planning timeframes are outlined in Table 4.5. As shown in the table, the consequences of erosion vary for some key assets over different timeframes due to the potential effects of increased erosion. For instance, a small amount of erosion could expose the foundation of a house but not cause any significant damage, and would therefore be insignificant, however a larger amount of erosion could undermine this foundation, with the effect being far more severe.

**Table 4.5 Assessment of Consequence of Coastal Erosion Impact**

Key Assets	Present Day	2040	2065	2090	2115
<b>Environment</b>					
Middleton Beach	Insignificant	Minor	Minor	Minor	Minor
<b>Social</b>					
Middleton Beach Foreshore Park	Insignificant	Minor	Minor	Minor	Minor
Albany Surf Life Saving Club	Insignificant	Moderate	Moderate	Moderate	Moderate
3 Anchors Restaurant	Insignificant	Minor	Moderate	Moderate	Moderate
Flinders Parade Car-Park	Insignificant	Insignificant	Insignificant	Minor	Minor
Residential Development (Existing)	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Residential Development (Proposed)	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
<b>Economic</b>					
Flinders Parade (Realigned)	Insignificant	Insignificant	Insignificant	Insignificant	Moderate
Hotel Site	Insignificant	Insignificant	Minor	Major	Major

Further details regarding the rationale behind the consequence ratings for coastal erosion are provided below.

- The consequence of coastal erosion impact on Middleton Beach has been classified as insignificant where any impact would result only in the migration of the beach (i.e. where

there is sufficient space available for the beach to migrate unimpeded). Where the beach could be lost the classification has been increased to minor. This rating has been used as it is not expected that there would be any significant environmental damage given the total length of this section of beach is small compared to the total length of Middleton Beach. Similarly from a social perspective, many alternative beaches exist.

- The consequence of coastal erosion impact of all infrastructure assets has been assessed as insignificant until they were directly affected by erosion.
- The consequence of erosion to Existing and Proposed Residential Development has been assessed to be insignificant, as the extent of the erosion is unlikely to impact Residential Development.
- The consequences of erosion on the Middleton Beach Foreshore Park and Flinders Parade Car Park have been assessed to be insignificant until they were directly affected by erosion. Thereafter, the consequence has been assessed as minor given that they are relatively small assets with values expected to be less than around \$500,000.
- The consequence of erosion to the Albany Surf Life Saving Club and 3 Anchors Restaurant have been assessed as moderate by 2040 and 2065 respectively, as erosion of the infrastructure would likely require reconstruction, which would be expected to cost more than around \$500,000.
- The consequence of erosion to the realigned Flinders Parade has been assessed as moderate by 2115, as erosion of the road would likely require its reconstruction, which would be expected to cost more than around \$500,000.
- The consequence of erosion to the Hotel Site has been assessed to be minor until 2065 as it is likely that only the promenade infrastructure such as landscaping and pavement would be impacted by erosion. By 2090 the rating could increase to major as potential damage cause by erosion may be greater than around \$5 million.

#### **4.2.2 Coastal Inundation**

The assessed consequence of coastal inundation for each of the key assets and each of the planning horizons is presented in Table 4.6.

**Table 4.6 Assessment of Consequence of Coastal Inundation Impact**

Key Assets	Present Day	2040	2065	2090	2115
<b>Environment</b>					
Middleton Beach	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
<b>Social</b>					
Middleton Beach Foreshore Park	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Albany Surf Life Saving Club	Insignificant	Insignificant	Insignificant	Insignificant	Minor
3 Anchors Restaurant	Insignificant	Insignificant	Minor	Moderate	Moderate
Flinders Parade Car-Park	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Residential Development (Existing)	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Residential Development (Proposed)	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
<b>Economic</b>					
Flinders Parade (Realigned)	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Hotel Site	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant

Further details regarding the rationale behind the inundation consequence ratings are provided below.

- The consequence of Middleton Beach being inundated is expected to be insignificant. This is because inundation of beaches in itself will not lead to a loss of the asset, as any inundation would be transient and already occurs almost every year.
- The consequence of inundation of the Albany Surf Life Saving Club has been assessed as minor by 2115, as the inundation depths would be small (less than around 0.3 m) and the majority of the ground floor is used for storage of equipment. As a result it is expected that the clean-up may cost slightly in excess of \$50,000, but certainly less than \$500,000.
- The consequence of inundation of the 3 Anchors Restaurant has been assessed by the extent of inundation. For instance by 2065, the consequence has been assessed as minor considering it may only be slightly inundated during this event (less than around 0.1 m) However, by 2090 and thereafter it has been assessed as a moderate consequence due to inundation. This is the case as commercial cooking / cleaning infrastructure could be damaged during the inundation event. Replacement of such infrastructure, and loss of revenue during the clean-up, may cost in excess of \$500,000.

- The consequence of the Middleton Beach Foreshore Park being inundated is expected to be insignificant. This is because inundation of the parklands themselves will not lead to a loss of the asset, as any inundation would be transient. Clean up of this area would be expected to cost less than \$50,000.
- The consequence of the Realigned Flinders Parade being inundated is expected to be insignificant. This is because inundation of the roads will not lead to a loss of the asset, as any inundation would be transient. Clean up of the Realigned Flinders Parade would be expected to cost less than \$50,000.
- The consequence of inundation of the Hotel Site and Existing and Proposed Residential Development has been assessed as insignificant. This is because this infrastructure will be constructed with a finished floor level in excess of 3.0 mAHD.

## 5. Risk Evaluation

### 5.1 Risk Evaluation Matrix

The risk rating from a risk assessment is defined as “likelihood” x “consequence.” A risk matrix defining the levels of risk from combinations of likelihood and consequence has therefore been developed for the coastal hazards. This risk matrix is generally consistent with WAPC (2014).

**Table 5.1 Risk Matrix**

RISK LEVELS		CONSEQUENCE				
		Insignificant	Minor	Moderate	Major	Catastrophic
LIKELIHOOD	Almost Certain	Low	Medium	High	Extreme	Extreme
	Likely	Low	Medium	Medium	High	Extreme
	Possible	Low	Medium	Medium	Medium	High
	Unlikely	Low	Low	Medium	Medium	Medium
	Rare	Low	Low	Low	Low	Low

A risk tolerance scale assists in determining which risks are acceptable, tolerable and unacceptable. The risk tolerance scale used for the assessment is presented in Table 5.2.

**Table 5.2 Risk Tolerance Scale**

Risk Level	Action Required	Tolerance
Extreme	Immediate action required to eliminate or reduce the risk to acceptable levels	Intolerable
High	Immediate to short term action required to eliminate or reduce risk to acceptable levels	Intolerable
Medium	Reduce the risk or accept the risk provided residual risk level is understood	Tolerable
Low	Accept the risk	Acceptable

The risk tolerance scale shows that the extreme and high risks need to be managed.

### 5.2 Risk Assessment

The risk assessment for the study area has been completed in accordance with the recommendations of AS5334-2013, which requires a detailed risk analysis to include a vulnerability analysis to thoroughly examine how coastal hazards and climate change may affect the asset. This includes consideration of the adaptive capacity and vulnerability of an asset.

Based on the results of the risk analysis completed previously, Table 5.3 presents the risk levels for each of the identified key assets. The order of the assessed risks in the table has been completed to show the priority risk areas for each planning timeframe at the start of the table, with decreasing risk down the table.

The results of this assessment show that the vast majority of assets have a low risk over all planning horizons. This includes the proposed residential development within the Middleton Beach Activity Centre.

With regard to priorities, the most vulnerable asset within the foreshore is the Albany Surf Life Saving Club. A medium level erosion risk is expected to exist for this asset by 2040, however based on the risk tolerance scale, this level of risk should be tolerable provided steps are taken to manage the risk. Such management would include monitoring the shoreline to track changes and provide an early warning if risks become elevated due to shoreline change. By 2065, this risk could increase to a high risk, which would require management, however this management strategy would need to be determined by the City of Albany. To date it is understood that the City have not considered any potential risk mitigation strategies for this asset.

A number of medium risks also exist by 2065. This includes erosion and inundation risks for the 3 Anchors Restaurant as well as erosion risk for Middleton Beach and the Middleton Beach Foreshore Park. As for the medium risk posed to the Surf Club in 2040, it is expected that these risks would be best managed by a monitoring process, though consideration of the adaptation strategies would need to be considered by the City of Albany who are responsible for the management of these areas.

More significantly, high levels of risk are expected for the 3 Anchors Restaurant (for both inundation and erosion) and the proposed Hotel Site (erosion) by 2090. These high levels of risk would require management action. Looking further forward, the hotel site could be subject to an extreme level of risk by 2115 if management action has not been completed prior to this time.

Further details regarding the management and adaptation options as they relate to the proposed development are provided in Section 6.

**Table 5.3 Preliminary Assessment of Risk Levels**

Key Asset	Coastal Hazard Description	Assessed Risk Level				
		Present Day	2040	2065	2090	2115
Albany Surf Life Saving Club	Erosion	Low	Medium	High	High	High
3 Anchors Restaurant	Inundation	Low	Low	Medium	High	High
3 Anchors Restaurant	Erosion	Low	Low	Medium	High	High
Hotel Site	Erosion	Low	Low	Low	High	Extreme
Middleton Beach Foreshore Park	Erosion	Low	Low	Medium	Medium	Medium
Middleton Beach	Erosion	Low	Low	Medium	Medium	Medium
Flinders Parade Car-Park	Erosion	Low	Low	Low	Medium	Medium
Residential Development (Existing)	Erosion	Low	Low	Low	Low	Low
Residential Development (Proposed)	Erosion	Low	Low	Low	Low	Low
Flinders Parade (Realigned)	Erosion	Low	Low	Low	Low	Low
Middleton Beach	Inundation	Low	Low	Low	Low	Low
Middleton Beach Foreshore Park	Inundation	Low	Low	Low	Low	Low
Albany Surf Life Saving Club	Inundation	Low	Low	Low	Low	Low
Flinders Parade Car-Park	Inundation	Low	Low	Low	Low	Low
Residential Development (Existing)	Inundation	Low	Low	Low	Low	Low
Residential Development (Proposed)	Inundation	Low	Low	Low	Low	Low
Flinders Parade (Realigned)	Inundation	Low	Low	Low	Low	Low
Hotel Site	Inundation	Low	Low	Low	Low	Low

## 6. Risk Adaptation & Mitigation Strategies

The SPP2.6 outlines a hierarchy of risk adaptation and mitigation options, where options that allow for a wide range of future strategies are considered more favourably. This hierarchy of options is reproduced in Figure 6.1.



**Figure 6.1 Risk Management & Adaptation Hierarchy**

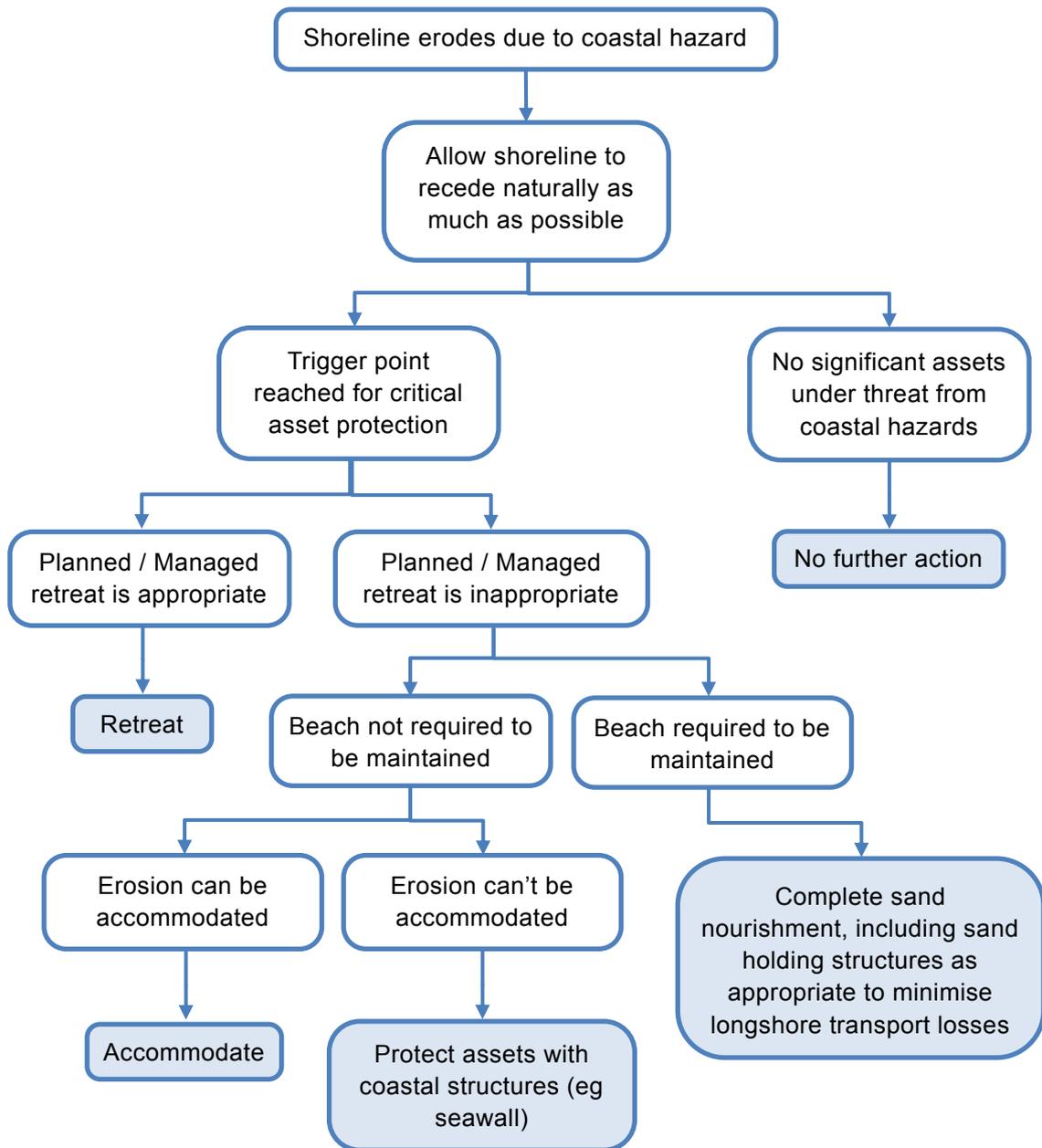
These options are generally outlined below.

- Avoid – avoid new development within the area impacted by the coastal hazard.
- Retreat – the relocation or removal of assets within an area identified as likely to be subject to intolerable risk of damage from coastal hazards.
- Accommodation – measures which suitably address the identified risks.
- Protect – used to preserve the foreshore reserve, public access and public safety, property and infrastructure.

The assessment of options is generally done in a progressive manner, moving through the various options until an appropriate mitigation option is found.

### 6.1 Potential Mitigation Strategies

The decision regarding potential mitigation strategies depends on the key assets in the foreshore and the requirement, or otherwise, to retain a beach in certain areas. Generally, the following flowchart is applicable when considering the potential mitigation strategies.



**Figure 6.2 Indicative Flowchart for Assessment of Coastal Hazard Response**

Potential risk mitigation strategies have been considered for the development proposed as part of the Middleton Beach Activity Centre only, as the risk management for existing assets lies with the City of Albany, who are the entity responsible for the management of these assets. However, it should be noted that any risk management or adaptation proposed for these existing assets could also provide protection to the proposed Hotel Site, which is the most vulnerable portion of the proposed development.

With regard to the risk management and adaptation for the proposed Hotel Site, there are two key adaptation and mitigation strategies that should be considered to reduce the overall risk of coastal erosion. These options are considered, as it is unlikely that a managed retreat option would be acceptable for this level of infrastructure.

- Option 1 – Accommodate the risk of coastal erosion and inundation by increasing the elevation of the managed section of the beach, which is artificially low.
- Option 2 – Protect valuable infrastructure with a seawall to resist the impacts of coastal erosion.

These two options are detailed in the following section.

## 6.2 Option 1 – Increased Beach Elevation

Section 3.2 previously detailed the existing management procedures undertaken by the City of Albany and the Surf Life Saving Club on the beach fronting the proposed Activity Centre. These are as follows:

- Removal of sand that builds up against the base of the existing retaining wall at the rear of the beach.
- Removal of seaweed and vegetation from the beach.

Such management procedures have the following effects on the beach:

- Reduction in the elevation of the beach.
- Prevention of the development of a natural vegetated dune system.

Both of these reduce the beach's ability to resist storm erosion and inundation. Additionally, the removal of 10,000 m<sup>3</sup> of sediment from this area to nourish Emu Beach would have also resulted in a reduction in the level of the beach.

Therefore a way to accommodate the potential risks identified in this investigation would be to increase the level of the beach, above the beach berm, in front of the Middleton Beach Activity Centre. By increasing the beach elevation the HSD could be extended and maintained approximately 30 m seaward of the current HSD. This would be more consistent with the alignment of the HSD on the unmanaged section of shoreline to the north. The extent of the area that could be affected by coastal erosion relative to the proposed HSD and an indicative cross section of the proposed beach profile are shown in the Drawing attached as Appendix B. A critical aspect of this proposal is that the types of beach use on this section of coastline are maintained, albeit, with a slightly increased elevation. This is due to the fact that all this proposal seeks to do is increase the elevation of the beach in this area. Other than the increase in elevation, there should be no impact on the use of the beach, which currently includes beach volleyball, school recreational activities and the like. Nevertheless, there are two aspects of this proposal that require further consideration. These are as follows.

- Increasing the elevation of the beach without also increasing the elevation of the retaining wall at the rear of the beach would be expected to result in an increase in the volume of sand blowing from the beach to the adjacent foreshore park. The current retaining wall is approximately 0.7 m above the level of the beach (refer Figure 6.3). As a result, if a new retaining wall was constructed with a crest level of 0.7 m above the proposed beach level this would maintain the status quo of windblown sand when compared to the current scenario. If an improvement on the current scenario is required, then the crest level of the retaining wall could be increased, or planting immediately adjacent to the wall (either above or below) could assist with the trapping of the sand (noting that if vegetation was used to

trap the sand, the elevation of this area would build up over time and would need to be managed).

- Increasing the elevation of the beach would impact the current drainage outfall locations. The best option to deal with this would be to divert the existing outlets to a less prominent section of the beach.



**Figure 6.3 Existing Retaining Wall**

By relocating the HSD, as proposed, the initial assessment of the likelihood of the Hotel Site being impacted by coastal erosion hazards can now be reassessed. The updated relative likelihoods for the various planning timeframes based on the proposed HSD can be seen in Table 6.1.

**Table 6.1 Hotel Site – Likelihood of Coastal Erosion Impact (Increased Beach Elevation)**

Key Assets	Present Day	2040	2065	2090	2115
Hotel Site	Rare	Rare	Rare	Rare	Unlikely

Considering the consequence rating remains unchanged, the updated risk assessment based on the proposed HSD can be seen in Table 6.2.

It should be noted that the proposed beach profile would need to be monitored and maintained for the following risk assessment of the Hotel Site to be valid.

**Table 6.2 Hotel Site – Preliminary Assessment of Risk Levels (Increased Beach Elevation)**

Key Asset	Coastal Hazard Description	Assessed Risk Level				
		Present Day	2040	2065	2090	2115
Hotel Site	Erosion	Low	Low	Low	Low	Medium

As shown in Table 6.2, the initial ‘extreme’ level of risk by 2115 can be reduced to a medium risk provided the proposed beach profile is sufficiently monitored and maintained. The ‘high level of risk by 2065 and 2090 can be reduced to ‘low’.

The proposed beach profile is able to be constructed by material sourced from the beach itself. As discussed previously in Section 3.2, any deficiency of beach sand caused by the extraction of sand from the current profile would be replaced by sand from further along Middleton Beach over time. It is acknowledged that this area is currently a source of sediment for the nourishment of Emu Point. The modification of the beach, as proposed, would be unlikely to impact this potential extraction of sediment in the future, as the volume of accumulation along the south western portion of the beach should be sufficient for the City to continue with this practice (refer to the shoreline movement rates in this area). Nevertheless, it would be recommended that the City look to extend the extraction zone over the beach up to around chainage 1,000 m. This is important so that the extraction is spread over a larger area of beach and does not inadvertently increase the vulnerability of a portion of the beach if the extraction was focused in one small area. Preliminary cost estimates to construct the proposed beach profile could range between \$150,000 and \$250,000. Following severe storm events additional re-working of the beach profile may be required. Therefore ongoing costs of approximately \$50,000 would be required following severe storms.

**6.3 Option 2 – Seawall**

The construction of a seawall would provide a last line of defence for the protection of the Hotel Site should it ever be threatened by coastal erosion. There are two different alternatives for the construction of a seawall. The first alternative would be to construct a seawall along the alignment of the existing retaining wall. The benefit of this option would be that it would also provide protection to the other assets in the area, such as 3 Anchors Restaurant and the Foreshore Park, however doing so would also increase the potential for the loss of Middleton Beach in this area at some stage in the future if the shoreline was to erode. The total length of seawall required for this alternative would be around 300 m.

The second alternative would be to construct a seawall around the Hotel Site itself. This option would only provide protection to the Hotel Site, but would reduce the risk of loss of Middleton Beach if the shoreline was to erode. The total length of seawall required for this alternative would be around 150 m.

A concept of the two alternative seawall layouts are provided in Figure 6.4.



**Figure 6.4 Concept Layouts for both Seawall Layout Alternatives**

The intent of construction of a seawall in either location would be for it to be buried initially and therefore be as unobtrusive as possible. However, should the shoreline erode to the extent that the seawall became exposed, the aesthetics of the wall could be important. As a result the seawall could be constructed out of either Geosynthetic Sand Containers (GSC's) or rock. Examples of both types of seawalls are shown in Figure 6.5



**Figure 6.5 Example of a GSC Seawall (Top) and a Rock Seawall (Bottom)**

Given the layouts for each of the alternatives, it is expected that the total cost for the alternative 1 seawall would be between \$1.7 to 2.7 million depending on the type of seawall (GSC seawalls are more expensive), while the cost for alternative 2 would be between \$1 to 1.5 million. This cost would cover the initial capital construction cost of the seawall to a standard sufficient to be able to withstand a 100 year ARI event. However, in the event that the seawall is exposed, maintenance

costs for the wall would be applicable and could be estimated to be around 5% of the capital cost per decade.

Provision of an appropriately designed seawall would obviously change the risk profile for the Hotel Site. Provided the seawall was adequately maintained, it is anticipated that the likelihood of the Hotel Site being impacted would be rare for both alternatives for all timeframes. As a result, the erosion risk to the Hotel Site would be low for all timeframes as shown in Table 6.3.

**Table 6.3 Preliminary Assessment of Risk Levels (Seawall)**

Key Asset	Coastal Hazard Description	Assessed Risk Level				
		Present Day	2040	2065	2090	2115
Hotel Site	Erosion	Low	Low	Low	Low	Low

**6.4 Risk Mitigation Triggers**

Given the assessed risk exposure for the Hotel Site, there is unlikely to be any requirement for risk mitigation strategies to be implemented until after 2065. However, given the benefit that would be provided to all existing assets and the relatively low cost of the option, it would be recommended that the increase in elevation of the beach level be completed as a matter of course. Implementation of this option would also further delay the potential requirement for the construction of a seawall to protect the Hotel Site (and other assets if the City choose to do so) until after 2090. The requirement for the construction of the seawall could then be informed by coastal monitoring, with a trigger being set for the construction of the seawall if the shoreline gets within around 25 m from the hotel site (15 m allowance for severe storm erosion plus a 10 m factor of safety).

It should be noted that the mitigation priorities outlined above are contingent on an understanding of the shoreline behaviour over time. As outlined above, monitoring of the shoreline is therefore required to understand the changes and when the construction of the seawall would need to be implemented.

## 7. Monitoring & Review

Coastal monitoring and review is essential in order to track changes to the shoreline over time. Whilst the results of the Hazard Identification provide an indication of the potential changes to the shoreline (and incorporate a justifiable level of conservatism), the system is inherently complex and the actual shoreline response could be different to that presented. Triggers for adaptation should therefore be based on the observed coastal response, but planning and priorities should be guided by the predictions.

There are a number of different monitoring strategies that are available. These strategies are generally complimentary, so the more information that is collected will enable a more thorough review of the observed change. Details of the recommended monitoring processes are provided below.

### 7.1 Aerial Photography

Aerial photography is generally used to map the location of the coastal vegetation lines or other shoreline indicators (see Section 7.2). However, aerial photographs can also be used to quantitatively assess changes to the shoreline or coastal features.

The State Government (now through Landgate) has historically undertaken aerial photography of the coastline at approximately 5 year intervals. Since approximately 2000, aerial photography has been flown most years. It is expected that aerial photographs will be available annually into the future.

As well as the Landgate aerials, other commercial products are available which capture aerial photographs across the City more frequently. One such product is Nearmap, which has high resolution aerial photographs of the entire City available at varying intervals since 2007. These are useful for assessing general changes to shorelines and seasonal movements.

Collection and review of aerial photographs covering the study area will form a key component of the shoreline monitoring in the future.

### 7.2 Shoreline Movement Data

DoT has historically mapped the position of the coastal vegetation line at locations around Western Australia at varying intervals. The coastal vegetation line is a commonly used indicator of the shoreline as it provides an approximation of the limit of the active coastal processes. It is much less susceptible to short term changes than other indicators such as the water line or high water mark. Comparison of the position of the coastal vegetation line over time (for areas that have not been prone to beach management) can therefore provide an indication of the shoreline movement.

Regular mapping of the shoreline should be completed as it will allow the following:

- Identification of shoreline movement trends.
- Identification of infrastructure at risk.
- Updates to vulnerability or hazard assessments.

Over a long enough period, shoreline movement mapping will assist in determining the impact of sea level rise on the shoreline.

### 7.3 Beach Profile Data

Shoreline movement data provides information on the plan-form movement of coastal features. By supplementing this with beach profile data, overall changes to the shoreline can be assessed and volumes of change estimated. This is generally a more cost effective approach to monitoring volumes of change, compared to detailed hydrographic surveys of the entire coastline.

Given the setback to the Hotel Site should see it encounter a low level of risk until after 2065, there is probably little requirement to complete beach profile monitoring in the early years for the Hotel Site, however beach monitoring would be useful to assess the vulnerability of other assets in the area. Initially, the beach response could best be tracked using other techniques, however if the shoreline was receding it would be prudent to commence completing beach profile monitoring when changes to the beach are observed.

When/if beach profile monitoring is to commence, it is recommended that beach profiles are taken every 2 years. The timing of these surveys should be consistent throughout the year in order to reduce the potential for seasonal changes. Generally, it would be recommended that surveys be completed in October in order to provide an indication of the profile at the end of winter. This would also provide an opportunity for action to be taken over the summer period if required.

The beach survey profiles should be completed in three locations as a minimum. One profile should be directly in front of the proposed Hotel Site and the other locations should be approximately 150 and 300 m north of the site. Covering a wider area of beach in this way would enable review of the extent of beach change over the general area, rather than just in front of the Hotel Site.

### 7.4 Beach Photography

Land based photographs from fixed locations and consistent frames of reference can provide a useful tool for monitoring general changes to beaches. DoT released a guideline on *How to photo monitor beaches* (2012) to normalise photo monitoring as part of coastal monitoring programs. This methodology suggests photography be completed at fixed locations with fixed field of views. This is a relatively low cost monitoring strategy, but can provide very useful results, particularly if completed at regular intervals.

### 7.5 Analysis & Reporting

The analysis of the monitoring information that is collected should be completed by an experienced coastal engineer to determine any trends in shoreline movement or significant change to coastal processes. Initially, it is recommended that an analysis of the monitoring data is completed approximately every 5 years. The analysis would be reasonably brief unless significant changes were detected. When/if the behaviour of the beach changes to the extent that beach profile monitoring is required it would be prudent to complete the review every 2 years. This reduction in time between analysis and reporting is due to the increased risk that could be associated with a reduced buffer.

The analysis and reporting would summarise movements on beach profiles (if applicable), assessment of shoreline movement and any relevant information on metocean conditions or shoreline works. Should the shoreline movement indicate large changes in key areas (particularly erosion) this would be highlighted. Additional investigations to determine the cause of the change would be recommended.

## 8. Conclusions

Review of the potential coastal hazards and associated risks for existing and proposed assets within and around the proposed Middleton Beach Activity Centre shows that there are some coastal risks that will need to be managed in the future. The most pressing of these risks appear to be associated with existing infrastructure, including the Albany Surf Life Saving Club and the 3 Anchors Restaurant. These assets are managed by the City of Albany, however to date no information is available regarding the potential management strategies that the City may look to complete to ameliorate any coastal hazard risks associated with these assets. Should the City choose to defend these assets from coastal hazards in the future, this protection would also be likely to provide protection to the proposed development that forms part of the Middleton Beach Activity Centre.

In the absence of any protection of the City's existing assets, the proposed Hotel Site would be the only part of the proposed development that would be vulnerable to coastal hazards within a 100 year planning horizon. In fact, the proposed Hotel Site could be vulnerable to erosion at some stage before 2090 if the assessed coastal hazards (in accordance with the requirements of SPP2.6) are realised. This would mean that management options would be required for the Hotel Site to reduce the potential risk.

Two options exist to manage the potential coastal hazard risk to the Hotel Site. The first option would be to increase the level of the beach in front of the development area to be more consistent with the natural levels of the beach. This recommendation arises due to the artificially low beach levels fronting the proposed Activity Centre that result from beach management practices and the removal of sediment from the area (that is subsequently used to nourish the beach at Emu Point). Increasing the elevation of the rear portion of the beach, above the beach berm, from its current level to a level of around 1.9 mAHD would reduce the potential impacts of coastal processes and reduce the risks to all assets, including the proposed Hotel Site. Other factors that are relevant to this proposed option are as follows.

- The proposed modification to the beach would still enable all of the same beach uses in this area to continue to occur, all that would change would be the elevation of the beach.
- Increasing the elevation of the beach would also require the crest level of the retaining wall behind the beach to be increased to minimise windblown sand issues. The current retaining wall is approximately 0.7 m above the beach level. As a result, to maintain the levels of windblown sand associated with the current beach configuration the crest of the retaining wall would need to be increased to be 0.7 m above the proposed beach level. If further reduction in windblown sand was required the crest level could be increased further, or vegetation could be used adjacent to the wall to trap sand.
- The existing drainage outlets that flow through the retaining wall would need to be diverted if the beach elevation was increased. It is expected that the best option would be to divert them to a less prominent beach area.
- The removal of sediment from this section of beach to renourish Emu Point could continue to occur in the future even if this option was implemented, as the volume of sediment accumulating on the south western portion of the beach is significant (as shown by the shoreline movement plots). However, it is recommended that the extraction area be extended out to chainage 1,000 m so that the extraction is spread over a larger area of beach and does not inadvertently increase the vulnerability of any area, which could occur with a more focused sediment extraction zone.

It is recommended that this option be implemented as a matter of course given the increase in protection that it provides to all infrastructure within the area. The total capital cost of this option is expected to be between \$150,000 and \$250,000, but could also require expenditure of up to \$50,000 after very severe storms. Implementation of this option would reduce the risk to the proposed Hotel Site to acceptable levels for the 100 year planning horizon.

The second option to manage the coastal hazard risk at the Hotel Site would be to construct a seawall. The seawall could be constructed along the entire foreshore (along the alignment of the existing retaining wall) or could be constructed only around the proposed Hotel Site. Costs associated with these options would be between \$1.7 to \$2.7 million and \$1 and \$1.5 million respectively depending on the type of wall that is chosen, with maintenance costs in the order of around 5% of the capital cost per decade. For either option, the intention is that the wall would be buried, at least initially, so that it is less obtrusive. Construction of a seawall would reduce the coastal hazard risk to acceptable levels throughout the 100 year planning horizon. It should be noted that the construction of a seawall would only likely be required in the later stages of the 100 year planning horizon. The exact timing of the construction of the seawall would be identified by the coastal monitoring program.

It should be noted, that whilst the assessment of the risk outlined above has been based on the required methodology outlined in SPP2.6, these vulnerability allowances are justifiably conservative. As a result, the outcomes of this study should be used to guide future management actions, but ultimately the implementation of these actions, particularly the construction of the seawall, should be triggered by the monitoring regime outlined within this document.

## 9. References

- Australian Greenhouse Office 2006. *AGO Factors and Methods Workbook*. Australian Government Department of the Environment and Heritage.
- BMT WBM 2012. *Wollongong Coastal Zone Management Plan: Management Study Final Draft Report*. Prepared for Wollongong City Council, NSW.
- Bruun, P. 1962, *Sea level rise as a cause of shore erosion*, Journal Waterways and Harbours Division, American Society of Civil Engineers. WWI, 88, pp. 117-130.
- Davis, G A & Nielsen, P, 1988. *Field Measurements of Wave Setup*. Chapter 38, ASCE International Conference on Coastal Engineering, Malaga, Spain, pp. 539-552.
- Dean, R G & Walton T L, 2008. *Wave Setup – a State of Art Review*. Beaches and Shores Research Centre, Institute of Science and Public Affairs, Florida State University.
- Department of Transport, 2009. *Coastal Demarcation Lines for Administrative & Engineering Purposes – Delineation Methodology & Specification*. Published by the Government of Western Australia.
- Department of Transport, 2010. *Sea Level Change in Western Australia – Application to Coastal Planning*. Published by the Government of Western Australia.
- Department of Transport (DoT), 2012. *How to photo monitor beaches*. Coastal Infrastructure Department, Government of Western Australia, Perth.
- Guza, R T & Thornton, E B, 1981. *Wave Setup on a Natural Beach*. Journal of Geophysical Research, Vol. 96, No.C2, pp. 4133-4137.
- Greenwood, B & Osborne, P D, 1990. *Vertical and Horizontal Structure in Cross Shore Flows: an Example of Underflow and Wave Setup on a Barred Beach*. Coastal engineering, Vol. 14, pp 543-580. Elsevier Publishing.
- Hansen, U A, 1978. *Wave Setup and Design Water Levels*. Journal of Waterway, Port, Coastal And Ocean Division, American Society of Civil Engineers, Vol. 104, No. WW2, pp. 227-240.
- Hanslow, D J and Neilson, P, 1992. *Wave Setup on Beaches and in River Entrances*. 23<sup>rd</sup> International Conference on Coastal Engineering, Venice, Italy, pp.240-252.
- Holman, R A & Sallenger, A H, 1985. *Setup and Swash on a Natural Beach*. Journal of Geophysical Research, Vol. 90, No. C1, pp. 945-953.
- King, B A, Blackley, M W L, Carr, A P & Hardcastle, P J, 1990. *Observations of Wave Induced Setup on a Natural Beach*. Journal of Geophysical Research, Vol. 95, C12, pp. 22289-22297.
- Komar P D 1998. *Beach Processes and Sedimentation (2<sup>nd</sup> Edition)*. Prentice Hall Inc, New Jersey, USA.
- Larson M & Kraus N.C, 1989. *SBEACH: Numerical Model for Simulating Storm-Induced Beach Change. Report 1: Empirical foundation and model development*. Technical Report CERC-89-9. Coastal Engineering Research Centre, Vicksburg, MS.

- Larson M, Wise R.A & Kraus N.C, 2004. *Coastal overwash, Part 2: Upgrade to SBEACH*. ERDC/CHL CHETN IV-XX. US Army Engineer Research and Development Centre, Vicksburg, MS.
- Lentz, S & Raubenheimer, B, 1999. *Field Observations of Wave Setup*. Journal of Geophysical Research, Vol. 104, No. C11, PP.25867-25875.
- MRA 1995. *Owen Anchorage Wave Study - Model Set-Up, Calibration and Verification, R008 Rev 1*. Prepared for Cockburn Cement Ltd.
- MRA 2005. *Cockburn Wave Modelling 2004 - Wave Model Validation, R142 Draft A*. Prepared for Cockburn Cement Ltd.
- MRA 2011. *Albany Port Expansion – Berth 7 Seawall Design, R295 Rev 2*. Prepared for Southdown Joint Venture.
- Nielsen, P, 1988. *Wave Setup: A Field Study*. Journal of Geophysical Research, Vol.93, No. C12, pp. 15643-15652.
- Raubenheimer, B, Guza, R T & Elgar, 2001. *Field Observations of Wave Drive Setdown and Setup*. Journal of Geophysical Research, Vol. 106, No. C3, pp. 4629-4638.
- Rogers M.P, Saunders B.S & Hunt, T.S, 2005. *Living on the Coast – But How Close is Safe?* Proceedings of the Coasts and Ports 2005 Conference, Adelaide, Australia.
- Rollason V; Fisk G; Haines P (2010) Applying The ISO 31000 Risk Assessment Framework To Coastal Zone Management [available @ [www.coastalconference.com/2010/default.asp](http://www.coastalconference.com/2010/default.asp)].
- Short, A. D. 1999. *Handbook of Beach and Shoreline Morphodynamics*. John Wiley & Sons Ltd. England.
- Standards Australia 2009. *AS/NZS ISO 31000:2009, Risk management - Principles and guidelines*. SAI Global Limited, Sydney, Australia.
- Standards Australia 2013. *AS 5334:2013, Climate change adaptation for settlements and infrastructure – A risk based approach*. SAI Global Limited, Sydney, Australia.
- Stockdon, H F, Holman, R A, Howd, P A and Sallenger, A H, 2006. *Empirical Parameterization of Setup, Swash and Runup*. Coastal Engineering 53 573-588, Elsevier Publishing.
- WAPC 2013. *State Planning Policy No. 2.6 - State Coastal Planning Policy*. Western Australian Planning Commission, Perth.
- WAPC 2014. *Coastal hazard risk management and adaptation planning guidelines*. Western Australian Planning Commission, Perth.
- Wise, R. A., Smith, S. J. & Larson, M. 1996. *SBEACH: Numerical Model for Simulating Storm-Induced Beach Change; Report 4, Cross shore transport under random waves and model validation with SUPERTANK and field data*. Technical Report CERC-89-9 rept. 4. Coastal Engineering Research Centre, Vicksburg, MS.

Yanagishima, S and Katoh, K, 1990. *Field Observations on Wave Setup Near the Shoreline*.  
Proceedings of 22<sup>nd</sup> International Conference on Coastal Engineering, Vol.1, Ch. 7, pp. 95-108,  
ASCE, New York.

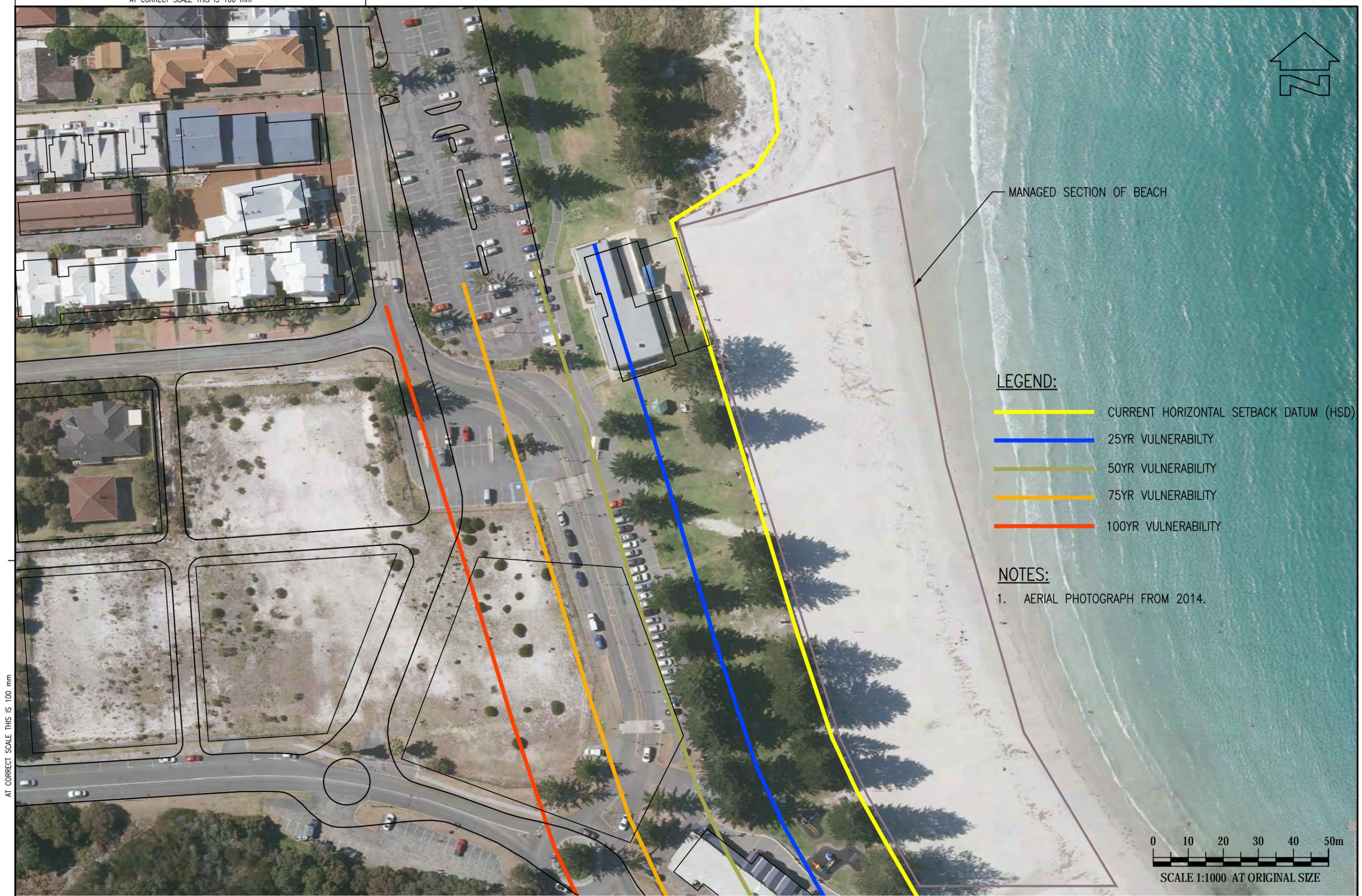
## **10. Appendices**

**Appendix A Coastal Hazard Mapping – Current HSD**

**Appendix B Coastal Hazard Mapping – Increased Beach Elevation**

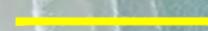
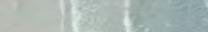
**Appendix A Coastal Hazard Mapping – Current HSD**

AT CORRECT SCALE THIS IS 100 mm



MANAGED SECTION OF BEACH

**LEGEND:**

-  CURRENT HORIZONTAL SETBACK DATUM (HSD)
-  25YR VULNERABILITY
-  50YR VULNERABILITY
-  75YR VULNERABILITY
-  100YR VULNERABILITY

**NOTES:**

1. AERIAL PHOTOGRAPH FROM 2014.



SCALE 1:1000 AT ORIGINAL SIZE

AT CORRECT SCALE THIS IS 100 mm

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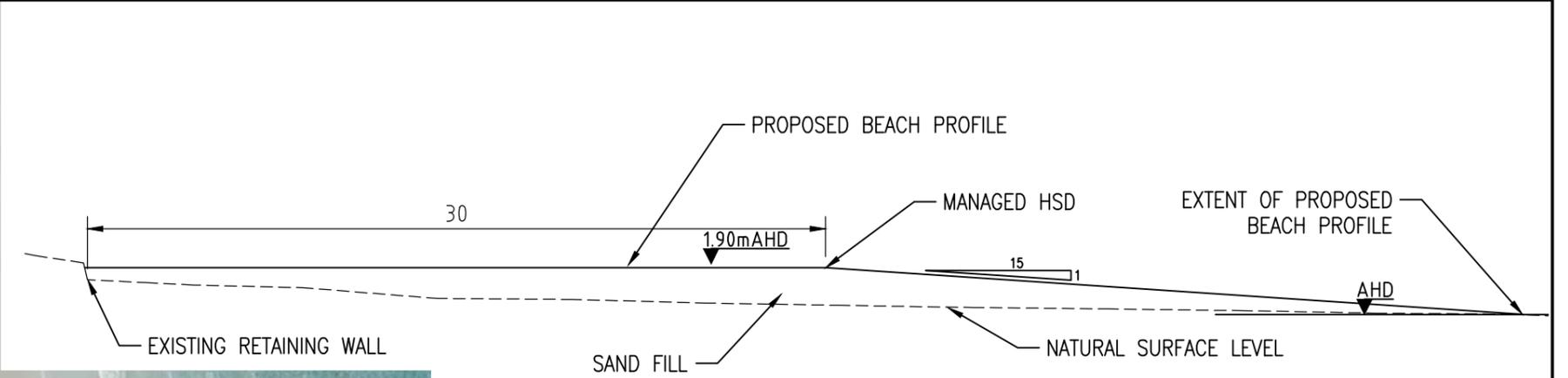
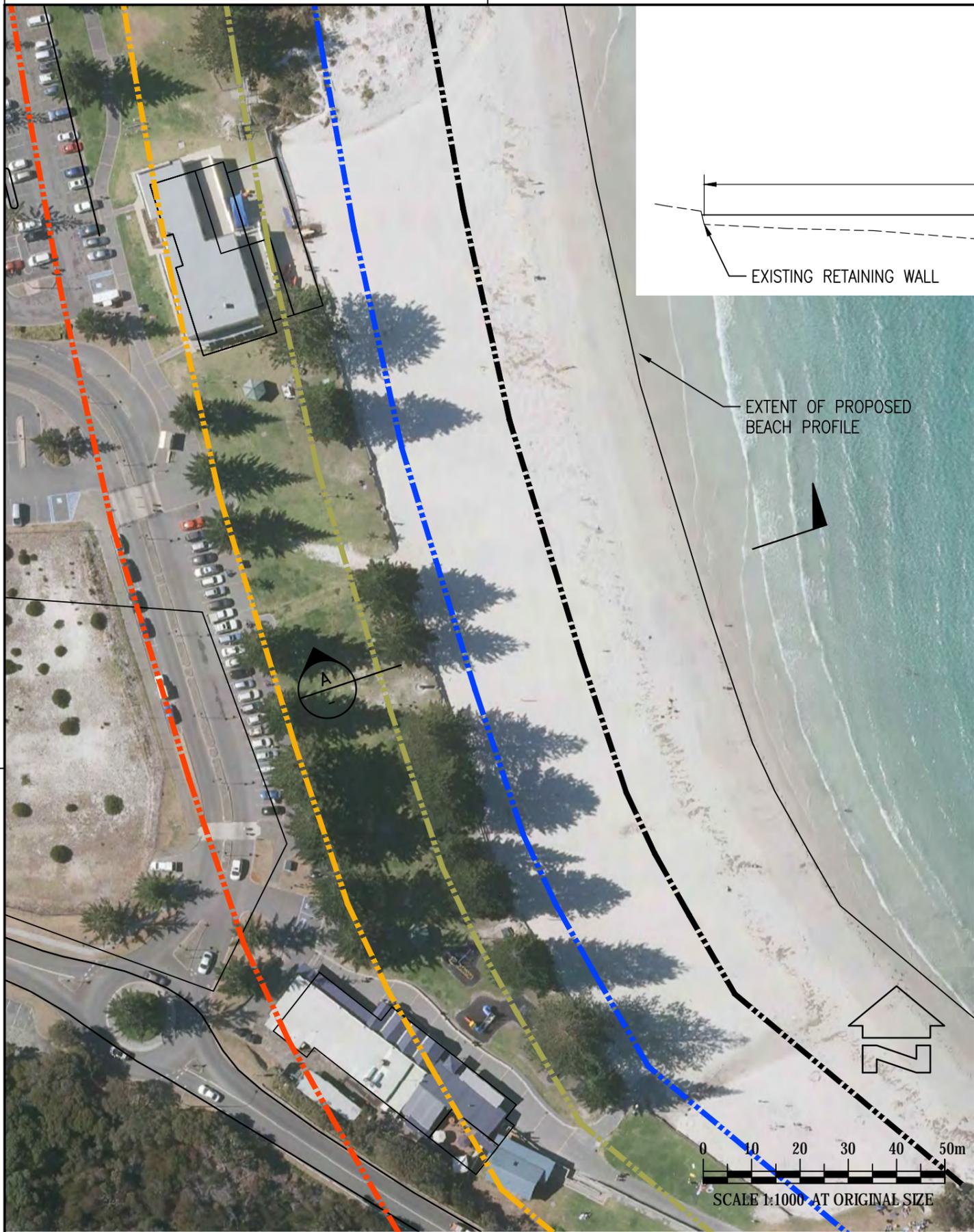
**MIDDLETON BEACH ACTIVITY CENTRE CHRMAP - COASTAL HAZARD MAPPING - CURRENT HSD**  
RPS / LANDCORP

SCALE  
AT A3 1:1000

OCTOBER 2015  
SK1265-16/10/2015-1A

**Appendix B Coastal Hazard Mapping – Increased Beach Elevation**

AT CORRECT SCALE THIS IS 100 mm



SECTION A  
1:250

**LEGEND:**

- MANAGED HSD
- 25YR VULNERABILITY – MANAGED HSD
- 50YR VULNERABILITY – MANAGED HSD
- 75YR VULNERABILITY – MANAGED HSD
- 100YR VULNERABILITY – MANAGED HSD

**NOTES:**

1. AERIAL PHOTOGRAPH FROM 2014.
2. THE PROPOSED BEACH PROFILE WOULD NEED TO BE MONITORED AND MAINTAINED IN ORDER FOR THE SHOWN VULNERABILITY LINES TO BE VALID.

AT CORRECT SCALE THIS IS 100 mm

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# Appendix C

## Middleton Beach Coastal Management Strategy

**R833 Rev 2**

**March 2018**

**LandCorp**

**Middleton Beach  
Coastal Management Strategy**

marinas

boat harbours

canals

breakwaters

jetties

seawalls

dredging

reclamation

climate change

waves

currents

tides

flood levels

water quality

siltation

erosion

rivers

beaches

estuaries

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## K1265/1, Report R833 Rev 2 Record of Document Revisions

Rev	Purpose of Document	Prepared	Reviewed	Approved	Date
A	Draft for MRA review	C Doak	M Rogers	C Doak	5/12/16
B	Draft for Stakeholder review	C Doak	M Rogers	C Doak	9/12/16
0	Issued for Client use	C Doak	M Rogers	C Doak	11/8/17
1	Proposed foreshore sections updated	C Doak	T Hunt	C Doak	6/9/17
2	Minor updates incorporated	C Doak	T Hunt	C Doak	9/3/18

Form 035 18/06/2013

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## 1. Introduction

The development of Middleton Beach Activity Centre seeks to further enhance the amenity of the Middleton Beach Foreshore, within Ellen Cove, through the development of a hotel combined with commercial and residential development. The enhancement of the foreshore landscaping is a significant aspect of this development, in order to ensure that the overall amenity of the area befits that of a regional destination and is appealing to locals and tourists alike.

The development of a foreshore landscaping plan has been led by the City of Albany, together with consultant landscape Architects from AECOM. Some of the key objectives of this plan are as follows.

- Retain the Norfolk Pines as they are considered a key part of the identity of the area.
- Enhance the connection between the foreshore area and the beach.
- Minimise, where possible, the impacts of windblown sand on the foreshore area.
- Ensure an activated foreshore is retained into the future.

Specialist coastal and port engineers M P Rogers and Associates Pty Ltd (MRA) were engaged by LandCorp to provide input during the preparation of the landscape plans, with particular emphasis on the coastal engineering aspects. Further to the assistance provided on the preparation of the landscaping plans, MRA were also engaged to prepare a coastal management strategy to outline the future requirements for the management of the coastline in this area. This strategy includes details on both the requirement for coastal management, as well as the proposed foreshore management approach. It is intended that this coastal management strategy will ultimately form part of an overall foreshore management plan for the area, which will also consider other items such as flora and fauna issues.

## 2. Requirement for Coastal Management

The requirement for coastal management within Ellen Cove is born from the results of the coastal hazard assessment as outlined in MRA (2015). The coastal hazard assessment, completed in accordance with the requirements of SPP2.6, highlighted that the foreshore area could be at risk of impact from coastal erosion and/or inundation over the coming 100 years.

In consideration of this risk, the City of Albany, as the authority responsible for the current and future management of the foreshore, together with relevant stakeholders, have undertaken an assessment of the future requirements for this area. This assessment highlighted that the Middleton Beach Foreshore within Ellen Cove represents a significant community asset that is seen by many to be the preeminent coastal precinct in the greater Albany region. The development of the Activity Centre, as proposed, would further enhance this status.

Given the above, AECOM have completed foreshore landscape planning in consultation with the City of Albany. This planning has been completed to ensure the foreshore provides the level of amenity required for such an asset. In particular, the foreshore plan has also sought to address existing issues that are currently experienced with the foreshore, such as windblown sand and stormwater drainage.

The proposed foreshore plan for the foreshore fronting the Middleton Beach Activity Centre is provided in Figure 2.1. Preliminary cross sections through the foreshore are attached in Appendix A.

As shown in the preliminary cross sections, which incorporate coastal protection, the decision has been made that the foreshore area requires protection to ensure the recreational and amenity values of the foreshore are preserved into the future.

### 2.1 Maintaining the Coastal Reserve

Maintenance requirements for the coastal reserve will ultimately depend on the future behaviour of the coastline. The assessment of the potential coastal hazards presented in MRA (2015) was completed in accordance with the requirements of SPP2.6.

SPP2.6 incorporates a justifiably conservative methodology in order to ensure that the siting of future development or assets is cognisant of potential future hazards, even those with a very low likelihood of occurrence. As a result, it is important to understand that the coastal hazard lines provided in MRA (2015) are not predictions of the future shoreline location. In this regard, the full requirements for maintaining the coastal reserve will need to be informed by ongoing shoreline monitoring. This monitoring will inform both the requirements for the maintenance of the beach in front of the Middleton Beach Activity Centre, as well as the requirements of the ongoing protection of the landscaped foreshore area behind the coastal protection. Further details on both of these aspects are outlined in the following section.



Figure 2.1 Proposed Foreshore Plan

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### 3. Proposed Foreshore Management Approach

Any foreshore management strategy that is developed for Middleton Beach needs to be sensitive to the constraints associated with the development of the foreshore. The significance of the Norfolk Pines and the requirement for them to be retained limits what can be done in terms of increasing the elevation of the foreshore. Furthermore, the requirement for a high aesthetic value and for a continuous access to the beach that isn't interrupted by an emergent and cumbersome coastal protection structure limits the available coastal protection options. The requirement to be able to assist in the management of windblown sand also needs to be considered.

The above factors ultimately limit the potential design response, however all these factors have been considered throughout the development of the coastal management strategy.

The proposed approach to the management of the foreshore will consist of a number of different elements and actions. Specifically, the coastal management strategy will comprise the following key items.

- Construction of an overall coastal protection structure that predominately provides protection against coastal erosion.
- Increasing the elevation of the foreshore area (where possible) and the finished floor levels of new development to minimise the future risk of inundation.
- Ongoing management of beach levels and windblown sand to prevent significant adverse impacts from windblown sand on the foreshore area.
- Importing beach nourishment material to replenish the beach if needed in the future.

These management requirements can be spilt into two categories, those that are capital requirements and those that are operational or maintenance requirements.

Construction of the coastal protection structure and the increase in the elevation of the foreshore are capital requirements, while the management of the beach and windblown sand and the potential requirement for beach nourishment are both operational or maintenance requirements.

The capital requirements of the management strategy have been captured in the foreshore plan at a concept level. This plan was presented in Figures 2.1 and Appendix A.

#### 3.1 Response to Coastal Inundation Risk

To overcome the risk associated with coastal inundation, the foreshore concept plans identify an increase in the elevation of the foreshore area. Nevertheless, this increase in the foreshore elevation is limited by the elevation of the Norfolk Pines. Therefore, proposed development areas, such as the hotel site will be increased to a level beyond what is possible for the foreshore to meet the requirements of SPP2.6.

SPP2.6 requires that commercial and residential development be located above the level expected during a 500 year Average Recurrence Interval (ARI) inundation event at the end of a 100 year planning horizon (2115). For foreshore areas the onus is on the responsible management authority to determine the elevation requirements based on the acceptable level of risk for the assets provided within the foreshore.

Due to the effects of sea level rise, the potential for coastal inundation changes over time. As outlined within MRA (2015) the estimated 500 year inundation level at Middleton Beach increases from 1.89 mAHD in 2015 to 2.79 mAHD in 2115 (refer Table 3.1).

**Table 3.1 500 year ARI inundation levels for different planning timeframes**

	2015	2040	2065	2090	2115
<b>Total Water Level (mAHD)</b>	1.89	2.01	2.22	2.49	2.79

Given the increase in the potential inundation levels associated with sea level rise, it follows that the potential for inundation of the foreshore will also change over time. The proposed foreshore concept plan has therefore been annotated to show the extent of inundation that would be possible during the 500yr ARI event at each of the different planning timeframes. These extents of potential inundation are shown in Figure 3.1.

The plots of the potential inundation areas show that the proposed development areas would not be impacted by coastal inundation. For the remainder of the foreshore, it is arguable that even in 2065 the potential impacts of inundation would be largely insignificant given the 500 year ARI event has an annual probability of occurrence of only 0.2%.

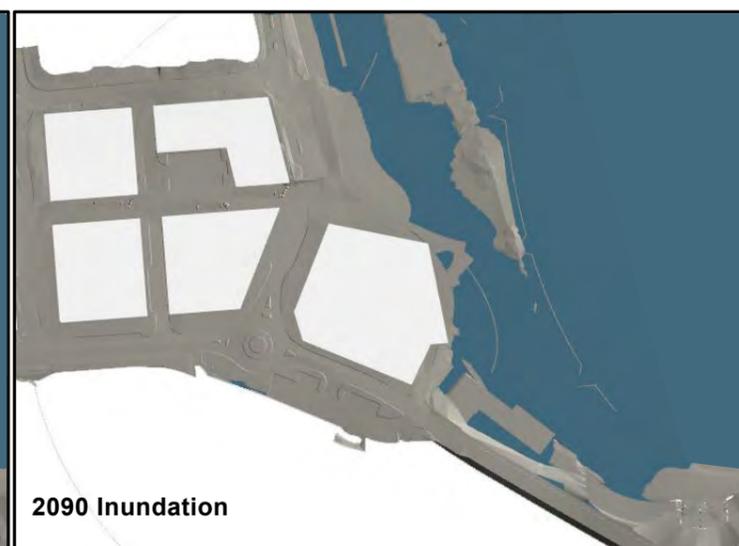
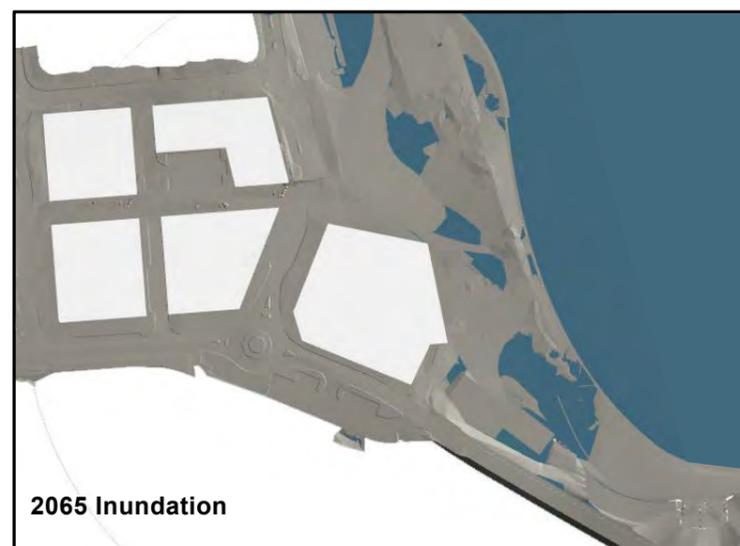
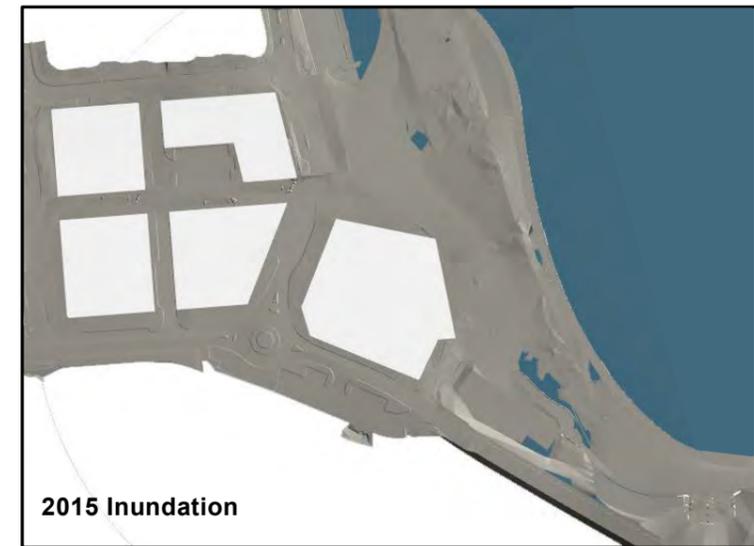


Figure 3.1 Potential Inundation Extents for each planning horizon based on current concept

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## 3.2 Response to Coastal Erosion Risk

Management of the foreshore is required to mitigate the risk of future coastal erosion. The management requirements are twofold. First, there is a requirement to protect the valuable foreshore area from the impacts of erosion – particularly that associated with severe storm erosion. Second, there is the requirement to manage the beach itself so that a useful beach area can be maintained into the future.

### 3.2.1 Concept Design of Coastal Protection

Given the constraints outlined previously, the design of the coastal protection needs to be as unobtrusive as possible. Whilst the ultimate design of the coastal protection will be determined at the detailed design stage, it is anticipated that this design will be consistent with the general requirements outlined within this foreshore management strategy. It is expected that the coastal protection will be comprised of the following key elements.

- A buried rock revetment to prevent toe scour.
- A vertical wall component to increase the crest level of the structure to limit wave overtopping and to catch windblown sand.
- A generous setback distance to significant infrastructure to limit the potential for damage as a result of wave overtopping.

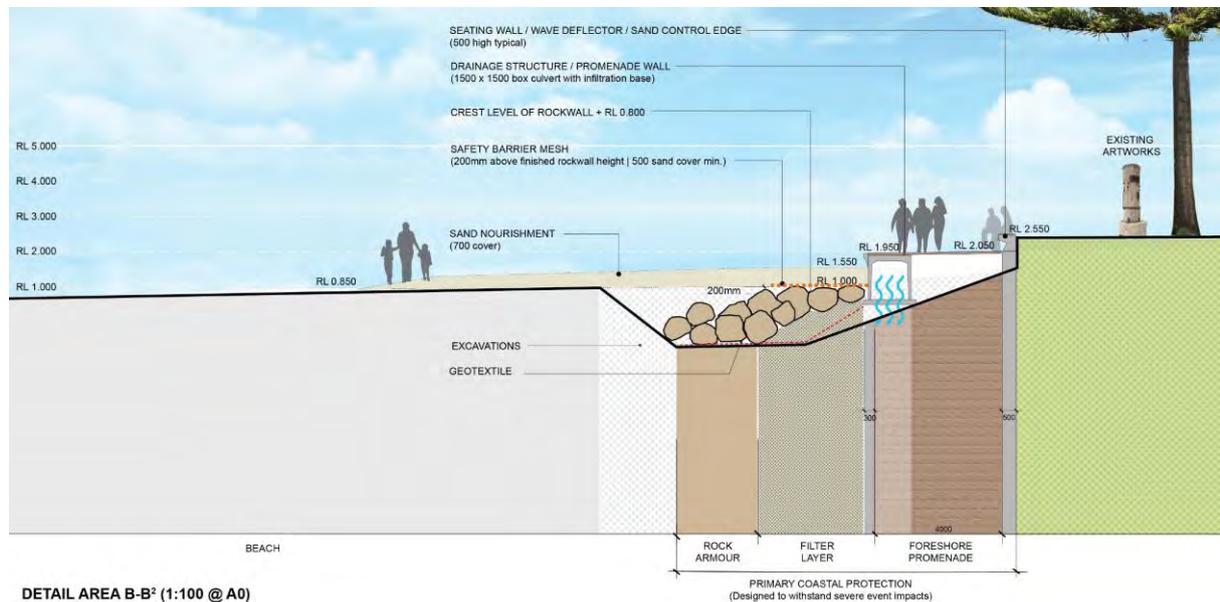
The impact of sea level rise on the design of the coastal protection structure is something that also needs to be considered, however given the sensitivity regarding changes in the elevation of the foreshore, it is not considered practical to respond to the full extent of sea level rise in the present day. Instead, it is proposed that the design of the foreshore protection be completed for a 50 year planning horizon, with the opportunity to retrofit the design thereafter to account for additional sea level rise. This methodology will help to ensure that there is a more seamless connection between the beach and foreshore in the short to medium term. Furthermore, it is expected that the design of the foreshore area will be modified, if not revised over the coming 50 years. As a result, retrofitting of the coastal protection could be completed at these times, particularly since retrofitting the coastal protection may only require the addition of another layer of armour rock and an increase to the elevation of the promenade and/or the seating wall.

Whilst a 50 year planning horizon has been specified for the initial design of the coastal protection, it should be noted that the structure must still be designed to be able to withstand a 100 year ARI design event. This is a requirement of SPP2.6.

The coastal protection design shown in Figure 3.2 has been developed in consultation with AECOM. This cross section illustrates the generally seamless relationship between the foreshore and beach that results from the proposed design. Essentially, the main premise of the design is that the rock revetment portion of the structure would be buried under the beach and would provide a last line of defence, akin to an insurance policy, against severe storm erosion.

An innovative design approach has also been adopted whereby the main vertical wall section would form part of a culvert that would ultimately seek to divert and/or infiltrate stormwater drainage that would otherwise flow over the beach (subject to detailed design). Additionally, to minimise the height of the main vertical wall, and promote the relationship with the beach, it is proposed that an initial low level promenade be provided which would be backed by a seating wall. This seating wall would double as a small wave deflector that would ultimately help to reduce the extent of wave overtopping. Minimisation of the wave overtopping is important, to

minimise the potential for damage to the adjacent foreshore and development areas. This will be the critical issue for the design of the coastal protection given the elevation limitations previously discussed.



The following are the key elements of the coastal protection design that are to be incorporated into the detailed design.

- The foundation level of the culvert must extend sufficiently below the crest elevation of the seawall to prevent scour of the foundation.
- The toe of the revetment shall be deep enough to prevent undermining during the design event.
- The seating/wave deflector wall shall have an appropriate foundation to prevent overturning if exposed to wave impact.
- The pathway section from the culvert to the seating/wave deflector wall must form a continuous defence against wave action.
- All reinforced concrete products need to meet the durability requirements as outlined in the relevant Australian Standards for the expected design life of the structure.

**Figure 3.2 Concept Design of Coastal Protection**

### Wave Overtopping

When considering the potential for wave overtopping there are two key factors that need to be assessed. First is the potential for structural damage during the design event. Second is the safety of the public during wave overtopping events. However, an important distinction in the case of public safety, is that it is highly unlikely that pedestrians would be present in the foreshore area during very severe events. The primary reason for this is because it would be physically uncomfortable for them to be there due to the high wind speeds. For instance, the Beaufort Scale (BoM, 2015) states that a person's progress is significantly impeded when wind speeds exceed 63 to 75 km/hour. According to AS1170.2, wind gusts of this magnitude occur in the 1 year ARI event, although sustained wind speeds over a 1 minute period would require around the 5 year ARI event. As a result, the 5 year ARI event should be used to consider public safety.

Wave overtopping calculations are typically completed using the EurOtop (second edition – 2016) method for calculation of wave overtopping. Wave overtopping levels are generally assessed versus tolerable overtopping limits that have been determined based on a number of different investigations and observations. Table 3.2 presents the relevant tolerable overtopping limits as presented in EurOtop.

**Table 3.2 Relevant Overtopping Rate Limits (EurOtop 2016)**

Hazard Type and Reason	Mean Discharge (l/s per m)
Damage to Grass Covered Area: wave height 1-3 m	5
wave height <1 m	5-10
wave height 0.3 m	No limit
Damage to building structural elements (Wave height 1-3 m)	<1
Damage to equipment set back 5 – 10 m	<1
People at seawall with a clear view of the sea: wave height = 3 m	0.3
wave height = 2 m	1
wave height = 1 m	10-20
wave height = 0.5 m	No limit

In order to prove the suitability of the proposed coastal management strategy, preliminary calculations have been completed to determine the expected overtopping rates. These overtopping rates have been assessed for both the 100 year ARI event, for the assessment of infrastructure protection, and the 5 year ARI event, for the assessment of public safety. Note that for the assessment of public safety, the overtopping rates have been calculated for the both the lower promenade as well as at the rear of the wave deflector wall.

It should be noted that wave overtopping calculations are particularly sensitive to both the wave height and water level. As a result, a sensitivity analysis has been included to assess the impacts of both the design wave event and the design water level event. Based on the joint probability, assessment of, say, the 100 year ARI wave event and the 100 year ARI water level event together would be far more severe than the 100 year ARI event. Therefore a general rule of thumb has been used for this concept assessment which suggests that, from experience, a 5:1 ratio is generally appropriate for event severity. In other words, a 5 year ARI design wave height could be accompanied by a 1 year ARI water level, and so on. The validity of this assumption would need to be reviewed at the detailed design stage.

The results of the initial assessment of the wave overtopping levels are presented in Table 3.3 for the protection of infrastructure, and Table 3.4 for public safety.

**Table 3.3 Calculated Overtopping Rates at the Coastal Protection Structure for Safety of Infrastructure**

Assessed Condition	Wave Condition	Water Level Condition	Hs at Wall (m)	WL at Wall (mAHD)	Overtopping Rate – Behind Wave Deflector Wall (l/s/m)	Overtopping Rate – At Hotel Site (l/s/m)
Present Day	100 yr ARI	20 yr ARI	0.60	1.86	0.05	0.000
Present Day	20 yr ARI	100 yr ARI	0.66	1.91	0.147	0.002
2065 (0.33m SLR)	100 yr ARI	20 yr ARI	0.85	2.17	2.178	0.036
2065 (0.33m SLR)	20 yr ARI	100 yr ARI	0.88	2.20	2.953	0.049

**Table 3.4 Calculated Overtopping Rates at the Coastal Protection Structure for Public Safety**

Assessed Condition	Wave Condition	Water Level Condition	Hs at Wall (m)	WL at Wall (mAHD)	Overtopping Rate – Lower Promenade (l/s/m)	Overtopping Rate – Behind Wave Deflector Wall (l/s/m)
Present Day	5 yr ARI	1 yr ARI	0.48	1.64	41.0	0.002
Present Day	1 yr ARI	5 yr ARI	0.41	1.65	29.9	0.000
2065 (0.33m SLR)	5 yr ARI	1 yr ARI	0.72	2.01	191.2	0.414
2065 (0.33m SLR)	1 yr ARI	5 yr ARI	0.65	1.99	159.3	0.159

Based on this concept level investigation, the wave overtopping calculations show the following.

- Overtopping levels to 2065 should not reach a level that causes damage to grassed areas behind the wave deflector wall as a direct consequence of the overtopping action.
- Overtopping levels to 2065 would not have any impact on the proposed hotel development location.

- It would not be safe for the public on the lower promenade during the 5 year ARI event. This would need to be managed to ensure that users of the area are aware of the risks during severe events, despite the fact that they are unlikely to be there during such an event.
- Overtopping levels to 2065 for the area behind the wave deflector wall would be safe for pedestrians during the 5 year ARI event.

It should be noted that the above outcomes are on the basis that the detailed design of the coastal protection structure ensures that the rock revetment, main vertical wall and wave deflector wall are all appropriately designed to withstand the expected wave loading. This will be a crucial element of the detailed design for these structures.

### **Future Maintenance Requirement of Coastal Protection Structure**

Coastal protection structures require maintenance to ensure that they continue to provide the requisite level of protection. The extent of maintenance required generally depends on the exposure of the structure. If a structure is constantly exposed to conditions that are similar to those that it was designed for, then the extent of maintenance will generally be comparatively larger than for a structure exposed to conditions that are less severe.

The exposure of the proposed coastal protection structure is not expected to be severe at least in the short to medium term. This is due to the fact that the structure will be located at the rear of the beach, with a large portion of the structure buried under the beach. As a result, maintenance requirements due to the action of the ocean are not expected to be significant.

The requirement for any maintenance to be completed should be informed by monitoring of the structure. After any severe storm event that exposes the structure an inspection should be completed. This inspection should focus on the overall condition of the structure, noting any departures from the design. This could include displacement of armour rocks from the revetment, or settlement of the vertical (culvert) wall, etc. Any such defects should be noted and reviewed by a qualified coastal engineer to determine the requirements for repair and maintenance.

### **3.2.2 Future Shoreline Management Requirements**

The Middleton Beach shoreline within Ellen Cove is a modified shoreline. The natural dune system has been removed in this area and an artificially wide flat section of beach has been created. As a result of this modification to the natural beach profile, ongoing management of the area is required, particularly with regard to windblown sand.

Given the above, there will be an ongoing requirement for management of the shoreline into the future given that this artificially wide section of beach is to be maintained as part of the proposed foreshore design. As a result, windblown sand will need to be regularly managed, both from the beach interface with the vertical wall, as well as from the lower promenade area.

Throughout this management of the windblown sand, it will be important to ensure that the elevation of the beach is also maintained. This will be important for the following reasons.

- To maintain an adequate level of sand cover over the buried revetment wall.
- To minimise the increase in the level of the beach against the vertical wall to prevent significant increases in windblown sand over the initial vertical wall.

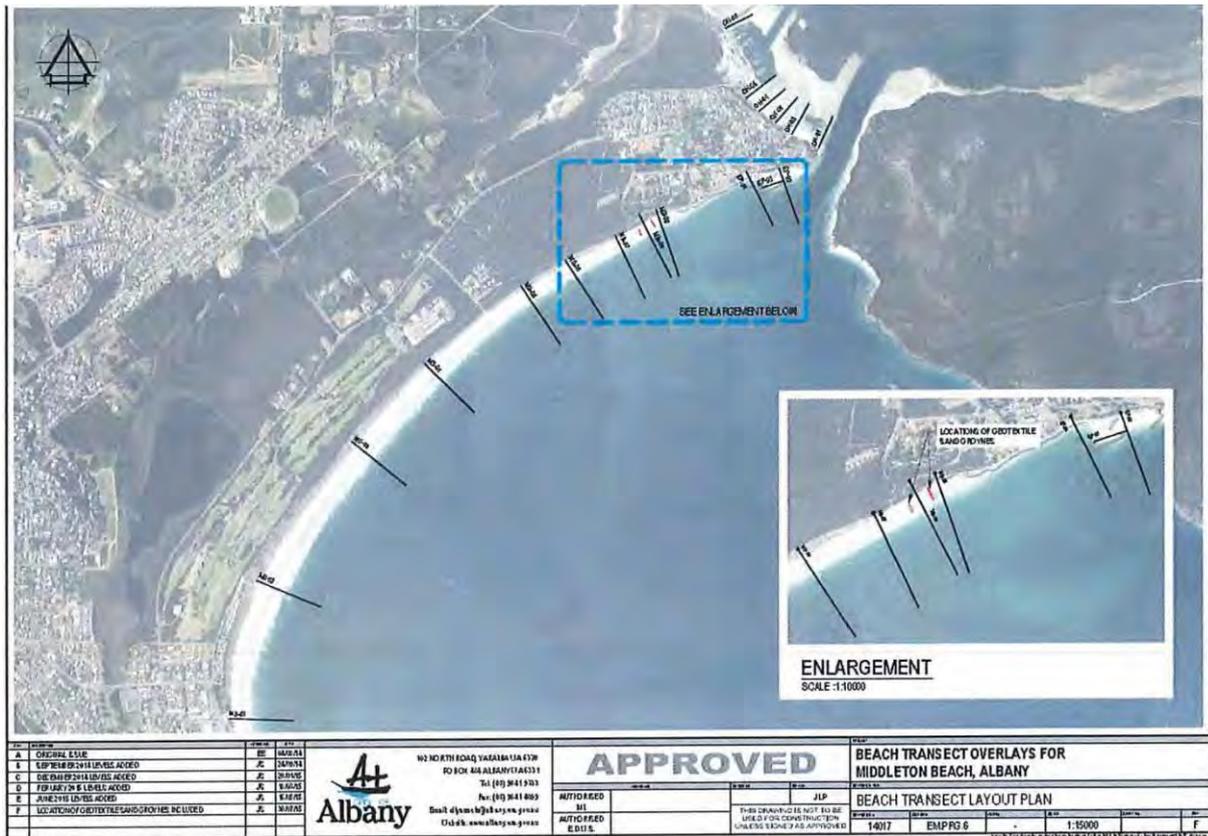
- To ensure that the elevation difference between the top of the vertical wall and the beach does not reach a point where the fall is so great that a handrail would be required along the edge of the vertical wall.

It is noted that the above points are conflicted in terms of there being requirements to both increase and decrease the elevation of the beach depending on which aspect is being considered. The corollary of this is that a balanced outcome must be achieved. The future management of the beach will therefore need to maintain the beach elevation within a range that is deemed acceptable.

As part of this ongoing maintenance of the beach level, it is noted that, in the future, there may be the requirement for nourishment of the beach to occur in response to shoreline erosion. Presently, as outlined in MRA (2015), the shoreline within Ellen Cove and the area to the north has experienced a chronic accretion trend. The City has therefore been using beach material from this area to nourish the Emu Point Beach, which has been eroding.

In light of the proposed foreshore development it is recommended that this practice of extracting sand from Ellen Cove for the nourishment of Emu Point be reviewed, as continued extraction may impact the stability of the Ellen Cove shoreline in the medium to long term. This is on the basis that the shoreline is expected to begin to erode in response to sea level rise, so the greater the buffer (ie the wider the beach) that can be formed before sea level rise may become more of an issue, the less future management will be required.

Ultimately however, the requirement for beach nourishment would be informed by beach monitoring. Beach monitoring is already completed by the City of Albany on a quarterly basis at selected profiles along the coastal compartment between Middleton Beach and Emu Point (at the locations shown in Figure 3.3). Analysis of this monitoring will enable the early identification of changes in beach widths that can be used to determine when remedial actions may be required. Nevertheless, the number of beach monitoring transects within Ellen Cove should ideally be increased to monitor the area immediately in front of the proposed foreshore development. It is recommended that an additional 4 profiles should be monitored within Ellen Cove, using around 50 m spacing between transects. Ideally, monitoring of these additional profiles should begin prior to the commencement of the foreshore works in order to establish a baseline.



**Figure 3.3 City of Albany Beach Monitoring Profiles**

If sand nourishment is to be completed, the nourishment material should be assessed to ensure that it is of sufficient size and character to prevent it being eroded more readily than the native material. Within the Albany region, there are two known sources that could be suitable for use as beach nourishment. The first source is a white quartzite sand that is currently used for compaction sand. It is understood that this material is extracted from a terrestrial sand dune. The grain size of this material is reasonably fine, however it may be possible to selectively target areas with a larger grain size in order to achieve a better outcome.

The second option for the nourishment material would be to use a lime sand. This material has a much larger grain size than the native beach material, and is also a slightly more yellow colour, however the increased grain size, depending on the density of the grains, could promote stability of the nourishment and may therefore be beneficial. The colour difference between this material and the native beach material would also be less of an issue after the material is reworked by the waves and mixed with the native material.

Whilst these two options are known, it is expected that other options could be offered as part of any tender process to procure nourishment material. As such, any tender process should require samples of the proposed material to be provided with the submission, together with particle size distributions so that the suitability of the material can be assessed. In this regard, it is not appropriate at this stage to provide limitations on potential grain sizes for nourishment material. Assessment of the best nourishment source should be made based on a multi-criteria assessment that considers the unit cost of the material relative to the overfill factor (an estimate of the volume of nourishment material required to replace a unit of the native beach material as defined within USACE, 2006) of the respective grain size. Other factors such as material colour and aesthetics should also be considered within the assessment.

When it comes to the placement of the beach nourishment, the material should be placed in a manner that best matches the natural beach profile and alignment. This minimises the amount of reworking of the nourishment, which reduces the loss of material, but also reduces potential safety issues associated with the creation of steep erosion scarps within the nourishment, which can become unstable. Throughout this process, allowance should be made for the reasonably rapid loss of nourishment initially as the material is reworked. The extra volume of material required to achieve the desired outcome will need to be determined based on the type of material that is used, the timeframe for placement and the overall geometry of the placed material.

## 4. Conclusion

This coastal management strategy has been prepared to form part of the overall Foreshore Management Plan for the Middleton Beach area. The strategy provides details on the proposed approach for the ongoing management and protection of the foreshore area. This is on the basis that the foreshore area is considered to be a valuable regional community asset that the City of Albany, as the responsible management authority, have chosen to protect. To augment this protection, management actions will also need to be completed, in particular those to manage and maintain the beach that fronts the activity centre.

The proposed approach to coastal management responds to potential risks associated with coastal erosion and inundation hazards over at least the next 50 years. Thereafter, a retrofit of the coastal protection could provide protection for the ensuing period. Using this approach the usefulness of the foreshore, and the more intimate relationship with the beach and ocean, is maximised in the short, medium and long term. This approach also provides the necessary level of protection for the proposed development (the hotel, commercial and residential development) in response to coastal hazard risk. The risk to pedestrians and public safety is also managed, however it is noted that under severe storm conditions where waves are impacting the vertical wall, the lower promenade along the beach could be unsafe for pedestrians due to wave action. This risk should be acknowledged by the City and others, with steps taken to notify users of the risks during these events.

## 5. References

MRA, 2015. *Middleton Beach Activity Centre – Coastal Hazard Risk Management & Adaptation Plan*. Report 684 Rev 0 prepared for RPS/ LandCorp.

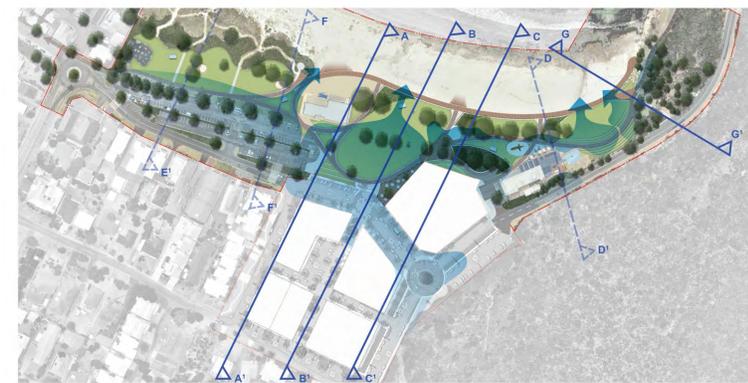
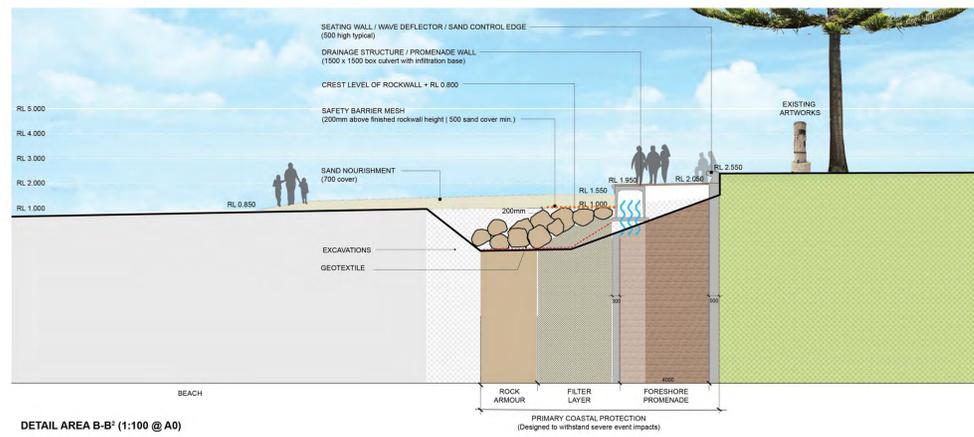
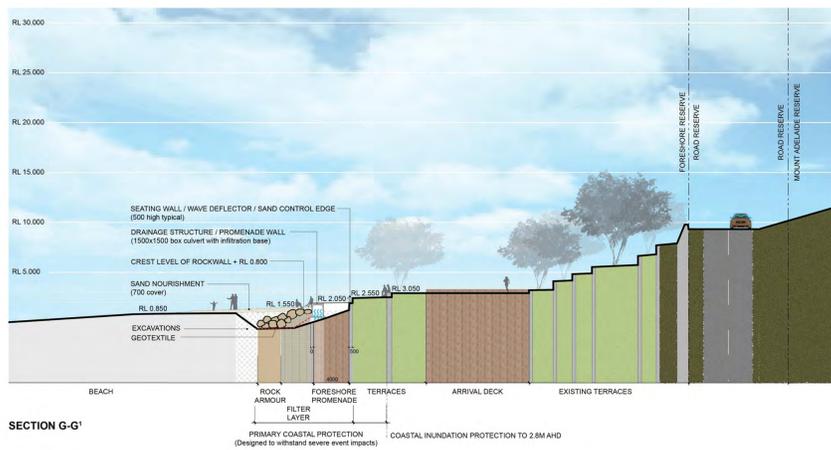
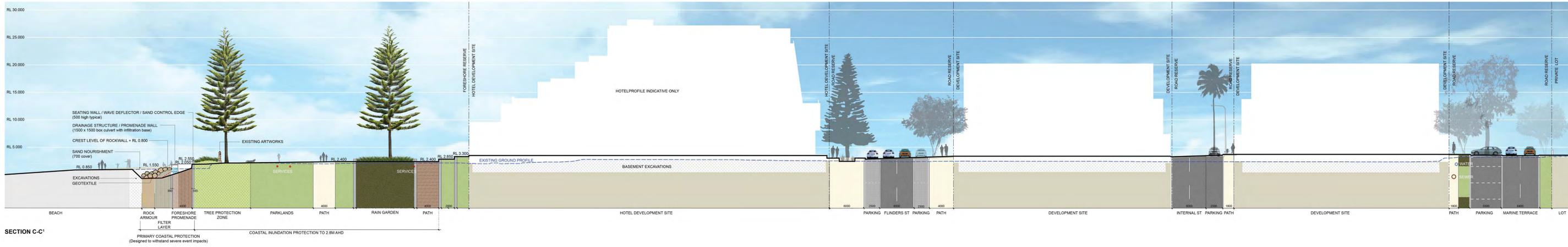
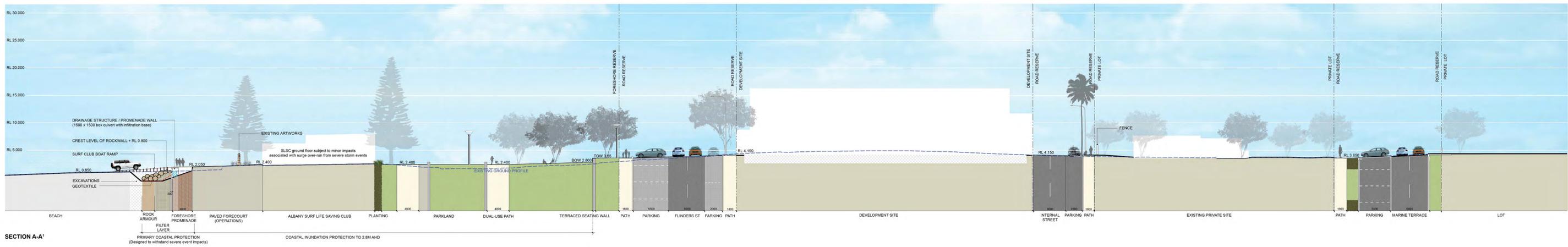
United States Army Corps of Engineers, 2006. *Coastal Engineering Manual*. Engineer Manual 1110-2-1100, U.S. Army Corps of Engineers, Washington, D.C.

WAPC 2013. *State Planning Policy No. 2.6 - State Coastal Planning Policy*. Western Australian Planning Commission, Perth.

# 6. Appendices

## Appendix A Proposed Foreshore Sections

**Appendix A Proposed Foreshore Sections**



m p rogers & associates pl

[www.coastsandports.com.au](http://www.coastsandports.com.au)



# Appendix D

## Middleton Beach Landscape Management Plan



# MIDDLETON BEACH FORESHORE

## LANDSCAPE MANAGEMENT PLAN

15.03.2018

**Albany** | Western Australia



Prepared for:

**City of Albany**

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Document: Middleton Beach Landscape Management Plan

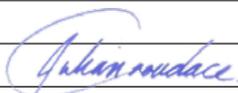
Reference: P:\604X\60444998\6. Draft Docs\6.1 Reports\Middleton Beach LMP Report.indd

Date: 21/9/2016

Prepared by: Ting Liu & Max Marshall

Reviewed by: Julian Croudace

Verified by: Faron Mengler

REVISION	DATE	NAME	SIGNATURE	NAME	SIGNATURE
V1	21 September 2016	Julian Croudace		Faron Mengler	
V2	04 October 2016	Julian Croudace		Faron Mengler	
V3	16 August 2017	Julian Croudace		Faron Mengler	
V4	13 March 2018	Julian Croudace		Faron Mengler	

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# Introduction

## CONTEXT

Middleton Beach is a coastal suburb of Albany, Western Australia. Located approximately 4km east of the city centre, the Middleton Beach Foreshore serves as a popular destination for the people of Albany and surrounding communities.

Middleton Beach is bounded by Wollaston Road and the Albany Golf Course to the north, King George Sound to the east and Heritage Park to the west and south. It's coast is protected by King George Sound, therefore the Southern Ocean's waves do not usually reach these sheltered waters. The foreshore precinct possesses one of Albany's few flat, green public open spaces for unstructured use.

The foreshore beachfront is highly valued for swimming, walking, sunbathing, reading and exercising amenity, whereas inland of the foreshore, activities such as play, cafe and dining as well as cycling. The wide active beachfront offers large areas of setback and shaded quiet places with existing facilities. The landscape environment varies, from the calm refuge of Ellen Cove to the active surfing banks to the north - there is something on offer for all that visit.

General population growth within the Great Southern (Western Australia), coupled a senior age migration from Perth and surrounds, emphasises the potential for Albany to develop its brand and grow as a première regional and tourism centre. Tourist activity has gained momentum with the recent launch of the ANZAC Centenary Commemorations and infrastructure upgrades upon the adjacent Mt. Clarence and Mt. Adelaide, as well as the newly reconstructed lookout at the Gap situated within the Torndirrup National Park. These award-winning bodies of landscape architectural, cultural and tourism work is drawing more visitors to explore Albany and its environs annually.

Landcorp's recent land acquisition and proposal for the Middleton Beach Activity Centre will create a mixed-use activity node directly adjacent to the Middleton Beach Foreshore precinct. The proposal, when considered alongside the Middleton Beach Foreshore site potential, offers a unique opportunity to plan, design and enhance the two collective spaces within a cohesive methodology in order to deliver a world-class Foreshore Precinct to further promote Albany's community engagement and tourism economy.

## PROJECT OVERVIEW

The City of Albany requires an Enhancement Plan for the Middleton Beach Foreshore which incorporates the Activity Centre development. The plan will guide current and planned investment in civil, coastal and public realm infrastructure within the precinct, and integrate landscape management strategies across both projects to maximise community benefit.

The plan defines urban design, place development and landscape management outcomes that will set a strong strategic direction for the Middleton Beach Foreshore Precinct. A key to the success of the plan will be maintaining its unique landscape character and natural assets, whilst enhancing lifestyle, tourism and increased patronage. This project will form the initial part of a wider Foreshore Management Plan that the City of Albany is positioning as part of a long-term vision and management framework for this part of the coastline.

## SITE APPRECIATION

A key naturalistic feature of the site is the rugged near-coastal topography of the Mounts Precinct bushland. This superb, natural and cultural quality provides a dramatic backdrop to the site but also presents bushfire, wayfinding and access challenges within developing management strategies. Conversely, these challenges present opportunities to innovatively connect and integrate with adjacent assets and reinforce the activation of the foreshore.

The open lawn areas and large mature Norfolk Island Pine trees form integral features of the foreshore's character. Landscape management strategies for the public areas establish both the overall integrity of the precinct as well as its fine grain details, unifying the often disparate influences that have enabled the site to evolve over time. Using sustainable materials and methods, our strategies will help to enhance the unique character of the place, its arrival points, streetscape contribution, major gathering areas, spaces for quiet reflection, recreational pursuits and scenic vistas.



# Implementation Extents





# Aerial Perspective East



after



before

**A. SHIPPING LANE INTERPRETIVE TRAIL**  
Heritage and arts interpretation | shared-use boardwalk | scenic connection to city centre & King George Sound | tourist attraction | education highlight

**B. CHARLES DARWIN INTERPRETIVE WALK**  
Heritage interpretation | accessibility audit | wayfinding signage | maintenance improvements

**C. ELLEN COVE JETTY**  
Heritage interpretation | accessibility audit | wayfinding signage | maintenance improvements

**D. PROMENADE TERMINUS LOOKOUT**  
Heritage interpretation | conceals drainage outfall to rocky headland | wayfinding signage | sheltered passive recreation | seating | weddings venue

**E. GRASSED TERRACES**  
Flexible and sheltered events space | local geology and heritage interpretation | picnic facilities

**F. OPEN GRASSED AREAS**  
Flexible, open, sheltered, sunny parkland | events capacity | informal recreation | kick-about space | open vistas

**G. THREE ANCHORS CAFÉ & PLAYSACE**  
Retain key play elements | improved interface with outdoor activity area | improved drainage | storm surge protection | shared disabled parking space | convenient drop off | shared path connection

**H. FORESHORE PROMENADE**  
Wide boardwalk covering drainage culverts | improved access to beach | surge and storm protection | integrated seating

**I. HOTEL INTERFACE**  
walk up alfresco terrace | elevated beach views | shared path connections

**J. ACTIVITY CENTRE INTERFACE**  
Seamless integration | views to ocean | universal access | connected cycling network | natural way finding | interpretive features | artwork

**K. FLEXIBLE OPEN GRASSED AREAS**  
Open, shady parkland | events capacity | informal recreation | kick-about space | open vistas | picnic facilities

**L. SURF CLUB FORECOURT**  
Extended operational lay down area | activated alfresco | multi-vehicle ramp | expanded surf boat storage

**M. SURF CLUB FORECOURT**  
Extended operational forecourt | activated alfresco | multi-vehicle ramp |

**N. SURF BOAT STORAGE**  
Earth sheltered surf boat storage | Dune lookout | Interpretive signage | play features | connected to dune path network | dune revegetation | integrated seating deck | skateable features

**O. NATURE TRAIL NETWORK**  
Controlled beach access | weed management | dune revegetation | stabilisation | improved habitat and diversity | art and interpretive features

**P. PICNIC FACILITIES**  
BBQs | seating | shelters | beach showers | kick about space | play features | universal access

**Q. EXERCISE & PLAY EQUIPMENT**  
Integrate existing play facilities | exercise equipment | seating | shade | picnic facilities | kick about space

**R. ARTIFICIAL SURF REEF ACCESS**  
Controlled beach access | weed control | dune revegetation | stabilisation | improved habitat and diversity | artificial surf break | active recreation | beach walk to Emu Point

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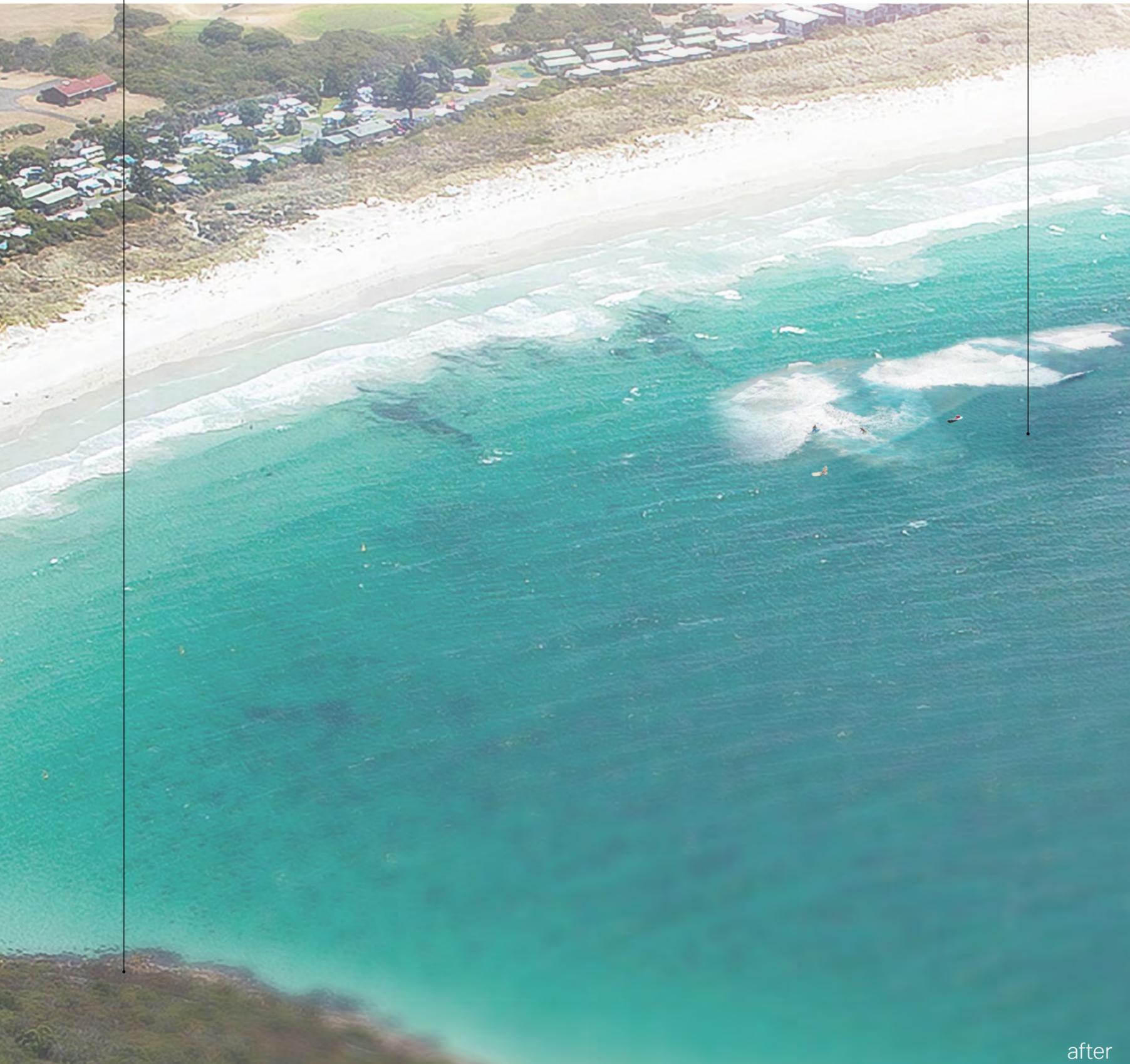
Q

C

O



# Aerial Perspective South



**A. SHIPPING LANE INTERPRETIVE TRAIL**  
Heritage and arts interpretation | shared-use boardwalk | scenic connection to city centre & King George Sound | tourist attraction | education highlight

**B. CHARLES DARWIN INTERPRETIVE WALK**  
Heritage interpretation | accessibility audit | wayfinding signage | maintenance improvements

**C. ELLEN COVE JETTY**  
Heritage interpretation | accessibility audit | wayfinding signage | maintenance improvements

**D. PROMENADE TERMINUS LOOKOUT**  
Heritage interpretation | conceals drainage outfall to rocky headland | wayfinding signage | sheltered passive recreation | seating | weddings venue

**E. GRASSED TERRACES**  
Flexible and sheltered events space | local geology and heritage interpretation | picnic facilities

**F. OPEN GRASSED AREAS**  
Flexible, open, sheltered, sunny parkland | events capacity | informal recreation | kick-about space | open vistas

**G. THREE ANCHORS CAFÉ & PLAYSACE**  
Retain key play elements | improved interface with outdoor activity area | improved drainage | storm surge protection | shared disabled parking space | convenient drop off | shared path connection

**H. FORESHORE PROMENADE**  
Wide boardwalk covering drainage culverts | improved access to beach | surge and storm protection | integrated seating

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**R. ARTIFICIAL SURF REEF ACCESS**  
Controlled beach access | weed control | dune revegetation | stabilisation | improved habitat and diversity | artificial surf break | active recreation | beach walk to Emu Point



after

before

# Context and Linkages

## HISTORICAL CONTEXT AND LINKAGES

Extending beyond the Middleton Beach Foreshore, the City of Albany exists as Western Australia's first settled town, being founded in late 1826.

During the First World War, the town played a significant role in the ANZAC legend, being the last port of call for troopships departing Australia in the First World War. This has defined the cultural significance of Albany, specifically the adjacent Mt. Adelaide & Mt. Clarence.

A historical Jetty, south of Middleton Beach and within Ellen Cove hosted the departure of Charles Darwin's expedition to Western Australia (1836). West of the Foreshore, the long standing Esplanade (1898) was demolished in 2007. A current proposal (presented by Landcorp to the City of Albany) intends to redevelop the Hotel and museum which will interface with the Middleton Beach Foreshore.

A tourist trail/public transport loop responds to the need to link key tourism sites to maximise public experience & appreciation of site. Middleton Beach, Albany's City Centre, Mt Adelaide & Mt Clarence will define key checkpoints within the proposed route, granting the Middleton Beach Foreshore the potential to become one of WA's premier regional tourism hubs and a regional recreation destinations for residents and visitors alike.

## PLANNING CONTEXT

The planning context of the site includes a requirement for coastal protection strategies (under state planning policy SPP 2.6) to be implemented to ensure the development lots created within precinct remain intact, as predicted climate and sea level changes occur over the next 100 years. These protection measures typically involve significant rock-reinforcements (like buried groynes or shore piling) that have profound impacts on the local amenity of the coastline.

In this situation, the impacts may affect some of the historic Norfolk Island Pines that are synonymous with the character of Middleton Beach and central to community values.

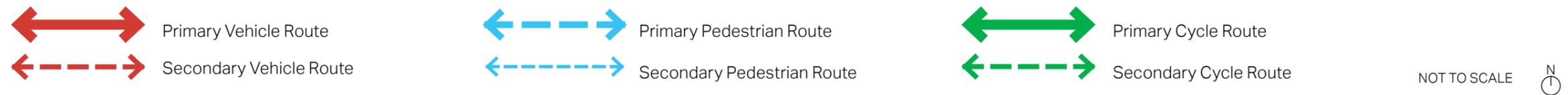
-  Activity Centre Boundary
-  Foreshore Boundary
-  Primary Access Links
-  Secondary Access Links
-  Cycle Route



NOT TO SCALE



MIDDLETON BEACH ACTIVITY CENTRE - INDICATIVE PLAN



# Purpose and Objectives

## PURPOSE

For Middleton Beach to be recognised as the region's best regional beachfront destination.

The purpose of the management plan process is to develop comprehensive strategies for the Middleton Beach foreshore area and surrounding precinct that complement and work with the key principles and objectives of the Middleton Beach Activity Centre (Landcorp). The management plan strategies will have a key focus on the foreshore area between the boardwalk and the eastern end of the Surf Life Saving Club (Middleton Rd).

A key objective of the management plan will be to Integrate the work of the coastal hazard risk management and adaption process (Landcorp terms of reference).

## TERM

It is anticipated that this process will be undertaken between June – December 2016, understanding the key priorities and time frame of Landcorp processes (i.e. the development of coastal hazard risk management and adaption strategies by end July 2016 and subdivision approval by December 2016).

## KEY PARTIES

- City of Albany
- Landcorp
- Specialist Consultants
- Relevant Authorities (DoP, DoT)

## OBJECTIVES

The Middleton Beach Foreshore Management Plan sets out to achieve the following objectives:

### Site Definition

Define an appropriate site which enables the broader vision to be realised, inclusive of the broader precinct adjacent to the Middleton Beach Activity Centre, with a key focus on the foreshore area between the boardwalk and the eastern end of the Surf Life Saving Club (Middleton Rd).

### Technical Resilience

Undertake technical reviews in order to develop integrated strategies for servicing, essential infrastructure, engineering, and coastal adaptation and protection (sea level change). This includes risk to existing or proposed infrastructure resulting from storm surge or sea level rise, with specific measures to address requirements of SPP 2.6.

### Strategic Approach

Take a strategic short, medium and long term approach to design and planning around coastal adaptation, urban growth, transport, infrastructure, climate change, and implementation factors; support the planning approval process of the Middleton Beach Activity Centre; and be consistent with previously approved City plans, strategies and policies.

### Public Realm

Develop integrated design strategies for high quality public spaces and facilities for all users which are safe, accessible, attractive, comfortable, flexible (event capability), well connected, and long lasting.

### Community Focus

Build on the objectives established by community engagement undertaken for the Middleton Beach Activity Centre (Landcorp) and the Coastal Parks Strategy (City); and engage and inform the local community at agreed project milestones.

## Partnerships

Work in partnership with key stakeholders throughout the process, taking a collaborative approach to design, planning, implementation and management decisions.

## Economic Viability

Support the development aims and investment strategy of the Middleton Beach Activity Centre and the broader precinct (including existing commercial land uses), and use the Enhancement Plan to advocate for funding and implementation support.

## Sense of Place

Protect, enhance and communicate the cultural and heritage values of the locale; create memorable, diverse and authentic experiences which express civic pride and encourage repeat visitation.

## KEY OUTPUTS

The City of Albany has formed an internal Project Control Group to guide the development and coordination of an integrated Foreshore Management Plan for Middleton Beach which supports the Middleton Beach Activity Centre Improvement Plan led by Landcorp. The Control Group will work with the Steering Committee and Consultant Project Team to establish the project plan and methodology. The Project Control Group will be responsible for the development and adoption of the following outputs, which may be combined:

- Coastal Risk Management Strategy (by end July 2016)
- Technical Review (by end July 2016)
- Foreshore Management Plan (by December 2016)
- Public Realm Landscape Plan (by December 2016)
- Integrated Engineering and Services Plan (by December 2016)

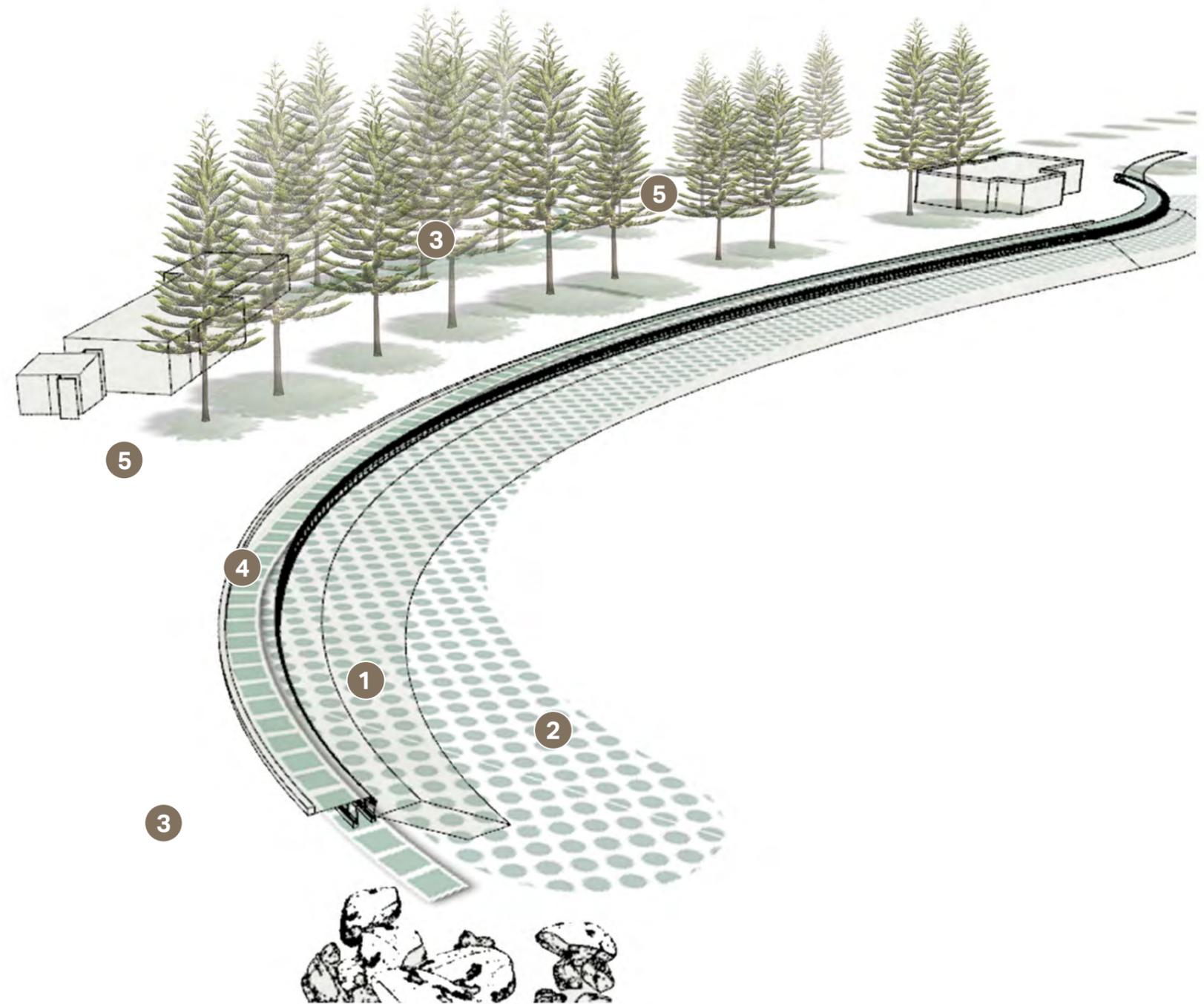
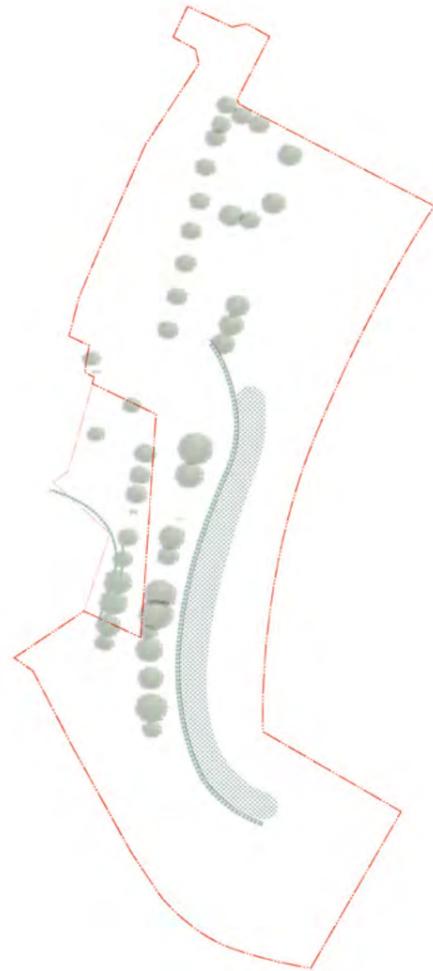
## DESIGN AIMS

To achieve the design principles a set of objectives has been identified;

- Establish a strong connection to the previous geomorphological and ecological histories of the site and its context; and in this way establish an 'urban ecology' to the precinct.
- Where appropriate, create a uniform 'shared public domain' where the distinction between trafficable and pedestrian spaces is only subtly defined where appropriate (i.e. Flinders Parade).
- Provide a public domain that responds to the climate conditions of Albany through the provision of shaded and comfortable areas and use of deciduous/ evergreen trees where solar access is desirable.
- Ensure that there is a seamless integration between interior and exterior spaces, expressed primarily through ground plane materiality, texture, colour and pattern.
- Ensure that there is a strong connection to the broader Middleton public domain through the connection of view lines and the selection of details, materials and vegetation.
- Integrate art work consistent with landscape themes.
- Provide flush pedestrian orientated surfaces.

## COASTAL PROTECTION

To achieve the design principles the following features have been identified;



### 1 ROCK ARMOURING

A band of placed granite boulders will provide the protective armour to the Middleton Beach Foreshore.

Extending 4 metres below the layer of sand nourishment (Refer Principle 2), the lineal rock treatment will dissipate wave velocities during surge events as the sacrificial layer of sand is subsumed by the ocean.

### 2 SAND NOURISHMENT

Sand sourced from the northern accreting dunal system within the Middleton Reserve will be relocated to foreshore's beachfront, creating a sacrificial sand layer over the foreshore's rock armour edge (Refer Principle 1).

Following storm events, the Foreshore's sand layer will be replenished, providing a perpetual visual and physical connection from the promenade to the beachfront.

### 3 VEGETATION PROTECTION

Strategically placed, isolated pockets of suitable planting will enable an additional layer of subsurface strength to the foreshore's edge.

Networks of interlaced root systems will provide a subsurface adhesive assisting the rock armour barrier, hardscape and sacrificial sand layer (Refer Principles 2, 4 & 5).

### 4 SURFACE TREATMENTS

Hardscape surface treatments, such as the enlarged promenade walkway, provide an additional layer of strength to the coastal protection armoury.

Whilst transitioning the grade change from the adjacent activity nodes, landscape wall terracing systems will assist the stabilization of the foreshore during coastal storm events.

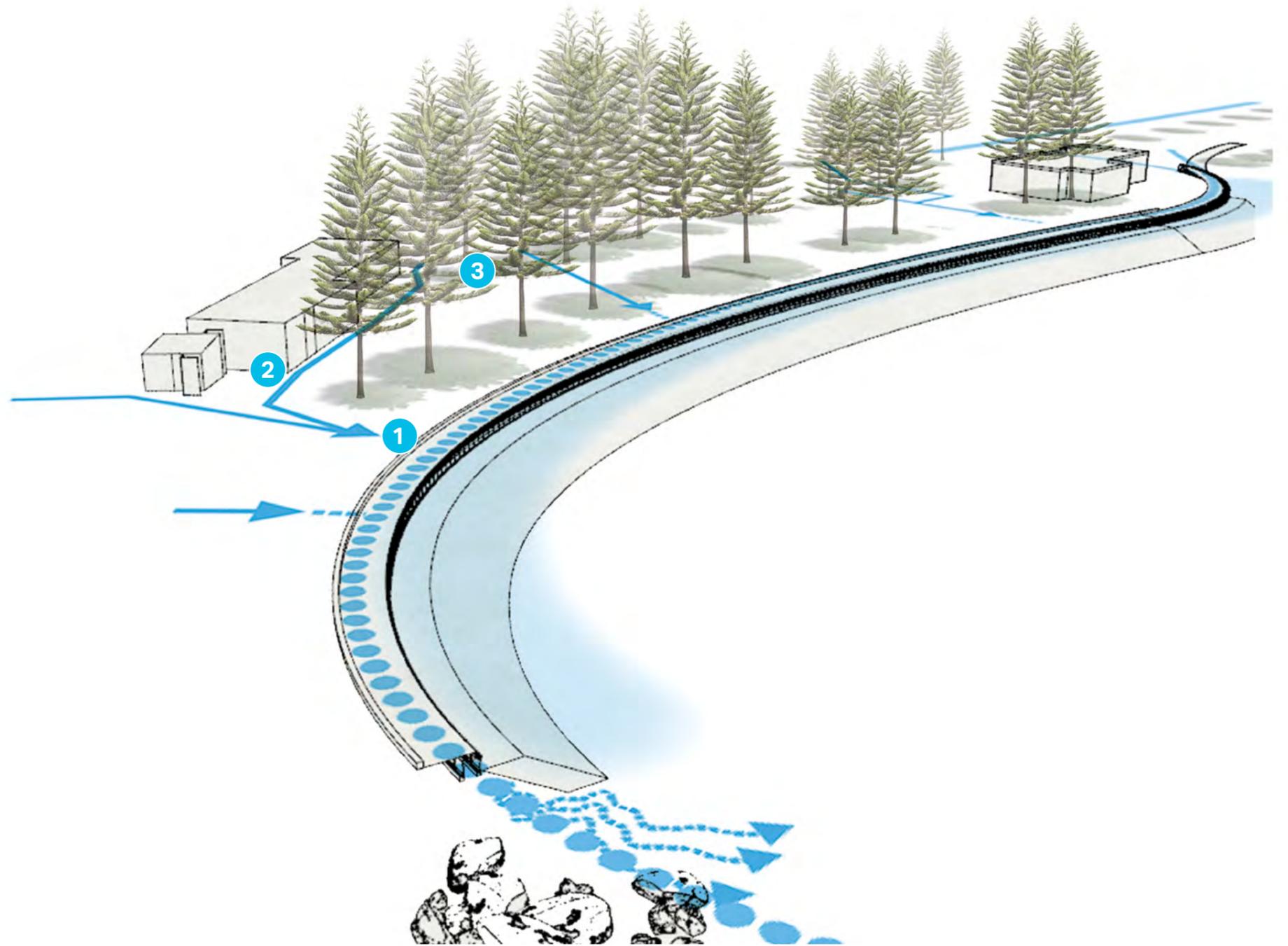
### 5 RETAINED LEVELS

Intentionally retaining and protecting the existing, forged ground levels will add further structural stability to the foreshore's edge.

The retention of adjacent levels will also provide stability to tree health and assist the vegetative protection component (Refer Principle 3) via maintained subsurface root systems.

**DRAINAGE AND WATER QUALITY**

To achieve the design principles the following features have been identified;



**1 CHANNEL SYSTEM**

Utilising the existing subsurface storm water infrastructure, the proposed channel system, via the use of a 1200mm high concrete box culvert, conceals, stores, and disperses the collective discharge from the existing system's outlets during heavy rain events.

Water volumes are initially stored within the culvert system before filtering through a drainage media of limestone rock particles. Stormwater is then dispersed into the groundwater system.

**2 GROUND WATER**

Excess groundwater will be controlled by the proposed channel system via the granite/limestone rock filter media and drainage channel system (Refer Principle 1).

Within its current condition, surface water is distributed onto the beach foreshore, causing erosion, hazardous pollutant deposits & potential safety risks to the public.

The proposed channel system (Refer Principle 1) will remove the risk of pollutant exposure to beachfront users.

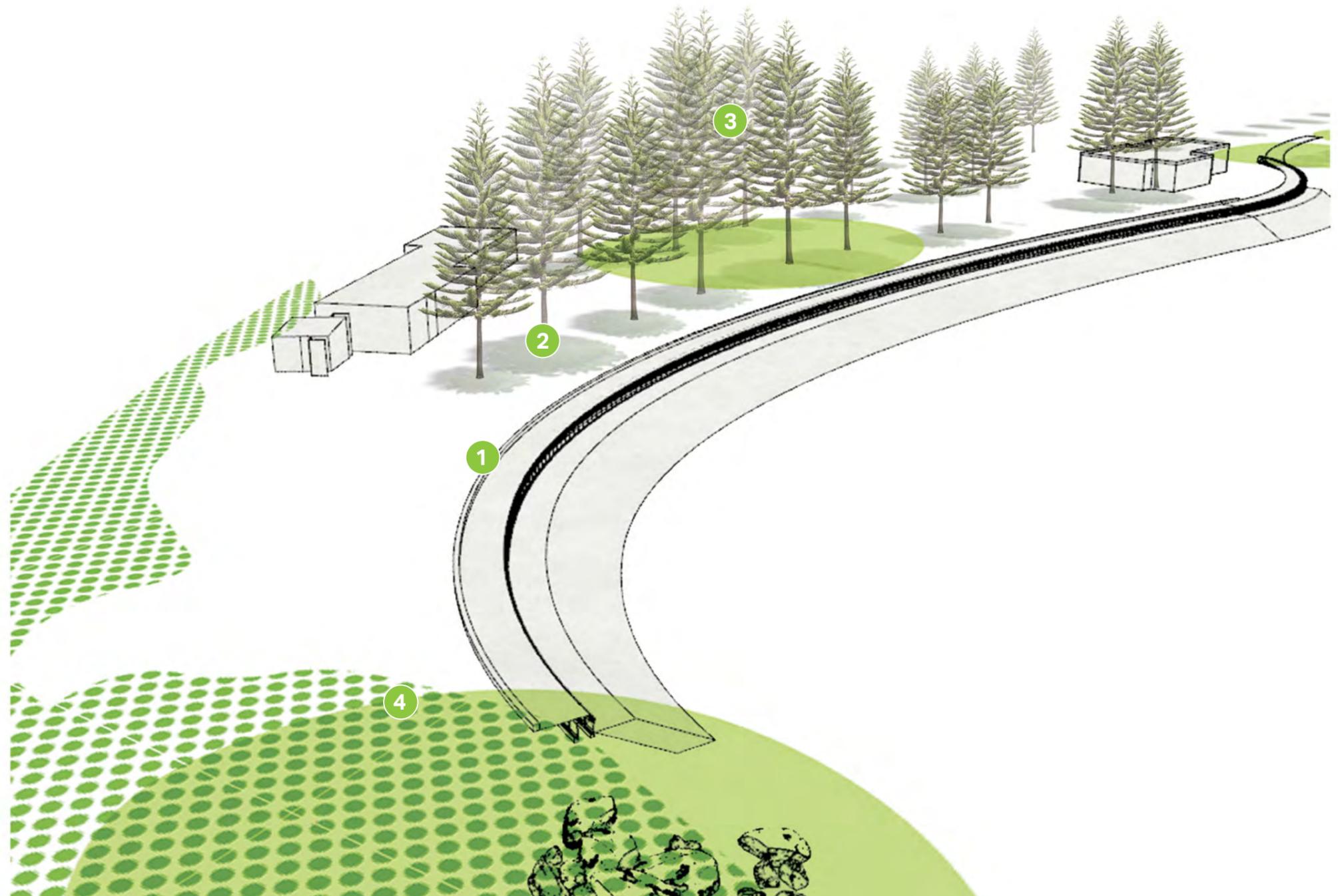
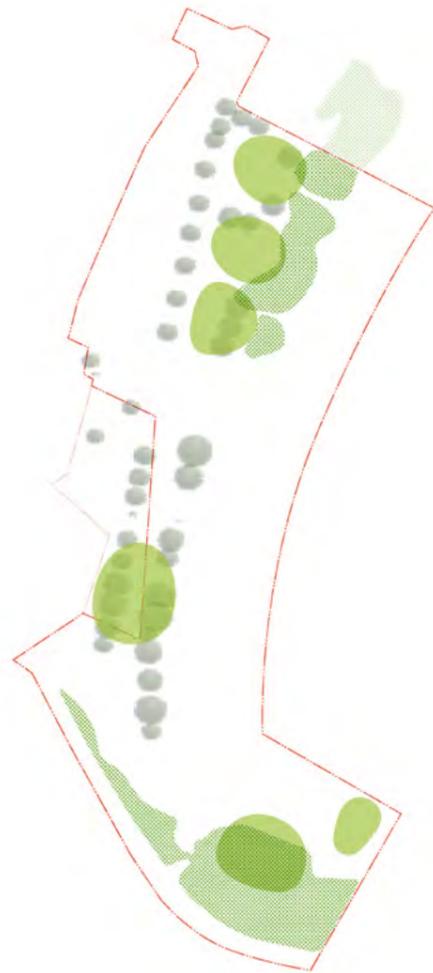
**3 WATER QUALITY**

The structural rock armouring and box culvert will retain, filter and redistribute excess ground and surface water into the wider water table system.

Additionally, strategic planting and existing tree vegetation will benefit from the enhanced filtration of ground water. In addition, the augmentation of the vegetative layer will provide further filtration to the ground water system.

**PASSIVE AMENITY**

To achieve the design principles the following features have been identified;



**1 PROMENADE TREATMENTS**

Varied surface material treatments to the promenade walkway will enhance visual amenity, activate activity and enhance the overall landscape user experience.

Utilizing a material palette sympathetic to the vernacular surroundings, the promenade will offer a variety of passive and active recreational usages through a consolidated furniture fittings and equipment (FFE) suite. This suite will integrate with the concrete and timber surface treatments of the promenade.

**2 SEATING WALL**

Seating opportunities will be offered along the western edge of the promenade, allowing for passive surveillance of the surrounding pathways and open spaces.

Utilising a selection of concrete and timber, the seating nodes will offer views either side of the promenade, either out to Ellen Cove or back towards the Middleton Beach Foreshore and Activity Centre.

**3 TREE CANOPY**

The retention and augmentation of the existing tree structure will soften the proposed hardscape treatments, as well as compliment and enhance the user experience through shade and visual connections to the surrounding landscape & proposed urban tree canopy.

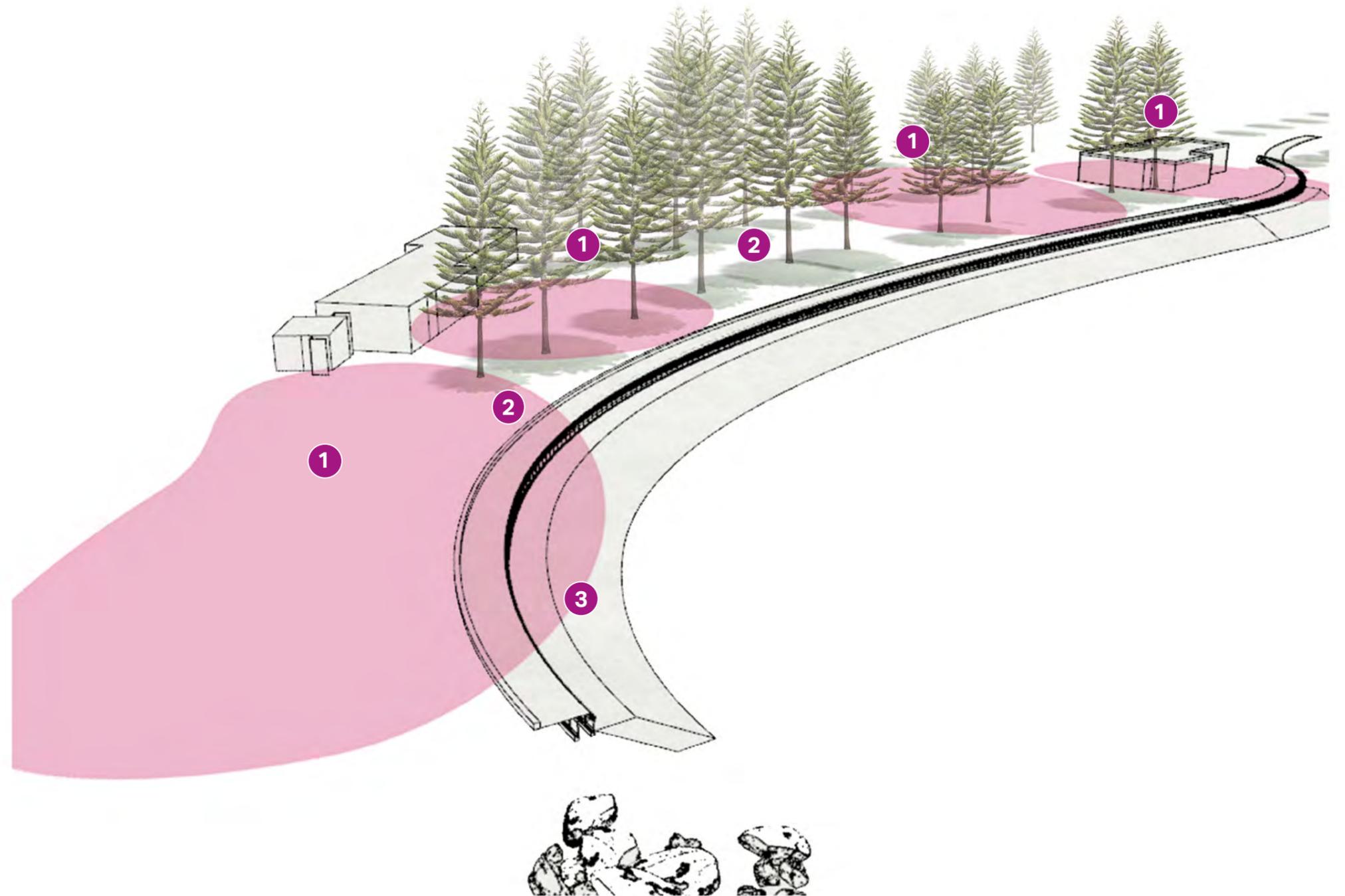
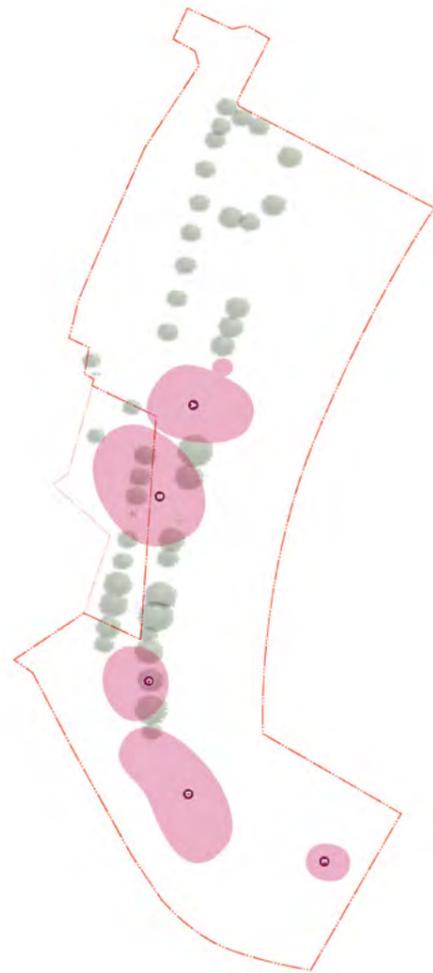
**4 ENVIRONMENTAL REHABILITATION**

Environmental enhancements such as tree structure and coastal re-vegetation and rehabilitation will form a key component of the proposed landscape scheme.

These enhancements will not only perform aforementioned functions for coastal protection, water quality, user comfort and visual amenity, but also provide ecological enrichment through the expansion and protection of habitat.

**PLACE ACTIVATION**

To achieve the design principles the following features have been identified;



**1 EVENT SPACES**

Proposed open grassed spaces situated along the promenade's western edge will be designed not only to offer opportunities for both passive and active recreation, but also for the facilitation of larger community events.

Assisted by the wind and sun protection of the existing and enhanced tree structure, activated event spaces will instil a strong 'sense of place' through positive experiences assisted by the optimised landscape surroundings.

**2 ACTIVE EDGE**

The promenade edge will encourage a variety of passive and active recreational opportunities.

Passive activities such as picnicking, gathering and seated surveillance will be assisted by strategically placed furniture situated under existing shade trees.

Spaces for dynamic activities including jogging, walking and cycling will be offered along the promenade, as well as group fitness activities within event spaces & activity nodes.

**3 BEACH**

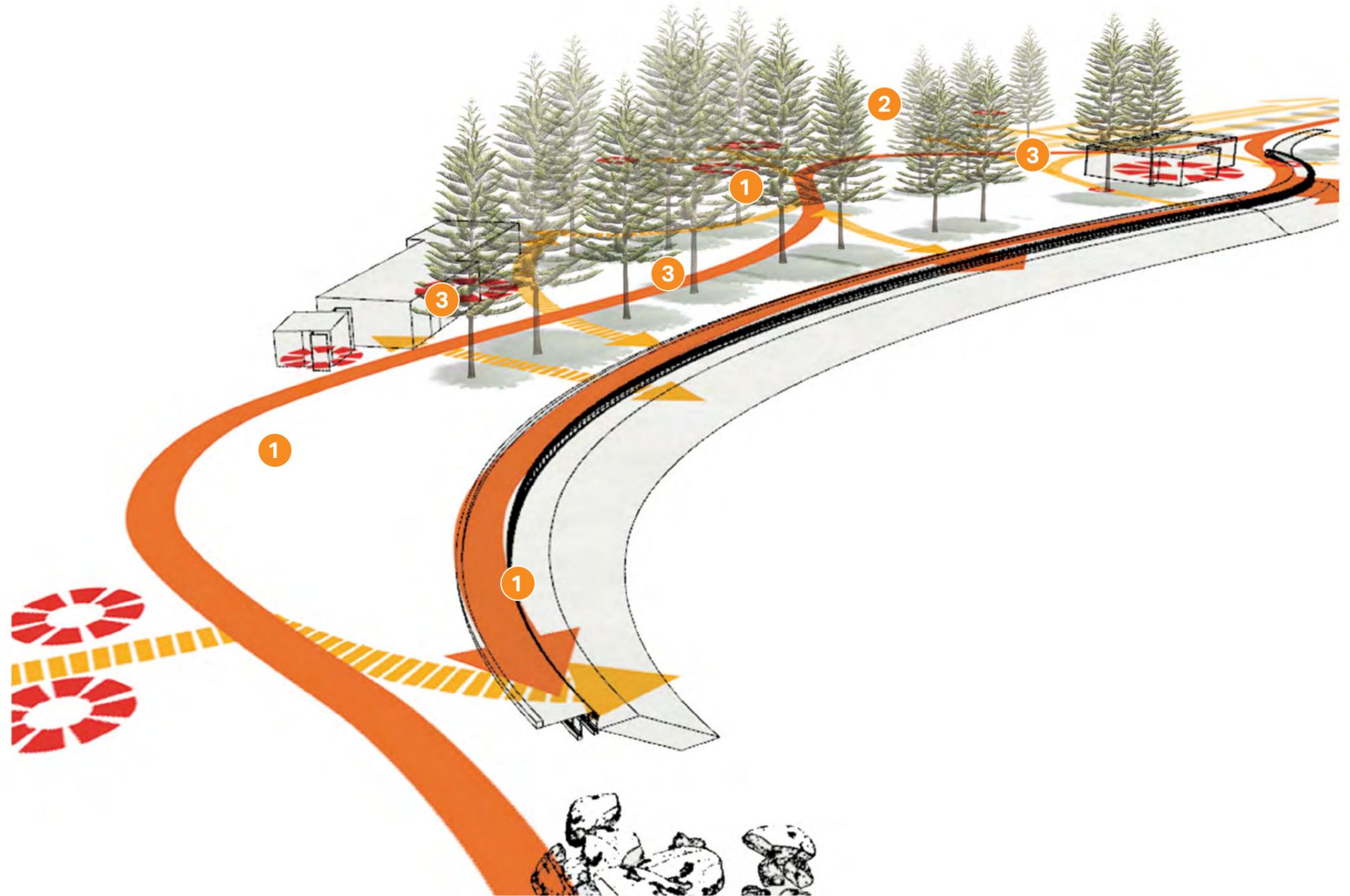
By combining the proposed sand nourishment and storm water discharge strategies, the beach foreshore will offer a much improved beachside experience.

The enhancements will enable further encouragement of beach side activities such as swimming, volleyball, sunbathing and picnicking, lending to a more memorable experience for the community and visitors to Albany.

The existing Surf Club will also benefit from the added public popularity provided by the proposed Middleton Beach Foreshore improvements.

## ACCESS AND LINKAGES

To achieve the design principles the following features have been identified;



### 1 PEDESTRIAN ACCESS

Within the wider pedestrian circulation network, the promenade walkway at the Foreshore's edge will encourage circulation away from Flinders and Marine Drive and re-distribute pedestrians into adjacent Middleton Beach urban environment.

The promenade, in association with further pathways pedestrian connections, will aid accessibility to all existing adjacent facilities, such as the Surf Club and northern surface carpark.

### 2 PUBLIC TRANSPORT PRIORITY

The enhanced pedestrian circulation network will assist the proposed prioritisation of public transport connections to the Middleton Beach Foreshore and surrounds.

Currently positioned within the northern surface carpark, the prioritised bus stop will distribute users from a wider City loop distribution route. The continuation of the promenade will collect these users, allowing for an uninterrupted approach toward to beach and adjacent activity nodes.

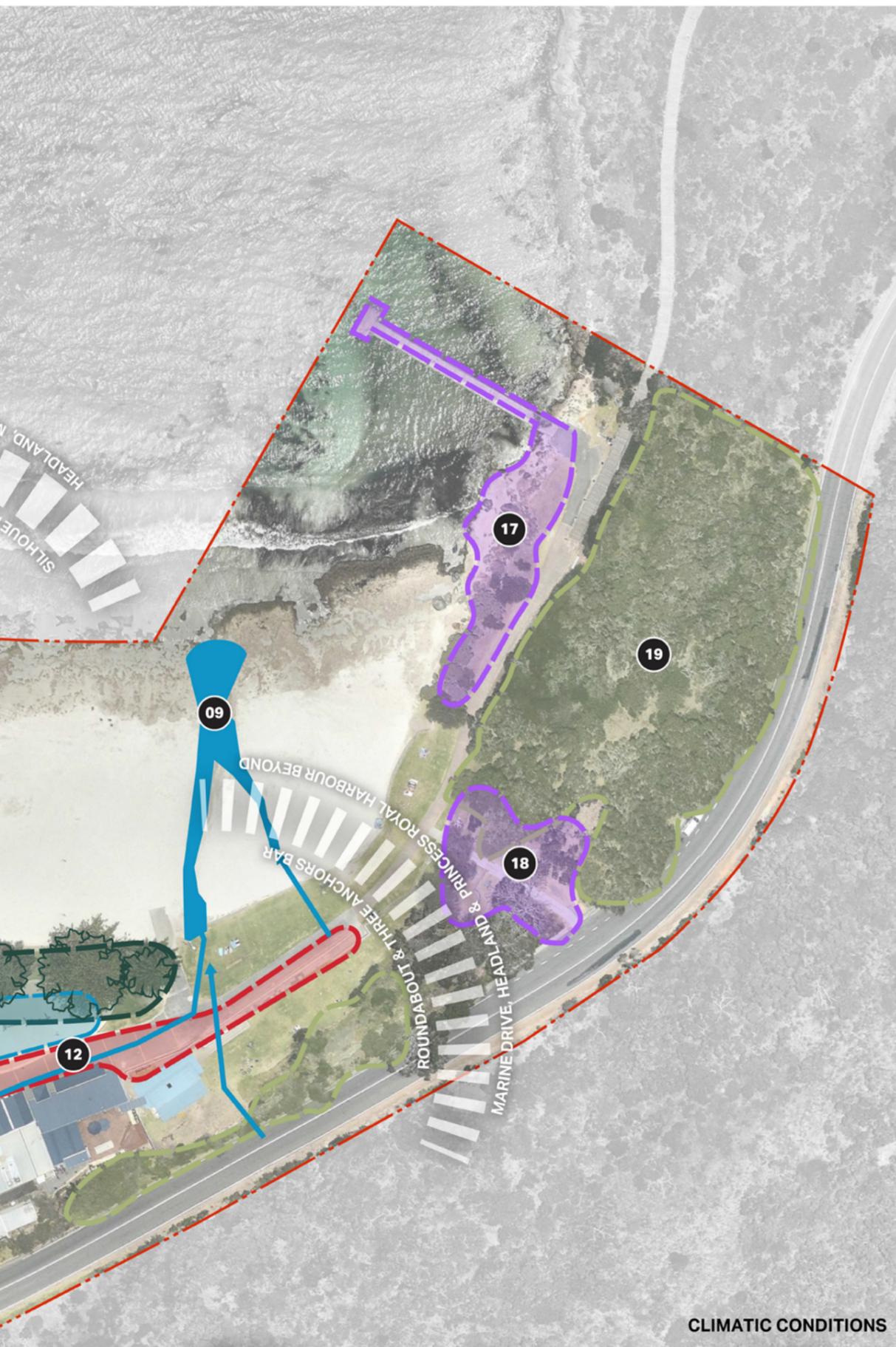
### 3 VEHICULAR CIRCULATION

The promenade and collective shared pathway networks will be designed to facilitate vehicular traffic, such as maintenance, delivery and emergency vehicles.

Adjacent facilities such as the Surf Club will receive operational benefit from enhanced hard paved connections (pedestrian and vehicular), stemming from Flinders Drive surface carpark.



# Existing Conditions



- 01 ACCRETING DUNE SYSTEM INFESTED WITH WEEDS TO WESTERN EDGES
- 02 DEEP SHADE UNDER EXISTING TREES PREVENTS TURF FROM ESTABLISHING REDUCING AMENITY AND EXPOSING ROOTS AT GROUND SURFACE
- 03 LIMITED PASSIVE SURVEILLANCE TO PLAYGROUND
- 04 CARPARK CREATES A PHYSICAL BARRIER TO PEDESTRIAN PERMEABILITY
- 05 LIMITED AND AGING RECREATION FACILITIES
- 06 BARBEQUE AND BUS SHELTERS ARE AGING AND AFFECTED BY CORROSION
- 07 TURFED & ELEVATED VERGES WITH NO STREET TREES
- 08 LOW POINT TO CARPARK SUBJECT TO FLOODING AND LIMITS STORM WATER INFILTRATION
- 09 UNTREATED DRAINAGE OUTFALL TO BEACH PRESENTS PUBLIC HEALTH RISK AND EROSION TO BEACH PROFILE REDUCING AMENITY
- 10 LIMITED ACCESS FOR SURF CLUB OPERATIONS
- 11 LIMITED SHADE AND SCREENING TO CARPARK
- 12 NARROW FRONTAGE LIMITS VISIBILITY OF CYCLISTS
- 13 SAND ACCRETION TO TURF CREATES UNEVEN SURFACES AND BURIES SPRINKLERS CREATING ONGOING MAINTENANCE ISSUES
- 14 SLOPING AREA TRANSITIONING TO PROPOSED DEVELOPMENT FINISHED LEVELS
- 15 PAVEMENTS ARE UNEVEN, CRACKED AND AFFECTED BY HEAVING FROM TREES
- 16 ELEVATED PLAYGROUND EDGING INTERRUPTS OVERLAND DRAINAGE CREATING A DAM EFFECT TO CAFE FRONTAGE
- 17 ROCKS, TREES AND JETTY PROVIDE VISUAL AMENITY
- 18 POPULAR PICNIC DESTINATION DUE TO SHELTER, SHADE AND ELEVATED VISTAS
- 19 WELL ESTABLISHED NATURAL VEGETATION WITH OCCASIONAL WEED INFESTATIONS TO UNDERSTOREY
- 20 MIDDLETON BEACH ACTIVITY CENTRE SITE

From the accreting sand dunes to the north to the Ellen Cove Jetty to the south, the existing condition of the Middleton Beach Foreshore presents strong opportunities for strategic enhancement as suggested by the Enhancement Plan.

## NORTHERN DUNES AND OPEN GRASS SPACES

Separated by timber post and rail fencing, the accreting, weed infested dunal formations and sloped grasslands provide a regressed amenity for the broader Middleton Beach precinct. Isolated within the grassland's northern corner, a junior playground serves as a popular play destination due to its detachment from the foreshore precinct and close proximity to the Flinders Parade Carpark.

## FLINDERS PARADE CARPARK

The adjacent carpark is exposed to high levels sunlight due to sparse, pine tree planting to the carpark's central islands. Vehicle and pedestrian circulation within the recently re-surfaced carpark is inhibited by a localised trap (low) point which frequently ponds during rain events. The carpark's exposure to the surrounding landscape is furthered by the lack of tree plantings within the adjacent grassed verges to the western side of Flinders Parade.

## ALBANY SURF CLUB

Serving as the precinct's active recreational hub, the surf club's functionality is hindered by the restrictive surrounding hardscape composition (Refer Key 10). During times of high usage, surf board users suffer from entry and egress constraints impeded by the shared use path dissecting the club and the Flinders Parade carpark, as well as the spatial tension shared between the northern building face and adjacent dunal batter.

## THREE ANCHORS CAFE/RESTAURANT

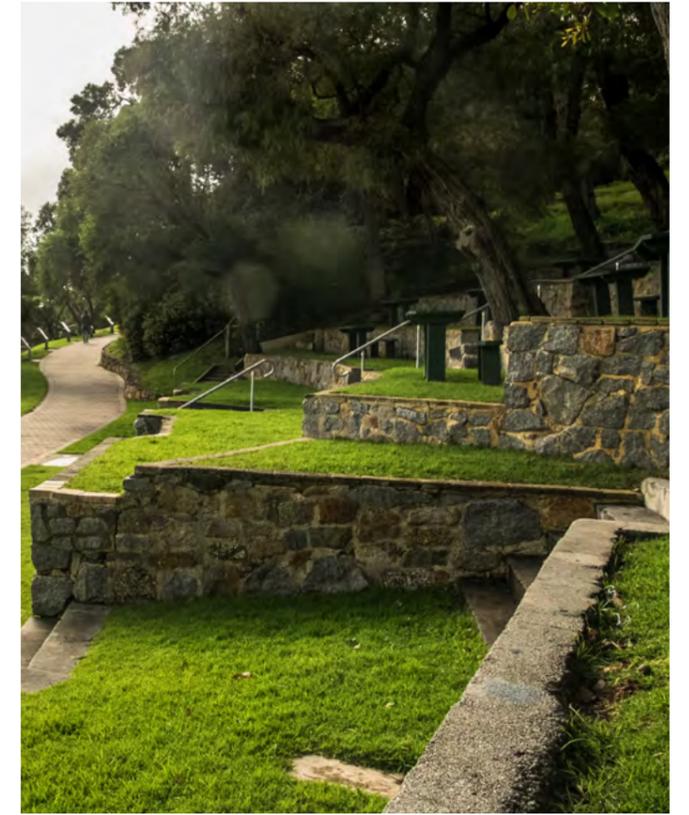
The long serving cafe and restaurant continues to draw a broad visitor and community scale to Middleton Beach. A poorly sighted play space impedes outlook from within the cafe, creating a pinch point for the shared use path (between the cafe's building face), as well as heavily disrupts the overland flow path stemming from the carpark to the shore.

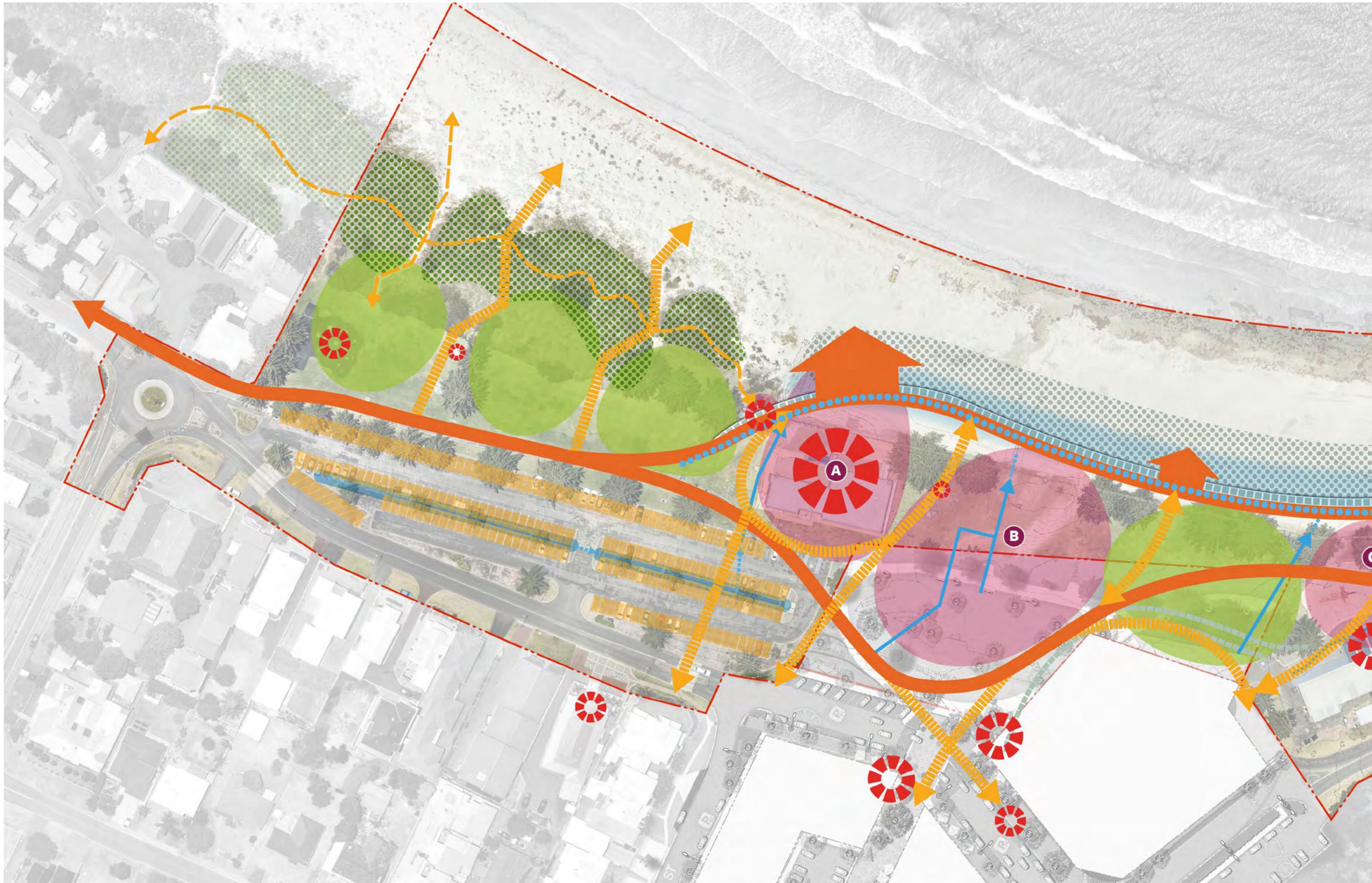
## ELLEN COVE BEACH FRONT

The character of the Middleton Beach Foreshore is defined by the scoured shoreline (Refer Key 09) due to the exposed stormwater outlet discharge. South of the beachfront and west of the Three Anchors Restaurant are a series of grassing expanses dissected by the shared use path serving for The Shipping Lane traverse. Varied stone wall treatments combine to form a prominent retaining element required by the topography of Marine Drive. Flanking a staired, pedestrian connection from Marine Drive to the shared use path is a popular passive and active recreational node lending itself to wind and sun protection via a series of grassed and stone wall terraces. The historic Ellen Cove Jetty bookends the project scope despite its detachment from the broader Ellen Cove precinct. Interpretive signage is offered en route via a DDA inaccessible dual use path dedicated to the Shipping Lane traverse (Refer Key 18).



## Existing Conditions Imagery





# Opportunities Activation Precincts

## PLACE ACTIVATION AND CHARACTER PRECINCTS

Providing for a varied, valued and memorable human experience is a key objective of the Middleton Beach Foreshore Management Plan. Measured, strategic, and adaptable design approaches to each unique spatial opportunity are fundamental in successfully responding to the needs of all users groups. These spaces are referred to as 'Character Precincts'.

Significant Character Precincts of the Middleton Foreshore include:

### A. NORTHERN DUNES AND ACTIVITY

The open grass space shaded by a cluster of Norfolk Island Pines is a popular destination for community users due to its proximity to the Flinders Parade carpark and wind protection provided by the accreting dunal formations to the south.

Potential opportunities can be realised via the retention of the space's current usage and distinct character, as well as the augmentation of its current facilities. This will therefore enable a broader spectrum of community utilisation.

### B. SURF CLUB

The Albany Surf Lifesaving Club is the recreational heart of Middleton Beach. Greatly valued by the community due to its long service as an interactive activity hub, the Surf Club is a key contributor to the Middleton Beach Foreshore's landscape and urban composition.

An assessment of Surf Club's functional performance demands additional capacity for storage, circulation, strengthened beach interface and accessibility improvements between the beach access and adjacent surface carpark.

### C. CENTRAL OPEN GRASSED SPACE

The existing open grassed space which envelopes the Norfolk Island Pine structure currently provides a transitional activity gradient interfacing the adjacent infrastructure (i.e. carparks and facilities) and the Middleton beach front.

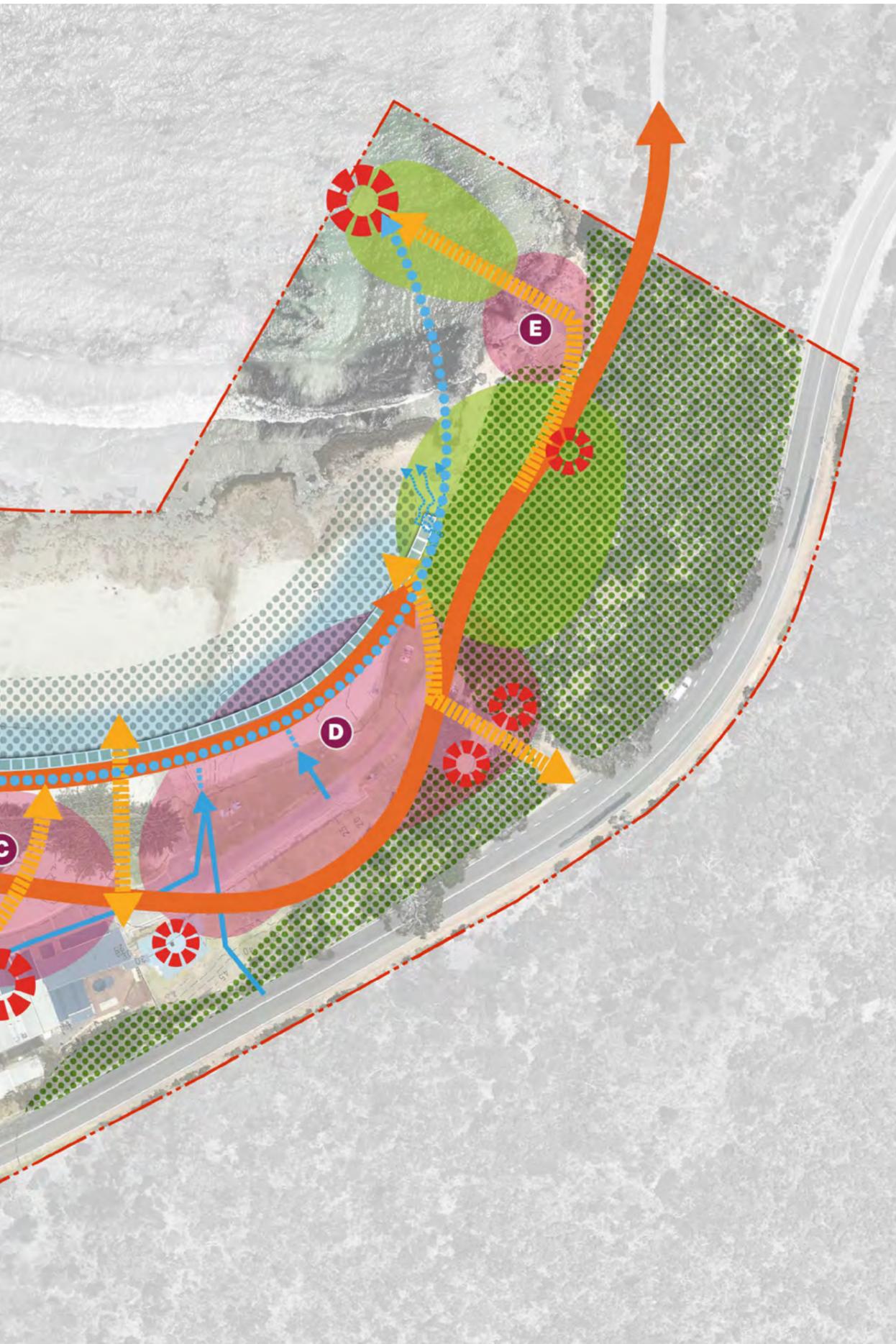
The Enhancement defines and programmes pockets of individual spaces within the broader grassed tract. Proposed activation strategies will directly relate to those activities surrounding them, therefore the grassed activity nodes will offer flexible opportunities for both passive and active recreation, whilst also holding the capacity to facilitate larger community forums and events.

### D. THREE ANCHORS CAFÉ/RESTAURANT & PLAYSACE

The Three Anchors Café/Restaurant has delivered the experiential essence of Middleton Beach to the community and passing tourist alike.

## LEGEND

	<b>PRECINCT BOUNDARY</b>		<b>STORMWATER DETENTION (PASSIVE INFILTRATION)</b>		<b>ACTIVATION ZONE</b> ACTIVITIES + EVENTS
	<b>COASTAL PROTECTION</b> ROCK ARMOURING & SAND NOURISHMENT (BELOW GROUND)		<b>PRIMARY STORMWATER COMPENSATION STRUCTURE</b>		<b>SURF CLUB</b> OPERATIONS + EVENTS
	<b>PRIMARY SHARED PATH</b> CYCLISTS + PEDESTRIANS (4m WIDE)		<b>STORMWATER PIPE OUTFALL</b>		<b>CENTRAL OPEN SPACE</b> FLEXIBLE SPACE LARGE SCALE EVENTS
	<b>SECONDARY PATHWAY</b> CYCLISTS GIVE WAY (3m WIDE)		<b>AMENITY ZONE</b> PASSIVE RECREATION		<b>THREE ANCHORS</b> ALFRESCO FORECOURT + PLAYSACE
	<b>NATURE TRAIL</b> PASSIVE WALKING ONLY (1M WIDE)		<b>SIGNIFICANT VEGETATION</b> RETAIN + REHABILITATE + PROTECT		<b>SHELTERED PICNIC POCKET</b> ACTIVE OPEN SPACE + POP-UP EVENTS
	<b>PUBLIC ACCESS NODE</b> (BUS SHELTER + BIKERACKS)		<b>EXISTING TREES</b> TO BE RETAINED + PROTECTED TRANSLOCATE SELECT SPECIMENS		<b>ELLEN COVE JETTY</b> KEY DESTINATION + AQUATIC ACTIVITY



The opportunity to re-organise and modify the composition of the precinct is crucial to the future functionality of the Middleton Beach Foreshore. Views from the Café/Restaurant through the grassed open space and beach are currently obstructed by the immediate play space. These viewsheds, as well as the pooling created by unsuitable surrounding surface grades would greatly benefit from the relocation of the playspace.

The relocation of the playspace would allow for the potential realignment of the shared use path by separating commuter movement, easing spatial pressure upon the Cafe's frontage.

### E. BEACHFRONT

The Ellen Cove Beach front has suffered as the collective outlet for the existing storm water surface collection system. Outlets currently distribute flows underground then onto the beachfront sand surface, causing severe erosion, beach surface fragmentation, as well as a hazardous chemical pollutant trap.

A strategic, hydraulic response would enable the concealment of the existing storm water infrastructure through the consideration of a consolidated yet secluded outlet. This would allow for a unified, uncontaminated, and aesthetically desirable beachfront ocean interface.

### F. GRASSED TERRACES

Currently mitigating the grade level change from Marine Drive and Ellen Cove is a series of retaining and terraced walls which combine to form a dramatic landscape feature which characterises Ellen Cove. The sheltered, grassed terraces allows for ideal views to the north of the foreshore, whilst the broad staircase offers a challenging fitness circuit for active users.

The current spatial allocation to the terraces is restrictive; therefore the potential to extend and enhance the terraces along with highlighting the unique, varied stonework of the current retaining wall system will facilitate ideal picnicking and observational vantage points to the beachfront and associated activities and events.

### G. ELLEN COVE JETTY

The historic Ellen Cove Jetty offers a key, historic snapshot of Middleton Beach Precinct and the wider City of Albany. The Jetty's narrative is expressed via interpretive signage flanking an uncompliant DDA path dedicated to the broader Shipping Lane historic trail.

The landscape character provided by the jetty, surrounding rock boulder outcrop and associated planting must be retained, yet preserved as a prevalent landscape feature within the composition of the broader foreshore precinct.

# Site: Existing



# Precinct Master Plan



LEGEND			
	PRECINCT BOUNDARY		DUNAL PATHWAY & FENCING
	OPEN TURF AREA		COASTAL REVEGETATION
	DUAL USE PATH		SEATING WALL
	DECKED PROMENADE		CONCRETE PAVING
	DECKED RAMP ACCESS TO BEACH		EXISTING PLAY STRUCTURE
	PLAY ACTIVITY NODE		BUS / PICNIC SHELTER



**LEGEND**

	<b>PRECINCT BOUNDARY</b>		<b>FORMALISED DUNAL PATHWAY &amp; ASSOCIATED FORESHORE FENCING</b>		<b>INSITU CONCRETE PAVING</b>
	<b>GRASSING</b>		<b>STORMWATER BIO-RETENTION SWALE MASS PLANTING</b>		<b>EXISTING / RELOCATED PLAY STRUCTURE PLAYSAND UNDER</b>
	<b>ASPHALT PATH</b>		<b>SEATING WALL 500 HIGH TYPICAL</b>		<b>EXISTING TREES TO BE RETAINED + PROTECTED TRANSLOCATE SELECT SPECIMENS</b>
	<b>DECKED PROMENADE ACTIVITY NODE</b>		<b>GRASSED WALL TERRACES</b>		<b>PROPOSED TREES TO BE RETAINED + PROTECTED TRANSLOCATE SELECT SPECIMENS</b>
	<b>DECKED RAMP ACCESS TO BEACH</b>		<b>PLAY ACTIVITY NODE PLAYSAND UNDER</b>		<b>BUS / PICNIC SHELTER ANODISED ALUMINIUM CONSTRUCTION SAFETY GLASS ROOF (Immité REG800)</b>



# Enhancement Plan



## INTRODUCTION

The Middleton Beach Foreshore will conserve and celebrate the cultural and ecological significance of Middleton Beach. The Enhancement Plan will provide flexible settings for recreational opportunities, as well as historical, ecological and economic enhancements which will directly benefit the residents of the Middleton Beach community.

Many of the aesthetically valuable components of the site - The Ellen Cove Jetty, retaining walls and grass terracing, as well as the Norfolk Island Tree Pine structure, open grass areas and sand dunes survive relatively undiminished.

Investment in the Middleton Beach precinct, combined with community stewardship will provide an ideal response to the Foreshore's current state of decline and transform it into the precinct that has been imagined by the local community for decades. The transformation will make the Foreshore more accessible, flexible and treasured for future generations.

Significant character precincts defined by the Middleton Beach Foreshore Enhancement Plan include:

### A. NORTHERN DUNES & ACTIVITY

The Enhancement Plan proposes the retention of the space's current usage and character, whilst additional opportunity is presented with the augmentation of its play amenity. Junior play facilities will be retained and enhanced, whilst a broader age group will be stimulated via the introduction of adult outdoor exercise elements sited within the open space amongst the existing pine trees.

Path connections through Middleton Reserve sand dunes will be formalised to allow for direct foot traffic to the beachfront, therefore minimising impacts on dunal vegetation. Dunal re-vegetation will be achieved via appropriate measures described with a Foreshore Management Plan (by others).

### B. SURF CLUB

The Enhancement Plan aims to provide the Surf Club with additional capacity for storage, circulation, accessibility improvements between the beach access and adjacent surface carpark. Upgrades and improvements will borrow visual cues and themes from the precinct, therefore preserving the 'sense of place' for both new & regular users.

### C. CENTRAL OPEN GRASSED SPACES

Isolated land parcels defined by pathways, terracing and an established tree structure, creates a series of individual spaces within the broad central landscape tract. Proposed activation strategies for these parcels will consider their neighbouring facilities respectively, whilst offering flexible opportunities for specialised recreation, as well as capacity to facilitate larger community forums and events.

### D. ACTIVITY CENTRE INTERFACE

Coupled with the adjacent Middle Beach Activity Node development, the Middleton Beach Foreshore Management Plan has highlighted the interface as an opportunity to provide an integrated, cohesive and adaptable response to the anticipated future urban environment.

The interface will perform as an arrival and subsequent distribution point for pedestrians entering from the west (Activity Centre), and the north (Flinders Parade Carpark). Directional signage will help guide the traverse from these entry points.

Treatments will allow users to successfully negotiate the associated level change from the Activity Node's proposed carpark down to the Central Open Grassed Spaces (Refer point C).

### E. HOTEL INTERFACE

Forming a large portion of the Middle Beach Activity Node development precinct, the proposed hotel directly interfaces with the Middleton Beach Foreshore. As this development is currently undetermined, the landscape response to this transitional landscape interface has remained largely

flexible, however key elements have been incorporated such as:

- Grassed terracing and alfresco dining from the proposed hotel floor level.
- Decked frontage serving as a collection point of adjoining path series.
- Arrival & distribution zone for adjacent hotel carpark.

### F. THREE ANCHORS CAFÉ/RESTAURANT & PLAYSPACE

The re-siting of the exiting play space to a new location within the adjacent Central Open Grassed Spaces (Refer Point C) will create an unobstructed view shed from the Three Anchors Café/Restaurant through to the beach front and King George Sound.

The relocation will also allow for clear overland flow path directing water away from the Café's frontage and into a rain garden filtration system as shown east of the hotel & west of the play space (shown in existing location).

Via revised path alignments, foot and bicycle traffic which currently interrupts the Café's façade will be diverted eastward, allowing for additional capacity for alfresco dining. The reconfiguration of the path network will assist in the definition of the proposed activity nodes within the Central Open Grassed Space (Refer point C).

### G. BEACH FRONT

The formerly fragmented Ellen Cove beachfront is revitalised via the proposed 'channel' system which collects and conceals flows from the existing storm water infrastructure through to a combined outlet, north of the Ellen Cove Jetty. The visually recessed outlet will disperse flows into the existing granite boulder outcrop, north of the Ellen Cove Jetty (Refer point J).

The consolidation of the beach front will further encourage activities such as swimming, volleyball, sunbathing and picnicking, lending to a more memorable experience for the community and visitors to Albany.

### H. FORESHORE PROMENADE

The introduction of the Foreshore Promenade will create an 'activation edge', encouraging a variety of passive and active recreational opportunities. Passive activities such as picnicking, gathering and seated surveillance will be assisted by strategically placed furniture situated under existing trees.

Spaces for dynamic activities including jogging, walking and cycling will be offered along the promenade, as well as group fitness activities within the Central Open Grassed Spaces (Refer point C).

### I. GRASSED TERRACES

Extending the existing grassed terraces further west will maximise this highly valued recreational precinct. The extension will occupy the base of an existing retaining wall, for which its striking appearance is perceived by the community as a 'geomorphological chronology' of Albany. The extension of the grassed terracing will consolidate as a collective amphitheatre space overlooking the beach and its associated activities.

### J. ELLEN COVE JETTY

The Ellen Cove Jetty will be further recognised as a singular component contributing to the historical context of the wider foreshore precinct.

The surrounding rock boulder outcrop will be reserved and improved, whilst the proposed promenade's south-eastern termination point will enable integrative opportunities through the hyperextension of a viewing deck into the existing landscape typology.



before



# Illustrative Renders



after

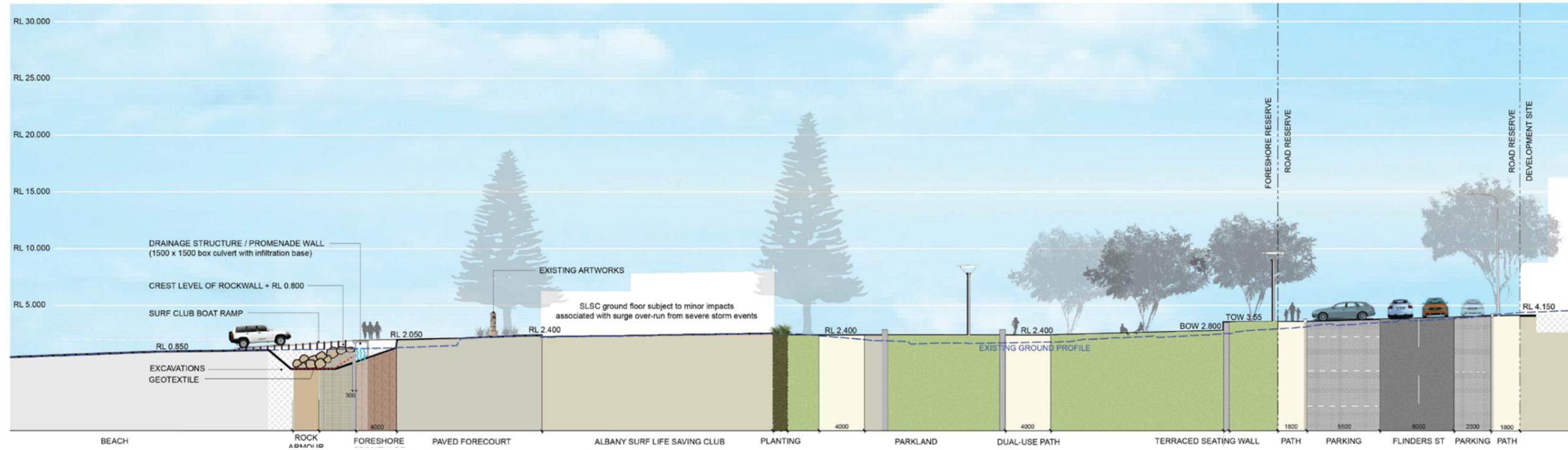




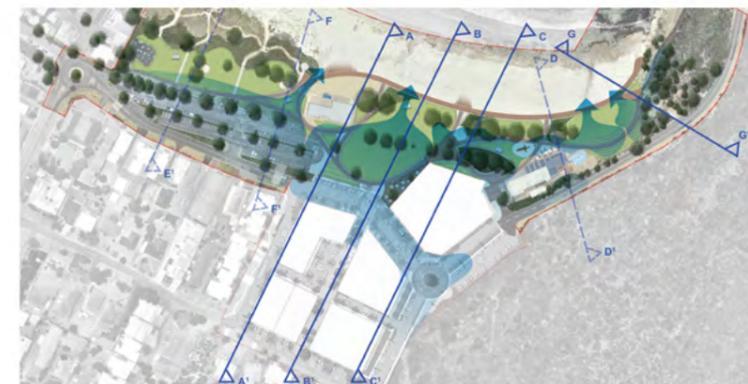
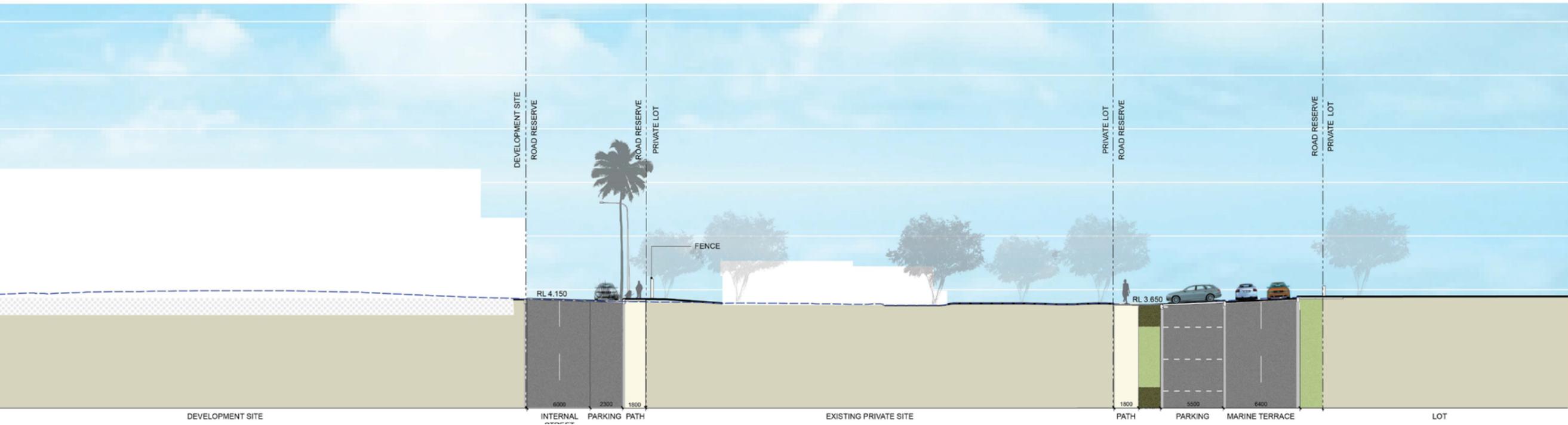




after

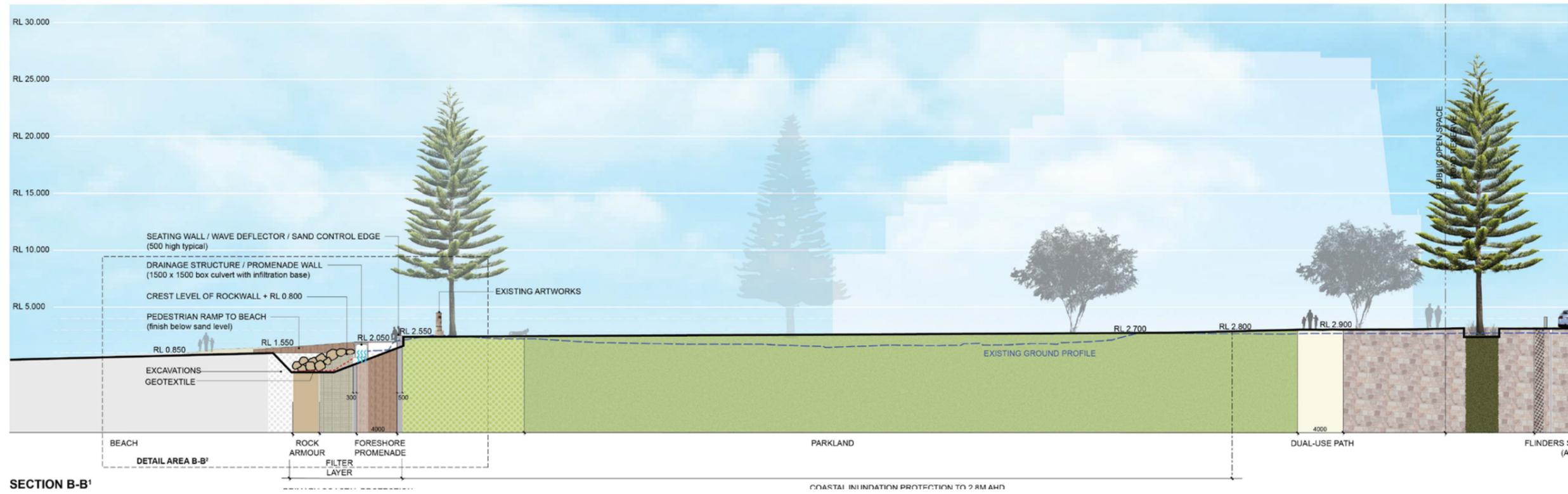


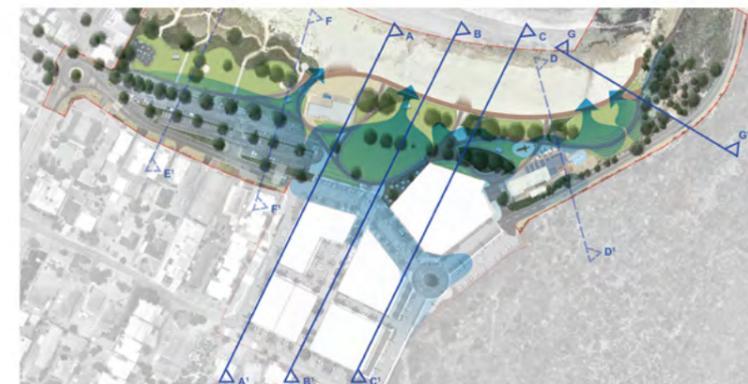
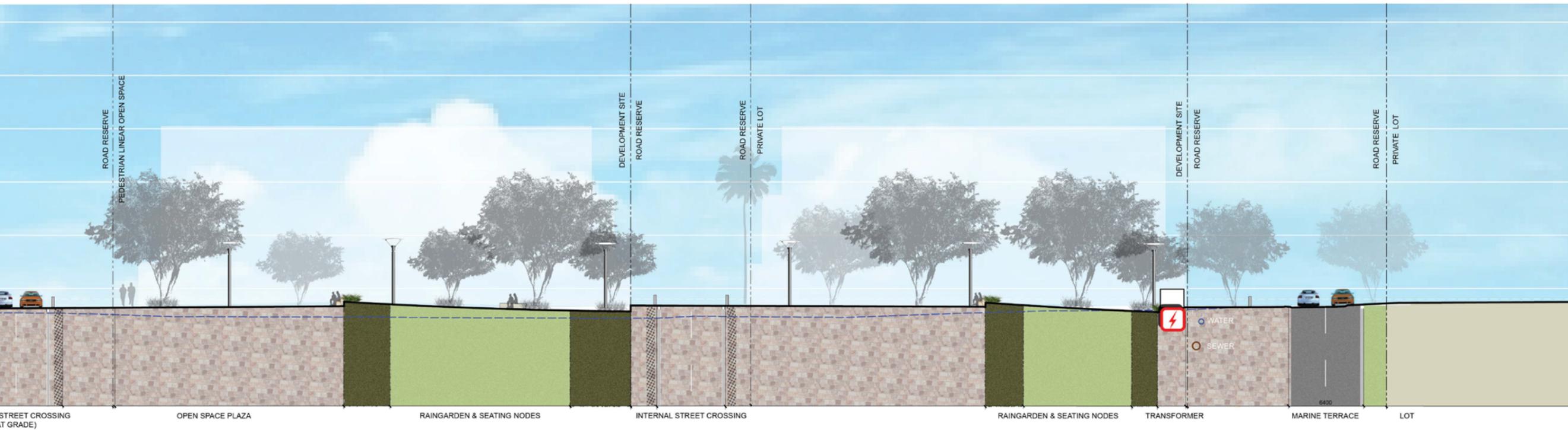
# Illustrative Site Sections



KEY PLAN & OVERLAND DRAINAGE (1:500 @ A0)

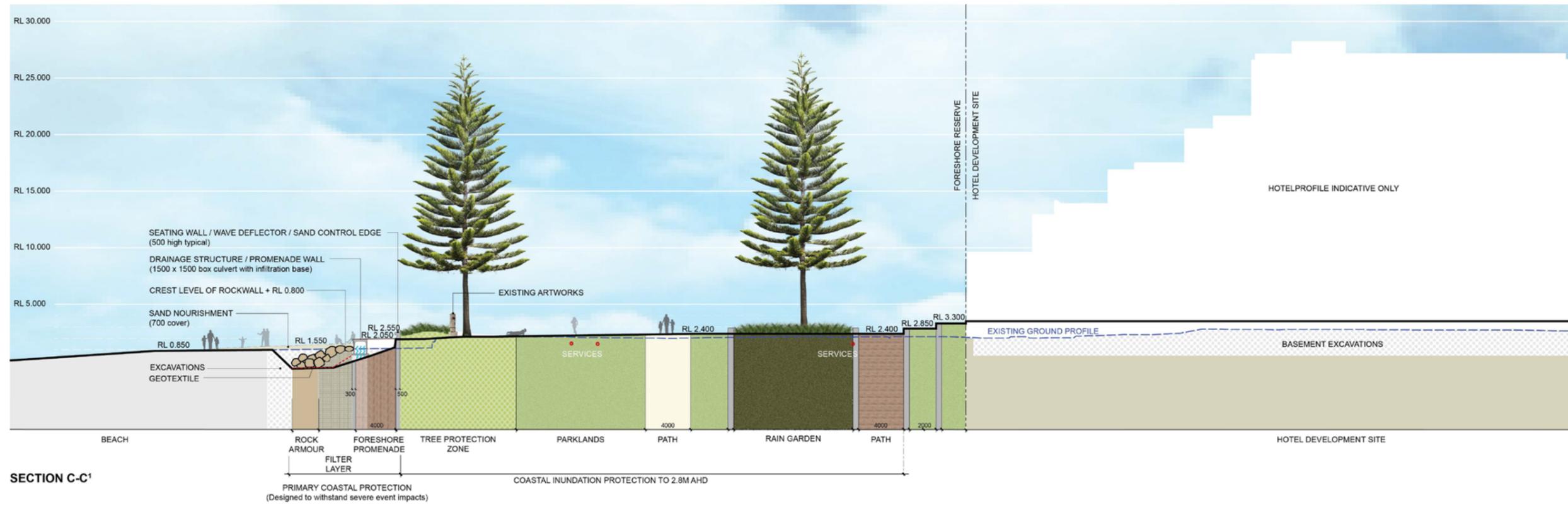
SECTION KEY PLAN (Not to Scale)

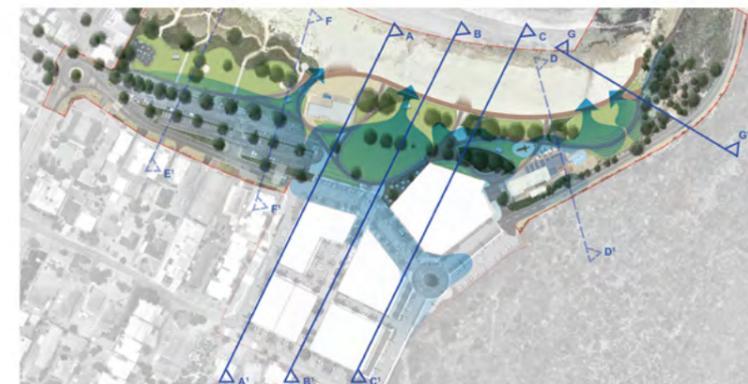
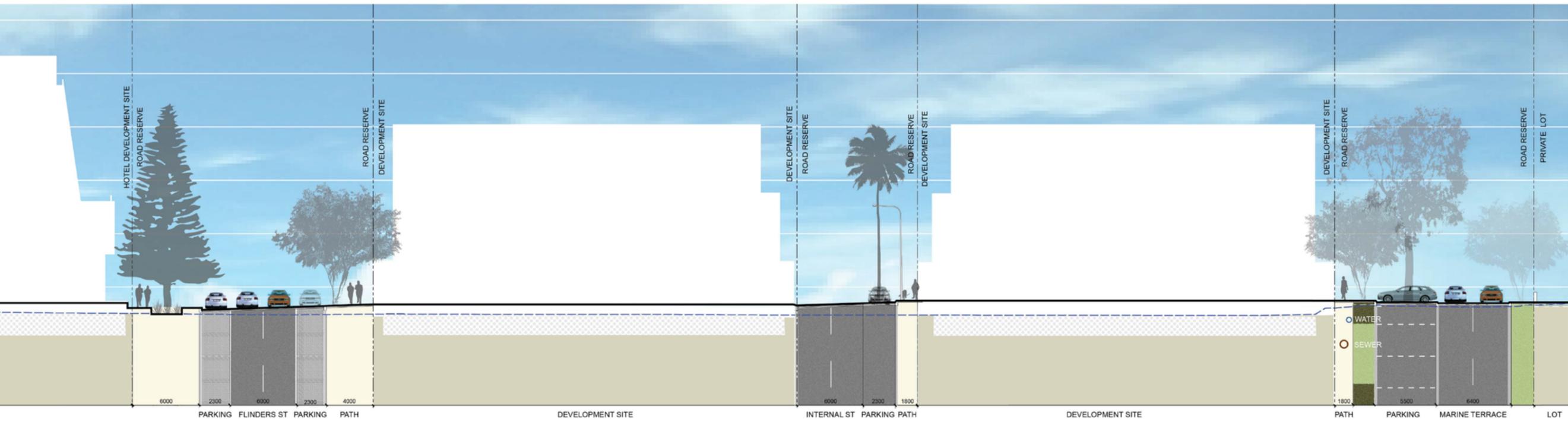




KEY PLAN & OVERLAND DRAINAGE (1:500 @ A0)

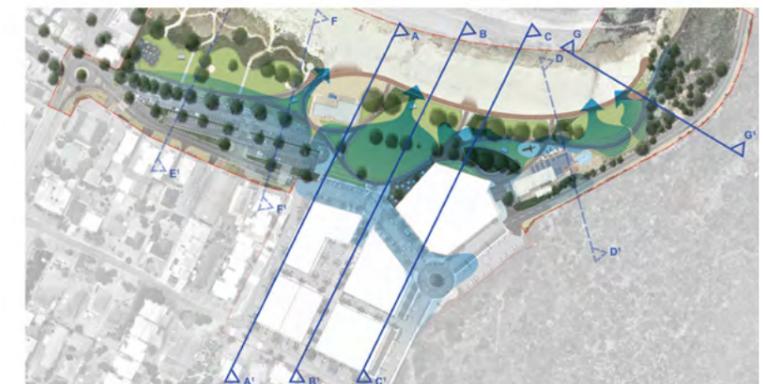
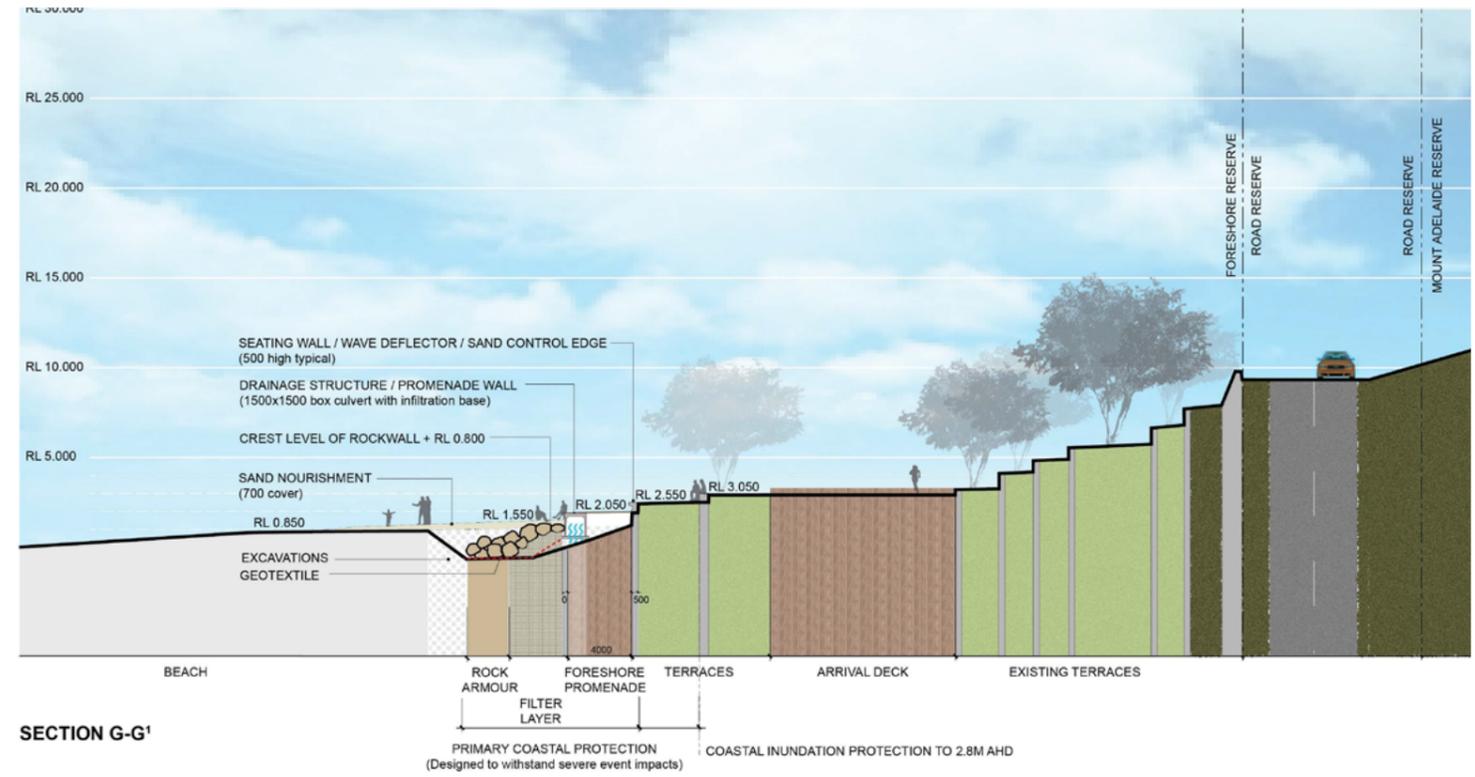
SECTION KEY PLAN (Not to Scale)



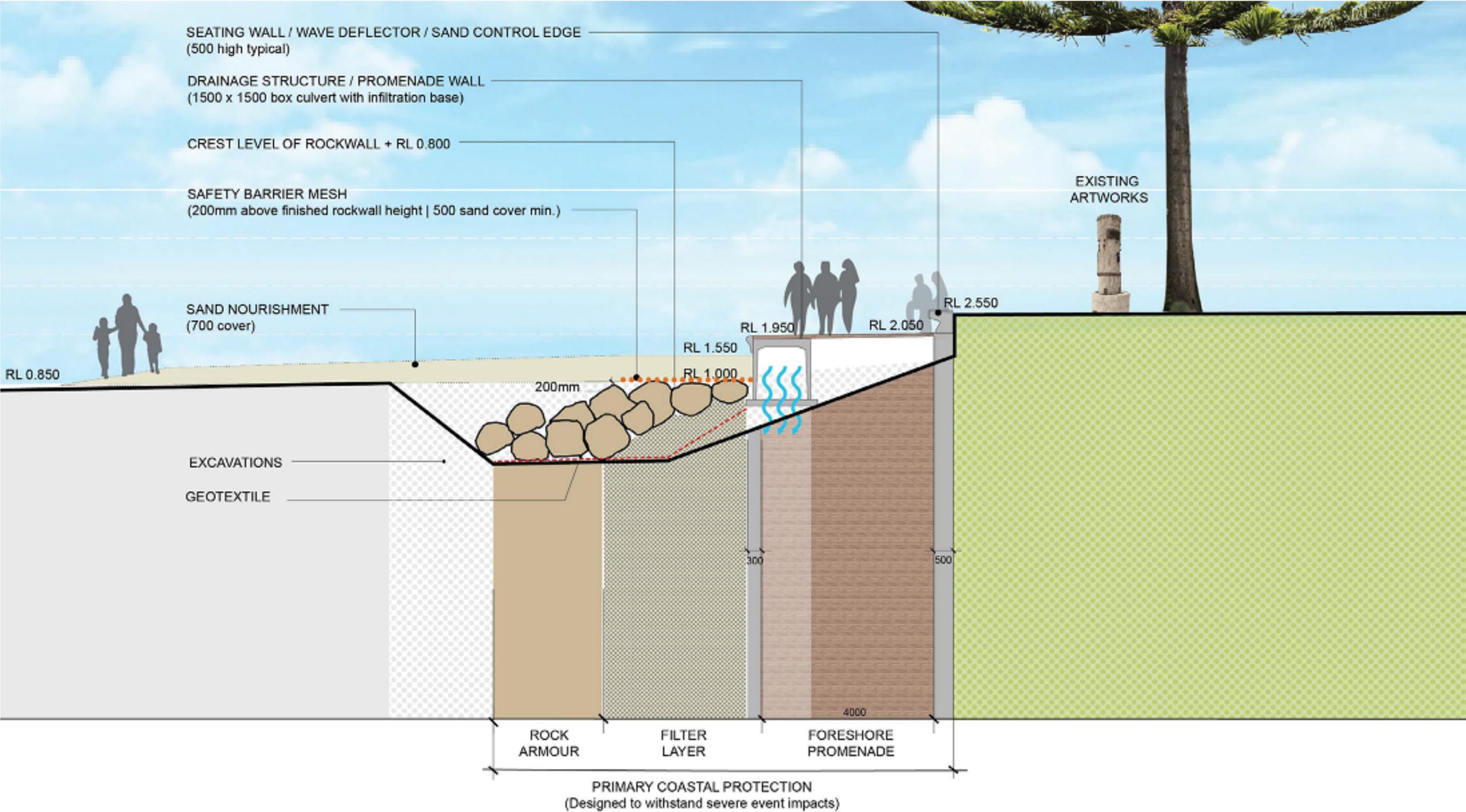


KEY PLAN & OVERLAND DRAINAGE (1:500 @ A0)

SECTION KEY PLAN (Not to Scale)



**SECTION KEY PLAN (Not to Scale)**





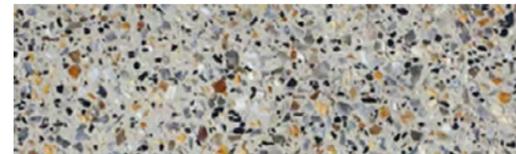
# Hardscape Materials

## Concrete Unit Paving



Name: Concrete Segmental Pavers  
 Finish: Exposed aggregate  
 Colour - Silver, Grey and Charcoal

## Path



Name: Insitu Coloured Concrete Path  
 Finish: Exposed Aggregate



Name: Natural Grey Concrete Path  
 Finish: Broomed

A simple, durable, safe and distinctive palette of hard landscape materials has been selected consisting of coloured and textured concrete, hardwood decking, local stone, stainless steel and corrosion-resistant aluminium.

The materials are arranged to emphasise the hierarchy of public spaces and key pedestrian desire lines across the site. These complementary materials will be installed using simple, coordinated detailing and a high quality of workmanship.

Natural granite has been selected as a signature material making reference to the outcrops along the coast at Ellen Cove. This material also has the sustainability advantages:

- Low embodied energy
- Low water footprint
- High durability (offset against cost)
- Low maintenance requirements
- High recyclability
- Natural local material

## Decking



Name: Jarrah Timber Decking  
 Finish: Dressed and Oiled  
 Dimensions : 140 x 25 planks

## Tactile Paving



Name: Urban Stone - Tactile paving  
 Finish: Shotblast finish , Colour - Noir  
 Dimensions : 400 x 300 x 60

## Retaining Walls and Planter Walls



Name: Granite Wall (Local Stone)  
 Finish: Drystone  
 Dimensions: 450 High Typical

In situ concrete and unit pavers with an exfoliated, nonslip finish have been selected to blend with the existing pavements in the precinct with high contrast tactile pavers selected to be consistent with universal access standards (such as AS1428) for luminance contrast against a variety of finishes.

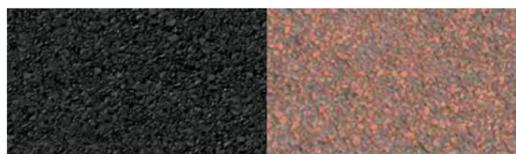
Local hardwood decking will provide a level of warmth and seaside comfort not offered by stone and concrete in Albany's cool wet winters, in reference to the seaside boardwalks and jetties that characterise this coastline.

## Feature Items



Name: Granite Boulders  
 Finish: Local Natural Stone  
 Dimensions: 1000 - 1500 dia

## Road Pavement



Name: Asphalt Road  
 Colour: Black and red



Name: Hexagonal Paver  
 Colour: Grey (varying tones)

The use of concrete in the public domain is limited to the use of 'low-heat' cement-base in situ paving, steps, retaining walls and footings to minimise the impact of energy and water input in the production of cement. This product is made up 40% recycled fly ash – a by-product from steel smelting processes. Concrete finishes will be varied from off-form, exposed aggregate broomed and patterned, dependent on its location and relative to the precinct character guidelines and interpretation strategy to be developed in the detailed design.



# Furniture Suite



Park Table and Benches - Aluminium batten and frame



Park Bench Seat - Aluminium batten and frame



Sun Lounge Seat - Aluminium batten and frame (Foreshore)

The furnishings for Middleton Beach are selected for maximum durability to withstand in the coastal environs and arranged to encourage a broad range of social interactions. A series of generously dimensioned seating elements are placed strategically at key locations along the Foreshore, Flinders Parade and within the Central Promenade. All furniture will be located in positions that are not obstructive, and will help to guide people through the site. The furniture will be supplemented by planter edges, walls and occasional granite boulders which will act as informal perching spots.

The furniture is formed with a mixture of permanent features and temporary tables and chairs associated with the restaurants and cafes. A series of standard, off-the-shelf street furnishings - including bicycle stands, signage, bins and lighting has also been selected. The manufacturers and model of these street furnishings will be consistent with City of Albany's recently updated street furniture palette and maintenance requirements.



Drinking Fountain - stainless steel + dog bowl



Rubbish Bin - stainless steel



Bollards (Fixed and Removable) - stainless steel



Bike Rack - stainless steel



Tree Grate - cast aluminium



Mass Granite Seat (edges of rain gardens and terraces)

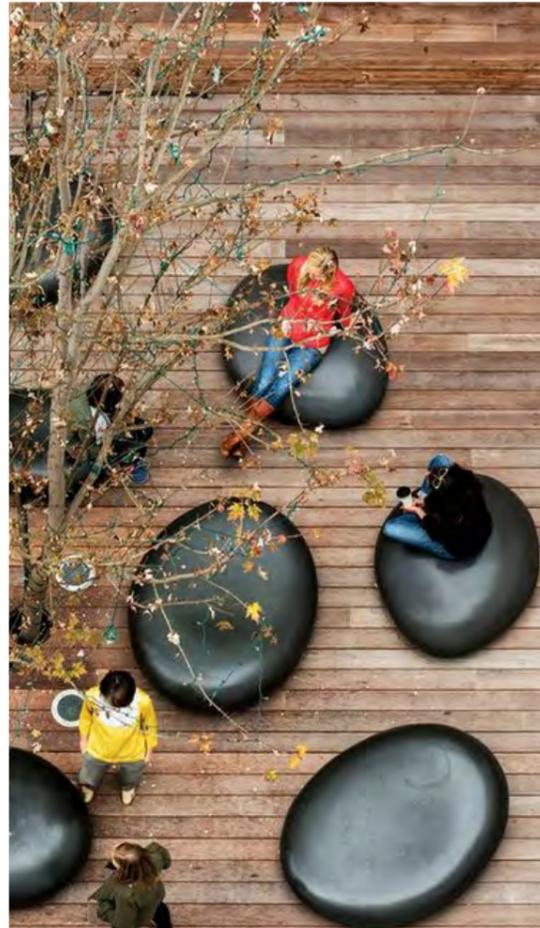


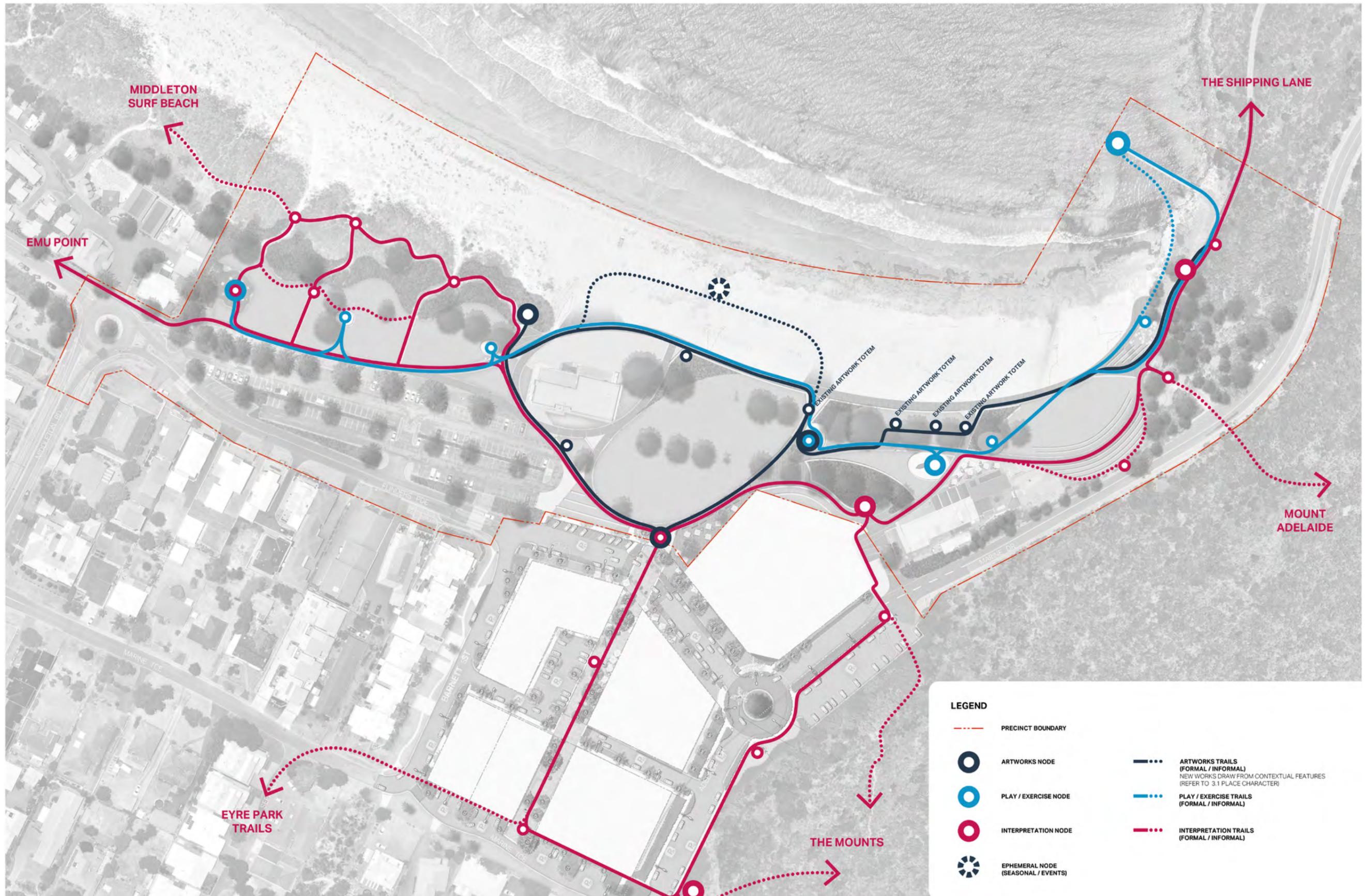
## Shelters & Decks

The application of timber furniture and decking throughout the Middleton Beach Foreshore will evoke a sense of warmth, comfort and coastal character.

Timber features in the new multipurpose shelters that are dotted throughout the site, so as to generate a sense of material cohesiveness. These structures serve as picnic areas, bus shelters, and recreational hubs for beach-goers, whilst simultaneously providing community information and interpretation opportunities.

The shelters take cues from the selected furniture suite to further promote a sense of space specific to Middleton Beach. A consideration of the wider context of the foreshore will see shelters strategically placed so as to not obscure views or interrupt the flow of pedestrian traffic. With a minimalist and lightweight construction, these shelters blend into the landscape and remain discreet yet functional and versatile.



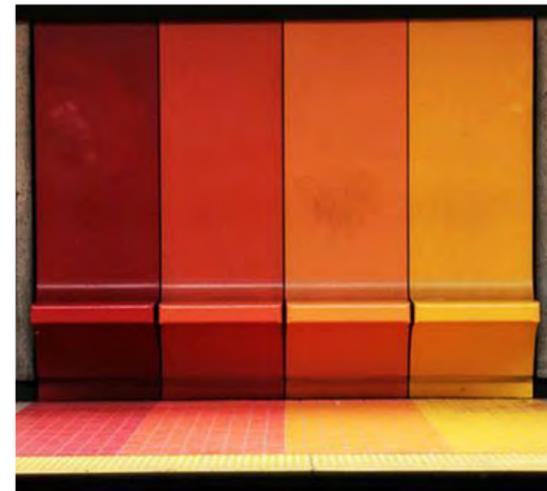
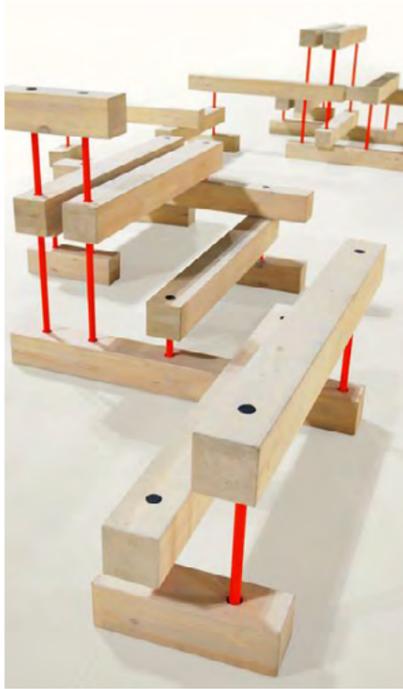


# Artworks, Play & Interpretation

The beach and foreshore precinct enhancement offers a unique opportunity for visitors and locals to learn, listen and enjoy the pristine surrounds and rich site history.

An integrated strategy has been developed to creatively deliver a layer of public art, heritage interpretation and interactive play features, which evokes a local narrative.

The opportunity for a vibrant mix of local and invited artisans will be explored, with careful consideration to the landscape and architectural design palettes, and new city wide standards of material selection, maintenance and quality finishes.

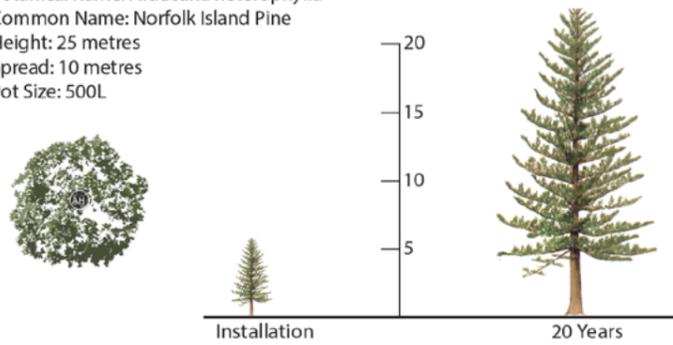




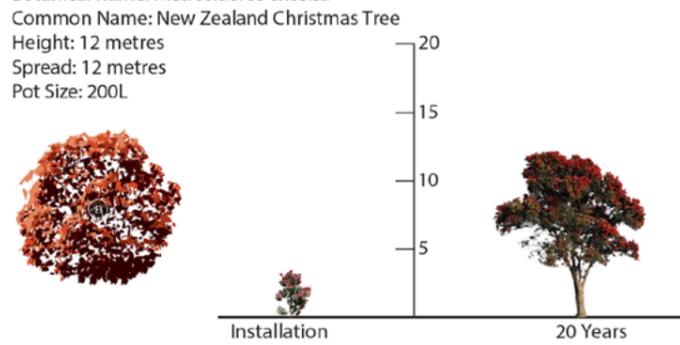
LEGEND					
	PRECINCT BOUNDARY		FORMALISED DUNAL PATHWAY & ASSOCIATED FORESHORE FENCING		INSITU CONCRETE PAVING
	GRASSING		STORMWATER BIO-RETENTION SWALE MASS PLANTING		EXISTING / RELOCATED PLAY STRUCTURE PLAYSAND UNDER
	ASPHALT PATH		SEATING WALL 500 HIGH TYPICAL		EXISTING TREES TO BE RETAINED + PROTECTED TRANSLOCATE SELECT SPECIMENS
	DECKED PROMENADE ACTIVITY NODE		GRASSED WALL TERRACES		PROPOSED TREES TO BE RETAINED + PROTECTED TRANSLOCATE SELECT SPECIMENS
	DECKED RAMP ACCESS TO BEACH		PLAY ACTIVITY NODE PLAYSAND UNDER		BUS / PICNIC SHELTER ANODISED ALUMINIUM CONSTRUCTION SAFETY GLASS ROOF (Inmote REG800)

# Planting Palette | Trees

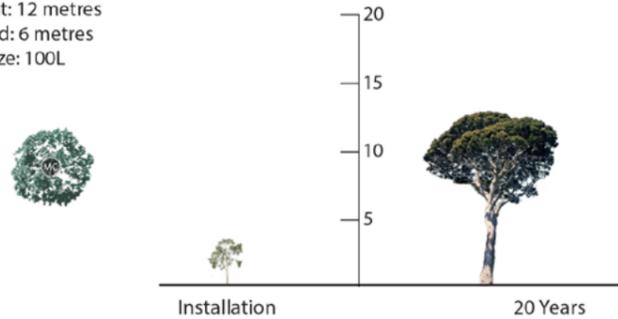
Botanical name: Araucaria heterophylla  
 Common Name: Norfolk Island Pine  
 Height: 25 metres  
 Spread: 10 metres  
 Pot Size: 500L



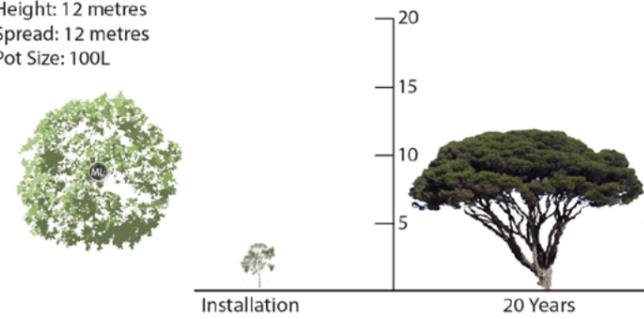
Botanical name: Metrosideros excelsa  
 Common Name: New Zealand Christmas Tree  
 Height: 12 metres  
 Spread: 12 metres  
 Pot Size: 200L



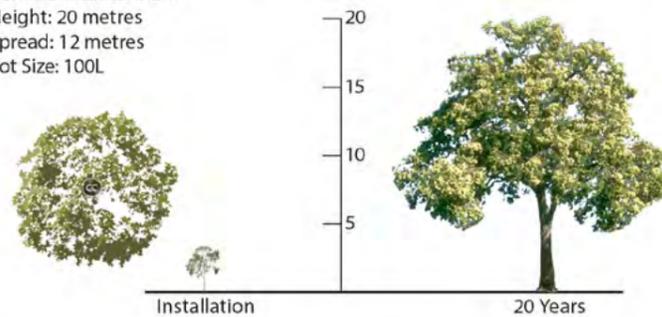
Botanical name: Melaleuca cuticularis  
 Common Name: Salt-Water Paperbark  
 Height: 12 metres  
 Spread: 6 metres  
 Pot Size: 100L



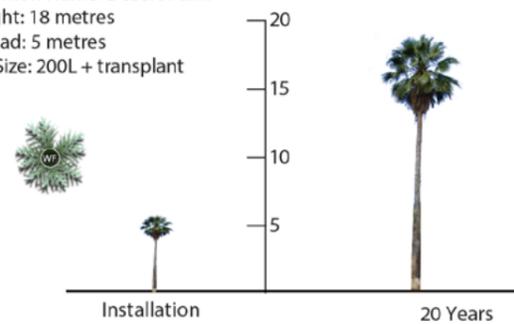
Botanical name: Melaleuca lanceolata  
 Common Name: Rottnest Island Tea-Tree  
 Height: 12 metres  
 Spread: 12 metres  
 Pot Size: 100L



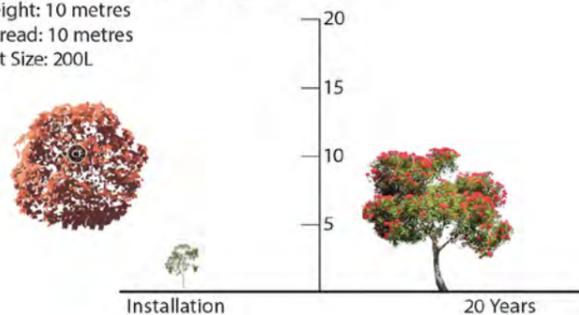
Botanical name: Corymbia calophylla  
 Common Name: Marri  
 Height: 20 metres  
 Spread: 12 metres  
 Pot Size: 100L



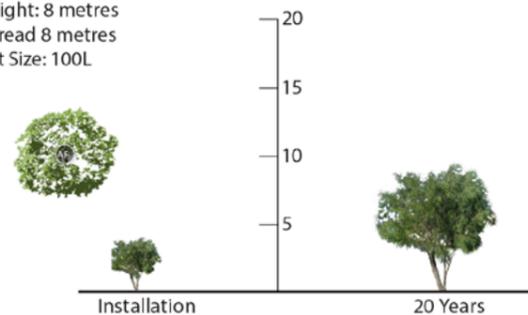
Botanical name: Washingtonia filifera  
 Common Name: Desert Palm  
 Height: 18 metres  
 Spread: 5 metres  
 Pot Size: 200L + transplant



Botanical name: Corymbia ficifolia  
 Common Name: Red Flowering Gum  
 Height: 10 metres  
 Spread: 10 metres  
 Pot Size: 200L



Botanical name: Agonis flexuosa  
 Common Name: WA Peppermint  
 Height: 8 metres  
 Spread: 8 metres  
 Pot Size: 100L



The planting scheme provides a strong landscape structure for the development including advanced tree stock used in select locations to create a landscape that is appropriate in scale to that of the proposed buildings and spaces. The intention is to plant the lower order streets with smaller street trees to maintain the current character of the suburb whilst the public open spaces are characterised by a larger stands of larger specimen trees and deciduous trees where solar access to built form will be enhanced.

Tree planting is used to unify spaces and routes, frame views and highlight desire lines and focal points as well as improve the local environmental conditions and in particular mitigate prevailing winds. Deciduous planting, flowering species and trees with distinct Spring colour have been chosen to provide seasonal change and interest relating back to the local environs and character of the place.

In discussion with City of Albany's landscape architects and urban designers it is agreed that root control devices may adversely affect the health of street trees in the longer term. An acceptable alternative to root barriers will be the use of tree-stock with noninvasive root systems.

All public green infrastructure will be irrigated via a water connection to the irrigation supply at the foreshore parklands. The water connection and meter will be located within a cabinet concealed within the seating on the foreshore or within a below ground pit within the paved public areas dependent on the City's preference for this service location.



## Planting Palette | Understorey

The understorey planting design references the geomorphic structure of the landscape that characterises Albany's low-lying coastal heath and the elevated Mt Adelaide bushland and granite outcrops.

### Swales and Rain gardens

Lining Adelaide Crescent and the extension of Marine Drive area is a series of vegetated drainage swales. The Promenade includes rain gardens that are sunken garden and turfed areas set into central areas of the reserve. The swales and rain gardens provide retention, filtration, gross pollutant traps and bio-remediation and have been developed to include integrated street furniture and lighting. The dense planting of *Lepidosperma calcicola* and *Meeboldina scariosa* assists in increasing biodiversity, stripping nutrients and binding pollutants into the soil profile.

### Streetscapes

The understorey planting within the streetscape is contained within kerbed beds that define the alfresco areas and address the level change between the road and footpath. Mass planting beds will be populated with local ground covers and coastal species that will maintain clear sight lines for traffic and pedestrian crossings.

Where existing streetscapes are currently addressed the existing character of the street will be maintained with minor enhancements and planting at key locations to soften the inclusion of formalised parking bays.

### Foreshore Parklands

The foreshore has been defined as an urban green space that provides a high level of public amenity. As such the planting palette is bio-diverse, vibrant, dynamic and seasonally-rich. The understorey planting provides an integrational link between the dunes and rocky outcrops, providing opportunities for the public to interact with nature. Its variety of species and structure will enhance the overall habitat range within the Middleton Beach precinct. The planting will be carefully designed to ensure that there are clear sight lines into and out of the foreshore and will be structured in a relaxed and informal arrangement.

### Promenade

The promenade is predominantly paved with parklet-lawn areas providing soft, flexible green space for passive use with contrast and seasonal colour. These green areas will articulate the built form addressing this corridor and complement the flowering trees selections.

### Swales and Rain Gardens



*Lepidosperma calcicola*



*Meeboldina scariosa*

### Streetscapes



*Carpobrotus virescens*



*Dianella revoluta* 'Little Rev'



*Casuarina glauca* 'Cousin it'

### Foreshore



*Hibbertia scandens*



*Scaevola crassifolia*

### Promenade



*Anigozanthos manglesii*



*Dianella tasmanica* TASRED



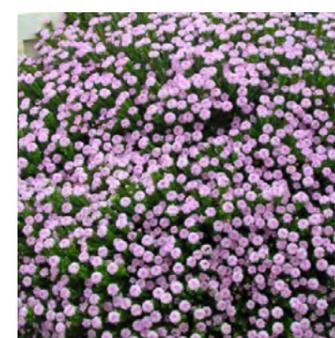
*Myoporum parvifolium*



*Lepidosperma gladiatum*



*Olearia little smokie*



*Pimelea ferruginea*



*Festuca glauca*



*Boronia crenulata*



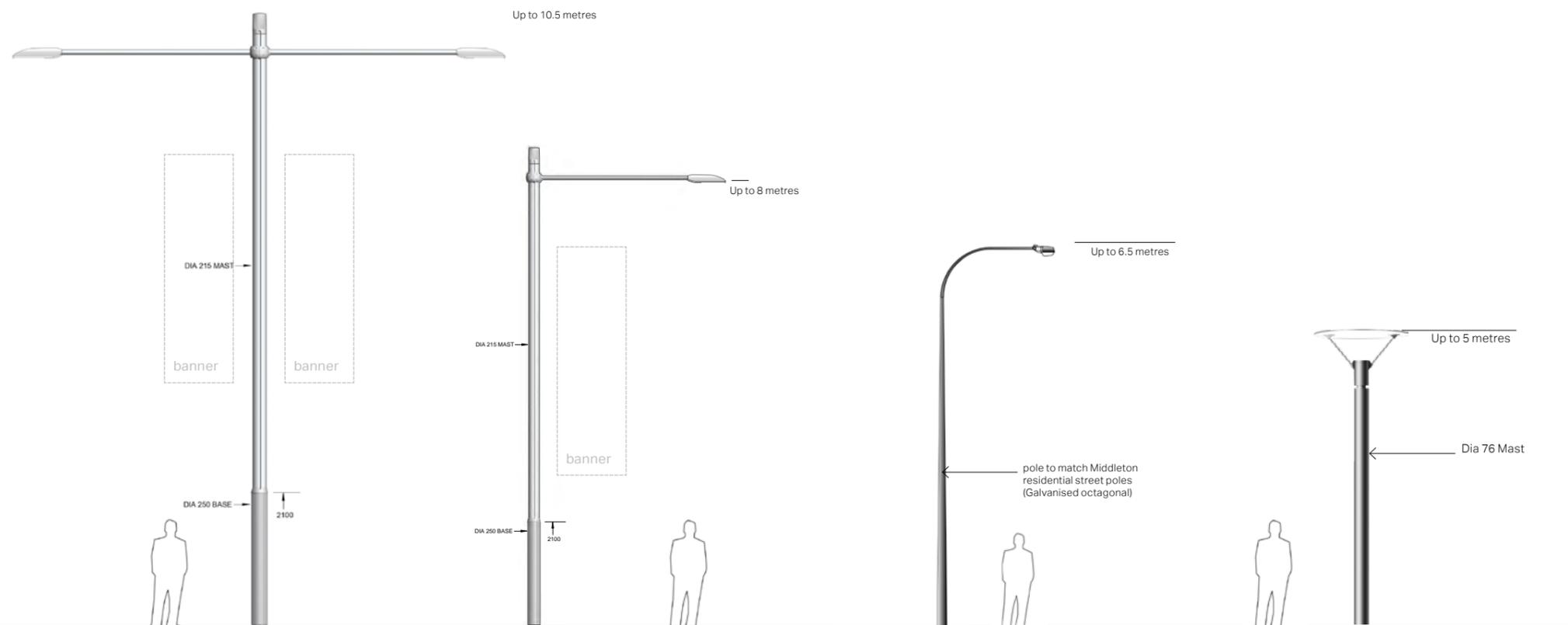
**LIGHTING PLAN**

- - - PRECINCT BOUNDARY
- PARK LIGHTING  
5M POLE (BEGA 8201)  
AT NOMINAL 20M SPACINGS
- PROMENADE EDGE FEATURE LIGHTING  
IN-GROUND SURFACE ILLUMINATION  
AT NOMINAL 10M SPACINGS

# Lighting | Event Support

The lighting strategy aims to create an elegant, multifunctional and aesthetically pleasing experience after dark that enables visitors to safely navigate all the routes and open spaces, whilst creating strong visual character for the site. The lighting also aims to support the various events that will take place and related commercial activities.

The overall lighting for the site is to be achieved from a variety of sources which include column lighting, in-ground up-lighting, soffit lighting and overspill lighting from buildings, together with atmospheric lighting accents to trees, planters and artworks to emphasise key public spaces.



### Multi-Function Pole (Double Outreach)

Adelaide Crescent - Marine Drive east arrival point and over flow carpark servicing the beach and mounts parklands precincts

### Multi-Function Pole (Single Outreach)

Flinders Parade (west) to accommodate events, accent spotlights and banners or seasonal decals and to shine away from future residences to reduce light pollution.

### Western Power Pole (Single Outreach)

Located on all other streets to tie in with existing streetscapes at typical spacings to provide simple, low-maintenance lighting to the street

### Parkland Pole (Reflector Panel)

Located on all other streets to tie in with existing streetscapes and provide simple low maintenance lighting to the street



### Directional Accent Spot Light

Strategically positioned on multipoles to enhance site features, trees and wayfinding



### Up-lighting

We-ef ETC130-GN.

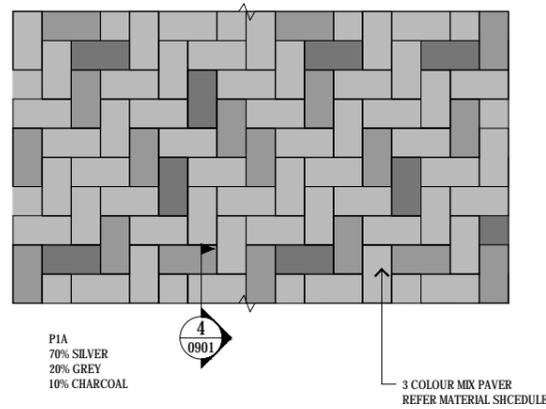
Flush in-ground up-light with directional for focused light distribution

# Appendix A Materials Construction Details

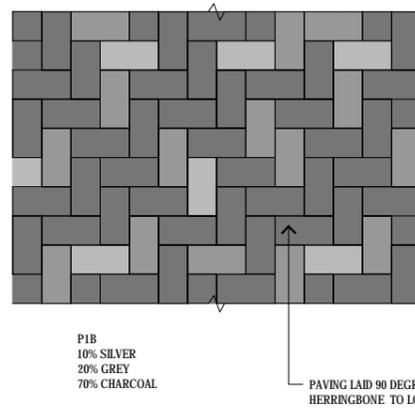
## Concrete Unit Paving



Name: Concrete Segmental Pavers  
 Finish: Exposed aggregate  
 Colour: Silver, Grey and Charcoal



1 PAVING TYPE 1A TYPICAL DETAIL PLAN  
 SCALE 1:20

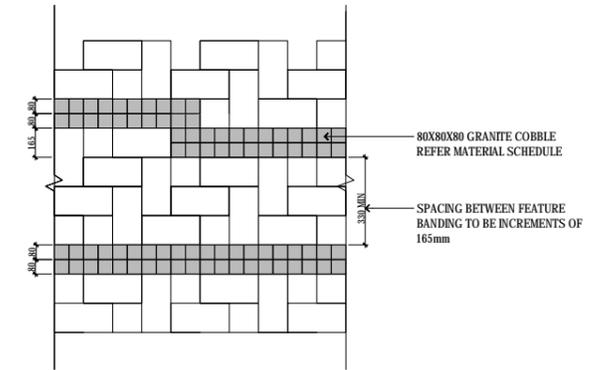


2 PAVING TYPE 1B TYPICAL DETAIL PLAN  
 SCALE 1:20

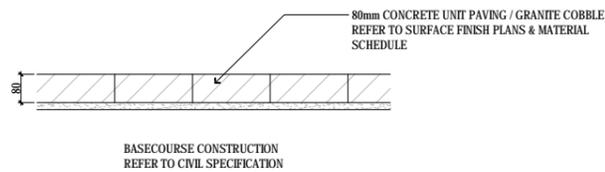
## Granite Cobble Paving



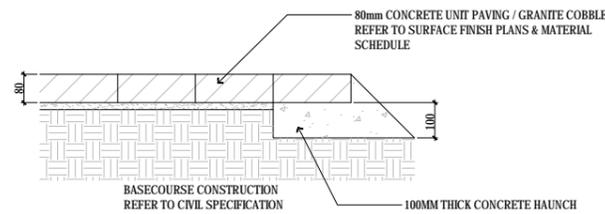
Name: Granite Cobble Unit Paver  
 Finish: Milled / Sawn  
 Colour: Charcoal



3 TYPICAL PAVING TYPE 1C - FEATURE BANDING  
 SCALE 1:20

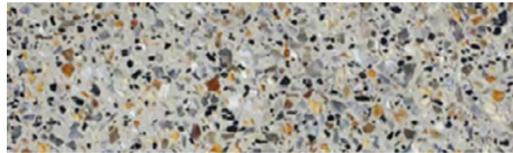


4 TYPICAL TRAFFICABLE UNIT PAVING TYPE P1A/P1B/P1C  
 SCALE 1:10



5 TYPICAL UNIT PAVING TO CONCRETE HAUNCH  
 SCALE 1:10

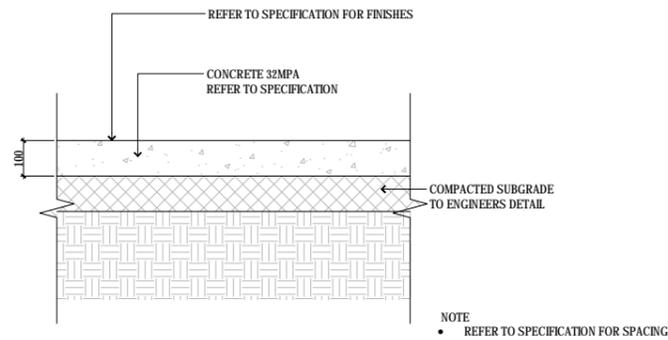
**Path**



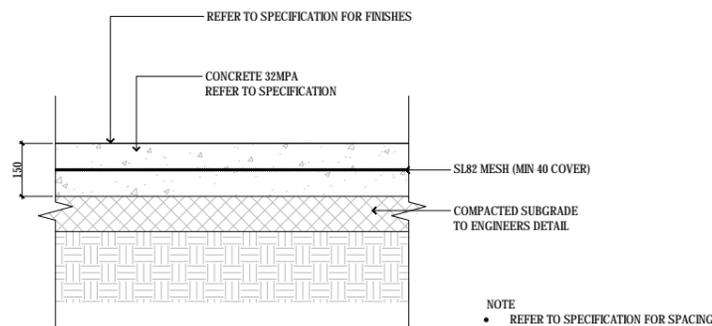
Name: Insitu Coloured Concrete Path  
Finish: Exposed Aggregate



Name: Natural Grey Concrete Path  
Finish: Broomed



**6** TYPICAL INSITU CONCRETE PATH  
SCALE 1:10

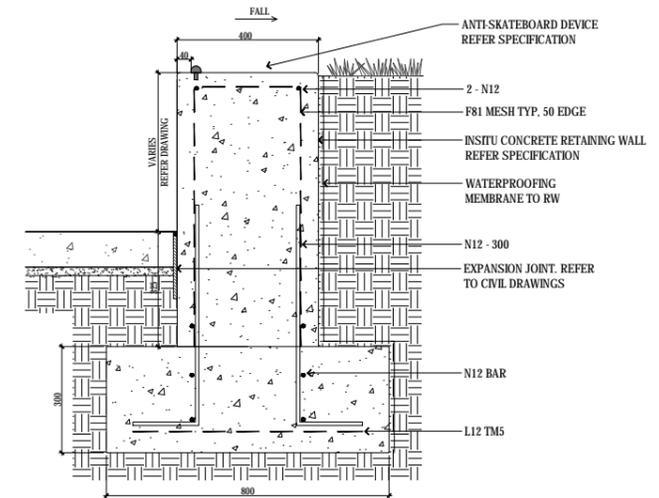


**7** TYPICAL TRAFFICABLE INSITU CONCRETE PATH  
SCALE 1:10

**Retaining Walls and Planter Walls**



Name: Granite Wall (Local Stone)  
Finish: Drystone  
Dimensions: 450 High Typical



NOTE:  
GRAFFITI COATING TO ALL EXPOSED SURFACES.  
REFER TO SPECIFICATION.

**5** TYPICAL OFF FORM CONCRETE WALL DETAIL  
SCALE 1:10

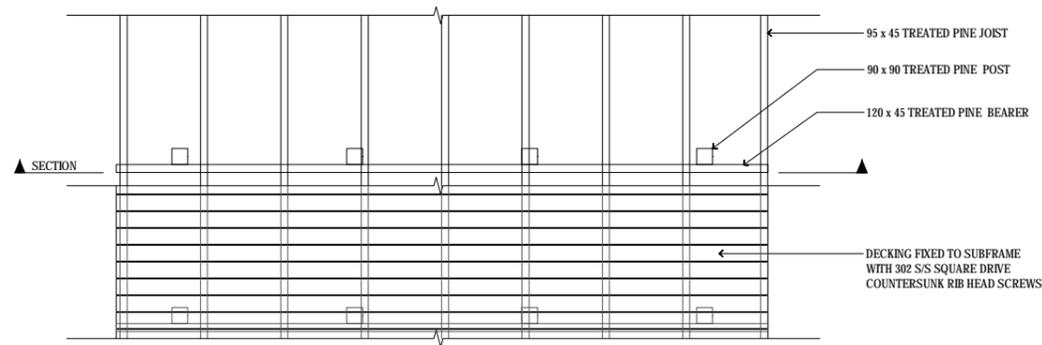
**Decking**



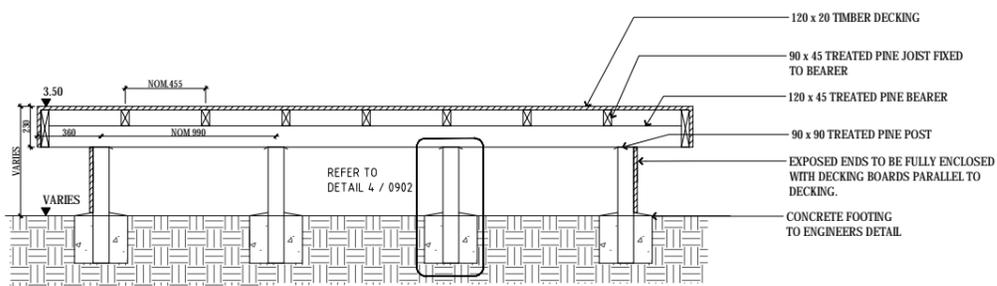
Name: Jarrah Timber Decking

Finish: Dressed and Oiled

Dimensions: 140 x 25 planks



**4 TYPICAL TIMBER DECK - PLAN**  
SCALE 1:20



NOTE:  
TIMBER DECK AND SUB STRUCTURE TO BE IN ACCORDANCE WITH AS 1884 TIMBER FRAMING CODE

**5 TYPICAL TIMBER DECK RAISED - SECTION**  
SCALE 1:20

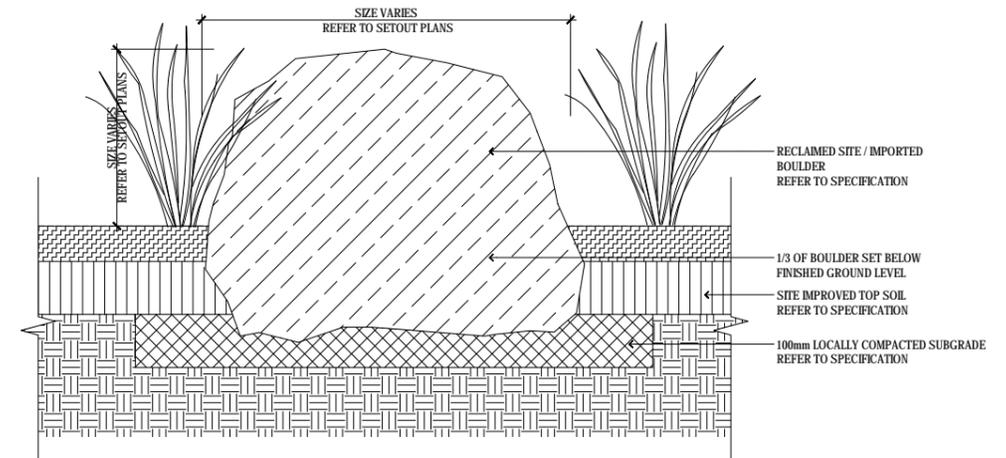
**Feature Items**



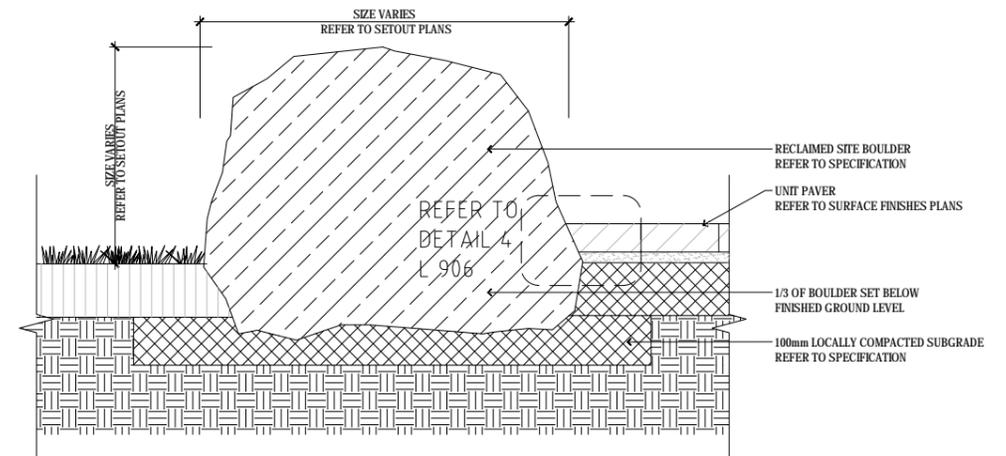
Name: Granite Boulders

Finish: Local Natural Stone

Dimensions: 1000 - 1500 dia



**1 BOULDER IN PLANTING LEVEL**  
SCALE 1:10

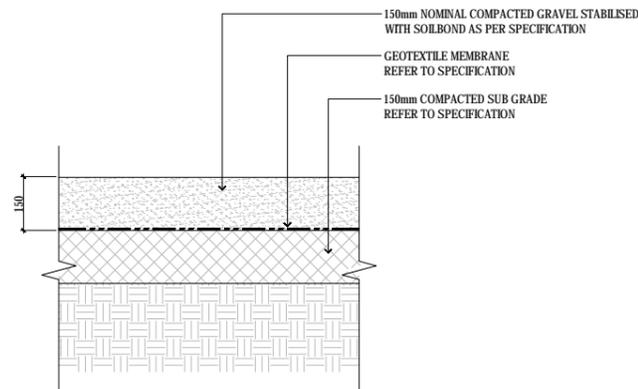


**2 BOULDER IN EDGE OF RAINGARDEN**  
SCALE 1:10

**Gravel**



Name: Gravel  
 Finish: Summerstone Fines  
 Dimensions: 1-6mm Nom. particle size (30% fines)

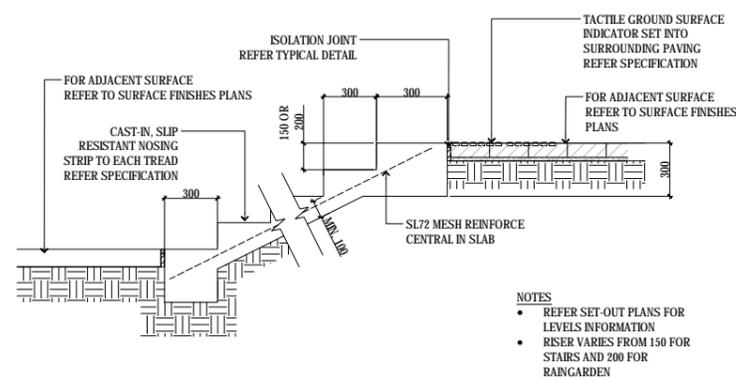


**2 GRAVEL TYPE 1**  
 SCALE 1:10

**Tactile Paving**



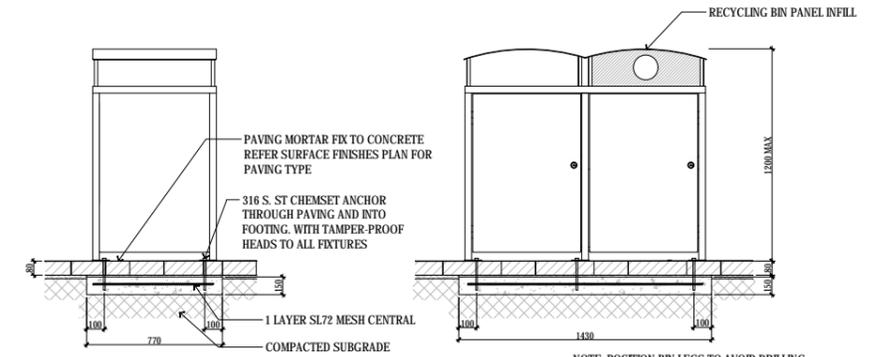
Name: Urban Stone - Tactile paving  
 Finish: Polyurethane 10mm Bladed Shaft  
 Dimensions: 1200 x 300 x 30



**NOTES**  
 • REFER SET-OUT PLANS FOR LEVELS INFORMATION  
 • RISER VARIES FROM 150 FOR STAIRS AND 200 FOR RAINGARDEN

**4 TYPICAL STAIRS**  
 SCALE 1:20

**Recycling stations | Litter**



**NOTE:** POSITION BIN LEGS TO AVOID DRILLING WITHIN 30MM OF EDGE OF PAVING UNIT. CONCRETE  $f_c=25\text{Mpa}$ . FIXING TO MANUFACTURERS RECOMMENDATION.

**7 TYPICAL DUAL BIN ENCLOSURE FOOTING DETAIL**  
 SCALE 1:20



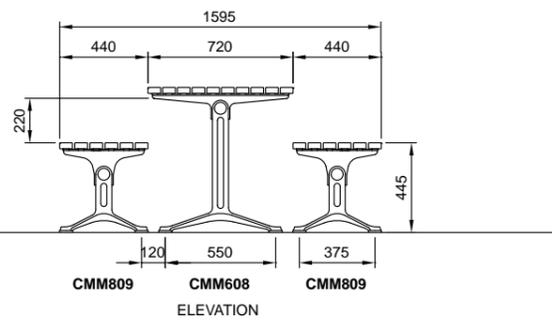
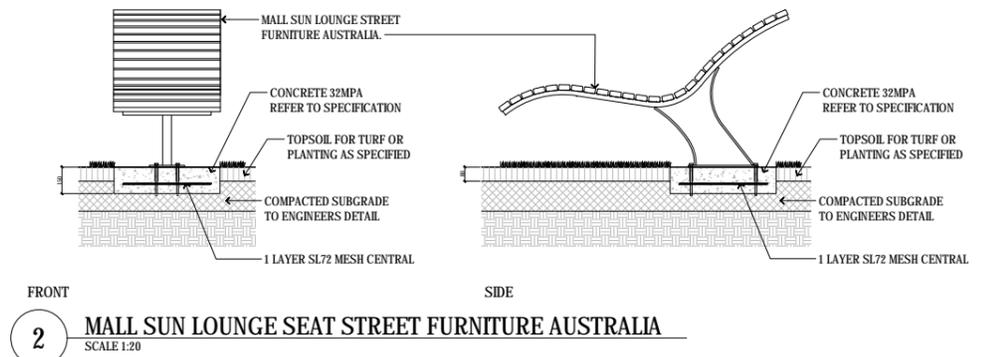
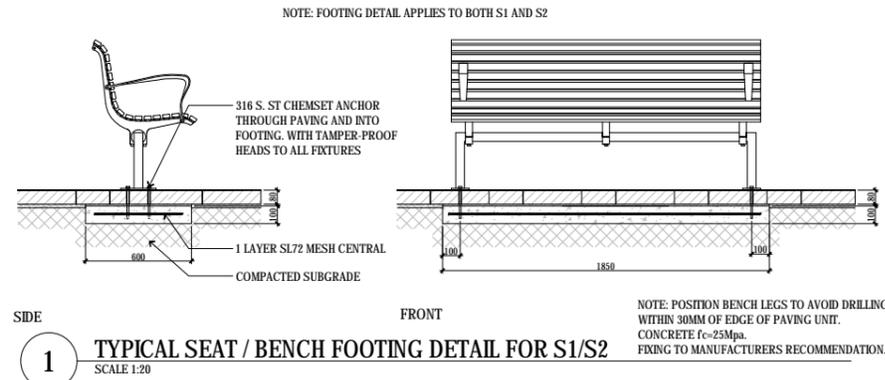
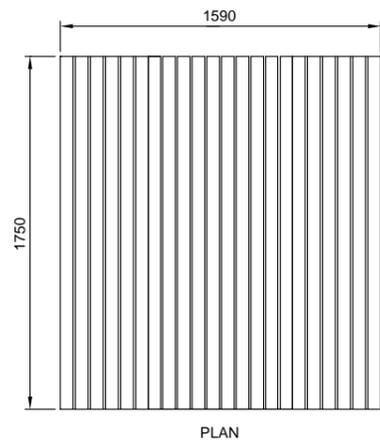
Park Table and Benches - Aluminium batten and frame



Park Bench Seat - Aluminium batten and frame



Sun Lounge Seat - Aluminium batten and frame (Foreshore)





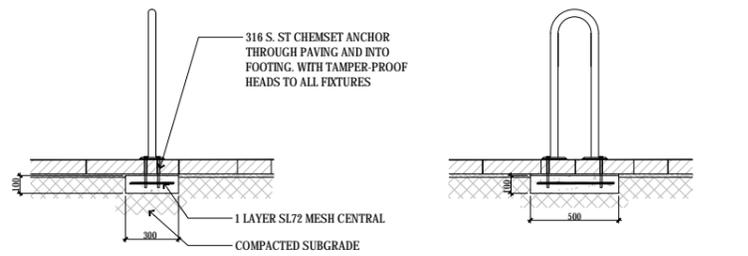
Bike Rack - stainless steel



Bollards (Fixed & Removable) - SFA B3F Flat (Single Collar)

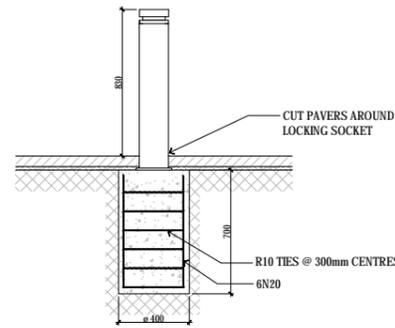


Drinking Fountain - stainless steel + dog bowl

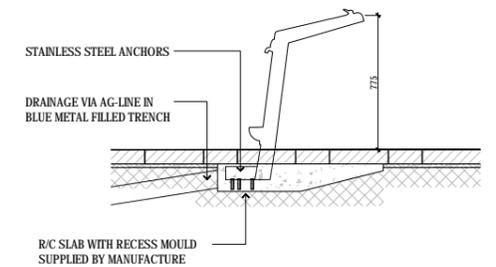


NOTE: POSITION BIKE RACK TO AVOID DRILLING WITHIN 30MM OF EDGE OF PAVING UNIT. CONCRETE  $f_c = 25\text{Mpa}$ . FIXING TO MANUFACTURER'S RECOMMENDATION.

3 TYPICAL BIKE RACK DETAIL  
SCALE 1:20

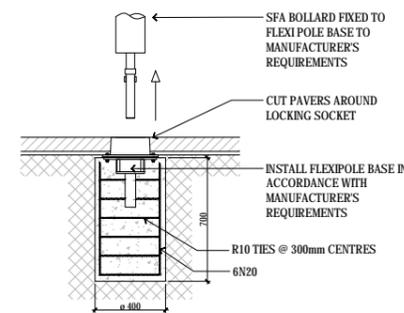


4 TYPICAL FIXED BOLLARD TYPE 1  
SCALE 1:20



NOTE: FOUNTAIN BASEPLATE, 1 MANUFACTURER

6 TYPICAL DRINKING FOUNTAIN FOOTING DETAIL  
SCALE 1:20



5 TYPICAL FLEXIPOLE BOLLARD TYPE 2  
SCALE 1:20

# Appendix E

## Government Gazette



WESTERN  
AUSTRALIAN  
GOVERNMENT  
**Gazette**

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# — PART 1 —

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## CONSUMER PROTECTION

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CP301

Travel Agents Act 1985

### Travel Agents Act 1985 Expiry Notice 2016

Made by the Minister under the *Travel Agents Act 1985* section 61.

**1. Citation**

This notice is the *Travel Agents Act 1985 Expiry Notice 2016*.

**2. Minister satisfied of matters in section 61(3)**

The Minister is satisfied of the matters specified in the *Travel Agents Act 1985* section 61(3).

**3. Expiry**

The *Travel Agents Act 1985* expires at the end of the day after the day on which this notice is published in the *Gazette*.

M. MISCHIN, Minister for Commerce.

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## HEALTH

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HE301

Health Act 1911

### Health (Public Buildings) Amendment Regulations 2017

Made by the Governor in Executive Council.

**1. Citation**

These regulations are the *Health (Public Buildings) Amendment Regulations 2017*.

## 2. Commencement

These regulations come into operation as follows —

- (a) regulations 1 and 2 — on the day on which these regulations are published in the *Gazette*;
- (b) the rest of the regulations — on the day after that day or the day after the *Health Regulations Amendment (Public Health) Regulations 2016* Part 19 comes into effect, whichever is the later.

## 3. Regulations amended

These regulations amend the *Health (Public Buildings) Regulations 1992*.

## 4. Regulation 3 amended

- (1) In regulation 3(1) delete the definitions of:  
*AS/NZS 4360*  
*supply authority*
- (2) In regulation 3(1) insert in alphabetical order:

*AS/NZS ISO 31000:2009* means Australian/New Zealand Standard AS/NZS ISO 31000:2009 - Risk Management - Principles and Guidelines;

## 5. Regulation 4 amended

In regulation 4(2):

- (a) delete “5 000” and insert:

1 000

- (b) delete “AS/NZS 4360.” and insert:

AS/NZS ISO 31000:2009.

## 6. Regulation 9 amended

In regulation 9(4)(a) delete “AS/NZS 4360; and” and insert:

AS/NZS ISO 31000:2009; and

## 7. Regulation 12 deleted

Delete regulation 12.

**8. Regulation 14 amended**

- (1) In regulation 14(3)(a)(iii) delete “Officer;” and insert:

Officer.

- (2) Delete regulation 14(3)(b).

**9. Regulation 17 deleted**

Delete regulation 17.

**10. Regulation 19 amended**

In regulation 19(1) delete “A radiant” and insert:

An

**11. Regulation 24 deleted**

Delete regulation 24.

**12. Regulation 25 amended**

In regulation 25 before “telephone” insert:

fixed-line

**13. Regulation 26 amended**

In regulation 26(1a)(b) delete “AS/NZS 4360.” and insert:

AS/NZS ISO 31000:2009.

**14. Regulation 30 deleted**

Delete regulation 30.

**15. Regulation 33 deleted**

Delete regulation 33.

**16. Regulation 34 deleted**

Delete regulation 34.

**17. Regulation 38 deleted**

Delete regulation 38.

18. **Regulation 40 deleted**  
Delete regulation 40.
19. **Part 5 Division 4 deleted**  
Delete Part 5 Division 4.
20. **Regulation 57 deleted**  
Delete regulation 57.
21. **Part 6 deleted**  
Delete Part 6.

K. H. ANDREWS, Clerk of the Executive Council.

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## JUSTICE

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JU301

Criminal Procedure Act 2004  
Fines, Penalties and Infringement Notices Enforcement Act 1994  
Sentencing Act 1995  
State Administrative Tribunal Act 2004

### **Attorney General Regulations Amendment (Travel Agents) Regulations 2016**

Made by the Governor in Executive Council.

#### **Part 1 — Preliminary**

##### **1. Citation**

These regulations are the *Attorney General Regulations Amendment (Travel Agents) Regulations 2016*.

##### **2. Commencement**

These regulations come into operation as follows —

- (a) Part 1 — on the day on which these regulations are published in the *Gazette*;
- (b) the rest of the regulations — when the *Travel Agents Act 1985* expires under section 61 of that Act.

**Part 2 — *Criminal Procedure Regulations 2005*  
amended**

**3. Regulations amended**

This Part amends the *Criminal Procedure Regulations 2005*.

**4. Schedule 1A amended**

In Schedule 1A delete “*Travel Agents Act 1985*”.

**Part 3 — *Fines, Penalties and Infringement Notices  
Enforcement Regulations 1994* amended**

**5. Regulations amended**

This Part amends the *Fines, Penalties and Infringement Notices Enforcement Regulations 1994*.

**6. Schedule 1 amended**

In Schedule 1 delete “*Travel Agents Act 1985*”.

**Part 4 — *Sentencing Regulations 1996* amended**

**7. Regulations amended**

This Part amends the *Sentencing Regulations 1996*.

**8. Schedule 2 amended**

In Schedule 2 delete “*Travel Agents Act 1985* s. 41(1)”.

**Part 5 — *State Administrative Tribunal  
Regulations 2004* amended**

**9. Regulations amended**

This Part amends the *State Administrative Tribunal Regulations 2004*.

**10. Schedule 1 amended**

In Schedule 1 delete “*Travel Agents Act 1985*”.

R. KENNEDY, Clerk of the Executive Council.

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**LOCAL GOVERNMENT**

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LG301

Dog Act 1976

**Dog Amendment Regulations 2017**

Made by the Governor in Executive Council.

**1. Citation**

These regulations are the *Dog Amendment Regulations 2017*.

**2. Commencement**

These regulations come into operation as follows —

- (a) regulations 1 and 2 — on the day on which these regulations are published in the *Gazette*;
- (b) the rest of the regulations — on the day after that day.

**3. Regulations amended**

These regulations amend the *Dog Regulations 2013*.

**4. Regulation 19 amended**

Delete regulation 19(5) and insert:

- (5) If an unsterilised dog is registered for its lifetime and is sterilised —
  - (a) in the 1<sup>st</sup> year after it is registered, the owner is entitled to a refund of an amount equal to the difference between the registration fee paid and the lifetime registration fee that would have been payable for a sterilised dog; or
  - (b) in the 2<sup>nd</sup> year after it is registered, the owner is entitled to a refund of an amount equal to the difference between two-thirds of the registration fee paid and two-thirds of the lifetime registration fee that would have been payable for a sterilised dog; or
  - (c) in the 3<sup>rd</sup> year after it is registered, the owner is entitled to a refund of an amount equal to the difference between one-third of the registration fee paid and one-third of the lifetime registration fee that would have been payable for a sterilised dog.

R. KENNEDY, Clerk of the Executive Council.

## — PART 2 —

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### AGRICULTURE AND FOOD

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AG401

**SOIL AND LAND CONSERVATION ACT 1945****CAPEL LAND CONSERVATION DISTRICT (APPOINTMENT OF MEMBERS OF DISTRICT COMMITTEE) INSTRUMENT 2017**

Made by the Commissioner of Soil and Land Conservation.

**1. Citation**

This Instrument may be cited as the *Capel Land Conservation District (Appointment of Members) Instrument 2017*.

**2. Appointment of members**

Under section 23(2b) of the Act and clause 5(1) of the *Soil and Land Conservation (Capel Land Conservation District) Order 1993\**, the following members are appointed to the land conservation district committee for the Capel Land Conservation District—

- (a) as persons actively engaged in, or affected by or associated with, land use in the district—  
~~Mr Michael Norman Norton, Ms Chelsea Rusha and Ms Lynne King.~~ **Insert**  
 Ms Jacqui Granger of Capel.

(\*Published in the Gazette of 23 April 1993 at pp.2170-2172 and Amendment Orders approved by Executive Council on 2 July 1996, 13 August 1996 and 1 December 1998 (refer to Department of Agriculture and Food reference: 125219V1)).

**3. Term of office**

Members appointed to the committee under this instrument will hold office for a term expiring on 18 January 2020.

ANDREW WATSON, Commissioner of Soil and Land Conservation.

Dated this 18th day of January 2017.

AG402

**SOIL AND LAND CONSERVATION ACT 1945****SOIL AND LAND CONSERVATION (KATANNING LAND CONSERVATION DISTRICT) AMENDMENT ORDER 2016**

Made by the Governor in Executive Council under Section 23 (2d) of the *Soil and Land Conservation Act 1945* on the recommendation of the Minister for Agriculture and Food.

**Citation**

1. This order may be cited as the *Soil and Land Conservation Act (Katanning Land Conservation District) Amendment Order 2016*.

**Commencement**

2. This order will take effect on the day which it is published in the *Gazette*.

**Principal Order**

3. In this order the *Soil and Land Conservation Act (Katanning Land Conservation District) Order 1990\** is referred to as the principal order.

(\*Published in the Government Gazette of 6 July 1990 at pp. 3268-3269 and an Amendment Order approved by Executive Council on 11 March 1997 [refer Department of Agriculture and Food Western Australia file reference 881722V02P00 and 153852V01]).

**Clause 5 amended**

4. Clause 5 of the principal order is amended by—

- (i) Deleting “22” in subclause (1) and substituting the following—“17”;
- (ii) Deleting “16” in subclause (1)(d)(i) and substituting the following—“12”; and
- (iii) Deleting “2” in subclause (1)(b) and substituting the following “1”.

By Her Excellency’s command

R. NEILSON, Clerk of the Executive Council.

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## FIRE AND EMERGENCY SERVICES

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FE401

### BUSH FIRES ACT 1954 TOTAL FIRE BAN DECLARATION

Correspondence No. 12080

Pursuant to powers delegated under the *Bush Fires Act 1954*, the Assistant Commissioner of the Department of Fire and Emergency Services, declared under Section 22A of the *Bush Fires Act 1954*, a total fire ban for 15th January 2017 for the local government districts of—

Cranbrook, Broomehill-Tambellup, Katanning, Kojonup, West Arthur, Wagin, Woodanilling, Boddington, Brookton, Cuballing, Narrogin, Pingelly, Wandering, Wickepin, Williams, Armadale, Gosnells, Swan, Chittering, Gingin, Kalamunda, Mundaring, Serpentine-Jarrahdale.

GRAHAM SWIFT, Assistant Commissioner of the Department of Fire and Emergency Services, as a sub-delegate of the Minister under section 16 of the *Fire and Emergency Services Act 1998*.

Dated 14th January 2017.

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## JUSTICE

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JU401

### JUSTICES OF THE PEACE ACT 2004 RESIGNATIONS

It is hereby notified for public information that the Minister has accepted the resignation of—

Mrs Gwenda May Pollard of Narembeen

from the Office of Justice of the Peace for the State of Western Australia.

MICHAEL JOHNSON, A/Executive Director,  
Court and Tribunal Services.

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## LOCAL GOVERNMENT

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LG401

### LOCAL GOVERNMENT ACT 1995 *Shire of Toodyay* (BASIS OF RATES)

This notice, which is for public information only, is to confirm that—

I, Brad Jolly, being delegated by the Minister of the Crown to whom the administration of the *Local Government Act 1995* is committed by the Governor, and acting pursuant to section 6.28 (1) of that Act, hereby, and with effect from 1 July 2017, determined that the method of valuation to be used by the Shire of Toodyay as the basis for a rate in respect of the land referred to in the Schedules are to be the gross rental value of the land;

#### Schedule A

	Designated Land
UV to GRV	All those portions of land being Lots 521 to 527 inclusive and Lot 534 as shown on Deposited Plan 28494; Lots 101 to 112, Lot 114, Lots 116 to 120 inclusive and Lots 122 to 124 inclusive as shown on Deposited Plan 29054; Lot 5 as shown on Deposited Plan 32196; Lots 125 to 133 inclusive, Lots 136 to 140 inclusive and Lot 142 as shown on Deposited Plan 32527; Lot 601 as shown on Deposited Plan 42855 and Lot 38 as shown on Deposited Plan 62986.

#### Schedule B

	Designated Land
UV to GRV	All those portions of land being Lot M1978 as shown on Diagram 17554; Lot 1 as shown on Diagram 63264 and Lot 500 as shown on Diagram 90146.

## Schedule C

	Designated Land
UV to GRV	All those portions of land being Lot 2, Lot 3, Lot 5 and Lots 7 to 9 inclusive as shown on Plan 10315; Lots 12 to 18 inclusive, Lots 20 to 29 inclusive, Lot 33 and Lot 34 as shown on Plan 22110.

BRAD JOLLY, Executive Director Sector Regulation and Support,  
Department of Local Government and Communities.

## LG402

## SHIRE OF CHITTERING

## APPOINTMENTS

It is hereby notified for public information that Bronwyn Southee and Glenn Sargeson have been appointed as an Authorised Officer in accordance with the following and is effective immediately—

*Caravan Parks and Camping Grounds Act 1995*, Section 17 and 23

*Caravan Parks and Camping Grounds Regulations 1997*, Regulation 6

All previous authorisations for Matthew Sharpe under the following are hereby revoked effective immediately—

*Bush Fires Act 1954*, Section 59(3)

*Bush Fires Act 1954*, Section 38—Fire Control Officer

*Caravan Parks and Camping Grounds Act 1995*, Sections 17(1), 23(2) and 23(11)

*Cat Act 2011*, Section 48(1)

*Cemeteries Act 1986*, Section 64(1)—Issue of Infringement Notices

*Control of Vehicles (Off-road Areas) Act 1978* and Regulations

*Dog Act 1976* and Regulations

*Litter Act 1979* and Regulations

Local Government Local Laws

*Local Government Act 1995*, Sections 3.39, 9.10, 9.11 and 9.15

*Local Government Act 1995*, Sections 9.13, 9.16 and 9.17

*Local Government Act 1995*, Sections 3.28 and 3.29

*Local Government Act 1995*, Section 3.39

*Local Government (Miscellaneous Provisions) Act 1960*, Section 449

Updated: 20 January 2017.

ALAN SHERIDAN, Chief Executive Officer.

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**PLANNING**


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## PL401

**PLANNING AND DEVELOPMENT ACT 2005**  
APPROVED LOCAL PLANNING SCHEME AMENDMENT  
*City of Gosnells*

Local Planning Scheme No. 6—Amendment No. 164

Ref: TPS/1807

It is hereby notified for public information, in accordance with section 87 of the *Planning and Development Act 2005* that the Minister for Planning approved the City of Gosnells Local Planning Scheme amendment on 21 December 2016 for the purpose of—

1. Recoding 303 (Lot 384), 291 (Lot 301) Fraser Road North and 858 (Lot 461) Nicholson Road, Canning Vale from Residential R17.5 to R60.
2. Insert Clause 5.14—Additional site and development requirements into the Scheme text as follows—

**5.14 ADDITIONAL SITE AND DEVELOPMENT REQUIREMENTS**

(1) Schedule 14 sets out requirements relating to development that are additional to those set out in the R-Codes, an activity centre plans, local development plans or State or local planning policies.

(2) To the extent that a requirement referred to in subclause (1) is inconsistent with a requirement in the R-Codes, an activity centre plan, a local development plan or a State or local planning policy the requirement referred to in subclause (1) prevails.

3. Insert Schedule 14—Additional site and development requirements into the Scheme text as follows—

**SCHEDULE 14—ADDITIONAL SITE AND DEVELOPMENT REQUIREMENTS**

No.	Description of Land	Requirement
1.	Lot 384 and 301 Fraser Road North, Canning Vale. Lot 461 Nicholson Road, Canning Vale.	Any residential development immediately abutting Fraser Road North shall be a maximum of two storeys, in accordance with building heights as set out in the relevant State planning policy. At subdivision and development application stage, a detailed noise assessment and subsequent noise mitigation measures being undertaken to inform lot layout and building design to the satisfaction of the relevant decision maker (Western Australian Planning Commission or Local Government). No future crossovers will be allowed onto Nicholson Road.
2.	Lot 701 Warton Road (corner Furley Road), Southern River.	Shops and/or Convenience Store limited to a maximum 400m <sup>2</sup> net lettable area.
3.	158 (Lot 2) Stalker Road, Gosnells; and Lot 164-168 (Lot 1100) Corfield Street, Gosnells	Lot 2—maximum retail floorspace 420 sq metres;  Lot 1100—retail floorspace to comprise a pharmacy only.
4.	Lots 21 (No. 9), 100 (No. 11), Pt Lot 87 (No. 15) and 100 (No. 17) Sydenham Street, Beckenham.	Within the Perth Airport noise exposure zone, a “noise on title” is to be required as a condition of subdivision or planning approval.

4. Modify Schedule 3—Restricted Uses by deleting rows R2, R6 and R8.  
5. Amend the Scheme Maps accordingly.

O. SEARLE, Mayor.  
I. COWIE, Chief Executive Officer.

PL402

**PLANNING AND DEVELOPMENT ACT 2005**  
METROPOLITAN REGION SCHEME MAJOR AMENDMENT 1270/41  
Ocean Reef Marina Redevelopment

**Call for Public Submissions**

The Western Australian Planning Commission (WAPC) intends to amend the Metropolitan Region Scheme (MRS) for land in the local government of Joondalup and is seeking public comment. MRS Major Amendment 1270/41 seeks to rationalise various zones and reserves, and part of Bush Forever Site 325 to facilitate the redevelopment of the existing Ocean Reef Marina Boat Harbour.

**Display locations**

Plans showing the proposed change and the WAPC’s amendment report, which explains the proposal, will be available for public inspection from Tuesday 22 November 2016 to Friday 24 February 2017 at—

- Western Australian Planning Commission, 140 William Street, Perth
- J S Battye Library, Level 3 Alexander Library Building, Perth Cultural Centre
- City of Perth, Council House, 27 St Georges Terrace, Perth
- City of Fremantle, Town Hall Centre, 8 William Street, Fremantle
- City of Joondalup, Administration Building, 90 Boas Avenue, Joondalup
- City of Wanneroo, Civic Centre, 23 Dundobar Road, Wanneroo
- Office of the Environmental Protection Authority, The Atrium, 168 St Georges Terrace, Perth

Documents are also available online at [www.planning.wa.gov.au/oceanreefmarina](http://www.planning.wa.gov.au/oceanreefmarina).

**Submissions**

Any person who desires to make a submission to support, object or provide comment on any part of the proposed amendment should do so on a Form 41, which is available from the display locations, the amendment report and online.

Written submissions can be lodged online via [mrs@planning.wa.gov.au](mailto:mrs@planning.wa.gov.au) or by post to: Secretary, Western Australian Planning Commission, Locked Bag 2506, Perth WA 6001.

Submissions close 5pm, Friday 24 February 2017. Late submissions will not be considered.

**Additional Information**

The Environmental Protection Authority (EPA) determined that the amendment should not be assessed, given that a Negotiated Planning Outcome (NPO) is required for the partial loss of Bush Forever site 325 and that the proposal to construct and operate the Ocean Reef Marina is being assessed by the EPA at the level of Public Environmental Review. The EPA's assessment of the proposal and the NPO are required to be finalised, prior to the WAPC making a final determination on the amendment.

Submissions on the Public Environmental Review should be directed to the EPA at [www.epa.wa.gov.au](http://www.epa.wa.gov.au).

KERRINE BLENKINSOP, Secretary, Western Australian Planning Commission.

**PL403**

**PLANNING AND DEVELOPMENT ACT 2005**  
APPROVED LOCAL PLANNING SCHEME AMENDMENT  
*City of Albany*  
Local Planning Scheme No. 1—Amendment No. 1

Ref: TPS/1785

It is hereby notified for public information, in accordance with section 87 of the *Planning and Development Act 2005* that the Minister for Planning approved the City of Albany Local Planning Scheme amendment on 23 December 2016 for the purpose of—

1. Rezone—
  - a. Lot 8888 Flinders Parade, Middleton Beach from the 'Hotel/Motel' and 'Tourist Residential' zones to 'Special Use Zone SU25';
  - b. Lots 660 and 661 Marine Terrace, Middleton Beach from the 'Tourist Residential' zone to 'Special Use Zone SU25';
  - c. Portions of Adelaide Crescent, Marine Terrace, Barnett Street, Flinders Parade and Marine Drive from 'Priority Road' and Local Road Reserves to 'Special Use Zone SU25';
2. Amend Schedule 4—Special Use Zones by inserting 'Special Use SU25' in the schedule and incorporate provisions relating to Middleton Beach Activity Centre as follows—

No.	Description of Land	Special Use	Conditions
SU25	Middleton Beach Activity Centre Lot 8888 Flinders Parade Lots 660 and 661, Marine Terrace Adjacent road reserves being portions of Adelaide Crescent, Marine Terrace, Barnett Street, Flinders Parade and Marine Drive, Middleton Beach	Land use permissibilities within the precincts shown on the Middleton Beach Activity Centre Precinct Plan are as follows— <b>Hotel / Mixed Use Precinct</b> Car Park 'D' Exhibition Centre 'A' Holiday Accommodation 'D' Hotel 'P' up to 5 storeys [21.5 metres] Hotel 'A' above 5 storeys [21.5 metres] Market 'D' Multiple Dwelling 'D'(1)(2) up to 5 storeys [21.5 metres] Multiple Dwelling 'A'(1)(2) above 5 storeys [21.5 metres] Nightclub 'D' Public Utility 'D' Recreation-Private 'A' Restaurant 'D' Shop 'A' Small Bar 'A' Tavern 'A'	<u>Performance Criteria</u> 1. All development within the Middleton Beach Activity Centre Special Use zone shall comply with the following performance criteria— (a) The Middleton Beach Activity Centre is developed in a co-ordinated manner, recognising its significance for local recreation, organised sporting and cultural events and as a tourist destination; (b) High quality built form and public place design is provided across the Special Use zone and public foreshore reserve interfaces recognise the iconic location and significance of the site to the community; (c) The development of public and private land is integrated to establish a safe, vibrant mixed use centre with an active beach front and urban edge that includes but is not limited to: local and tourist facilities; restaurants, cafes and shops; holiday and short stay accommodation; together with a range of permanent residential uses but excludes detached houses;

No.	Description of Land	Special Use	Conditions
		<p><b>Mixed Use Precinct</b></p> <p>Car Park 'D'</p> <p>Consulting Rooms 'D'</p> <p>Convenience Store 'D'</p> <p>Exhibition Centre 'A'</p> <p>Holiday Accommodation 'P'</p> <p>Hotel 'D'</p> <p>Market 'D'</p> <p>Multiple Dwelling 'P' (3)</p> <p>Office 'D'</p> <p>Public Utility 'D'</p> <p>Recreation-Private 'A'</p> <p>Restaurant 'D'</p> <p>Shop 'D'</p> <p>Single Attached Dwelling 'D'(3)</p> <p>Small Bar 'A'</p> <p>Tavern 'A'</p> <p><b>Residential Precinct</b></p> <p>Home Office 'D'</p> <p>Multiple Dwelling 'P'</p> <p>Public Utility 'D'</p> <p>Single Attached Dwelling 'P'</p> <p><b>Edge Precinct</b></p> <p>Car Park 'D'</p> <p>(1) Means the use is prohibited where it fronts the street at pedestrian level.</p> <p>(2) Means that the use is prohibited if prior or concurrent approval and development of a hotel has not occurred.</p> <p>(3) Means that the use is prohibited where it fronts the street at pedestrian level within the 'Primary Active Frontage' area as depicted on the Precinct Plan.</p>	<p>(d) An effective, efficient, integrated and safe transport network that prioritises pedestrians, cyclists and public transport users is provided;</p> <p>(e) Vehicle parking is efficient and promotes the establishment of shared, reciprocal and common use facilities;</p> <p>(f) Developments incorporate sustainable technologies and design including best practice with regard to energy efficiency, water sensitive urban design and fire safety requirements; and</p> <p>(g) Opportunities for investment and development are facilitated.</p> <p>2. Due regard shall be given to the Activity Centre Structure Plan in accordance with the relevant clauses within the deemed provisions for Local Planning Schemes.</p> <p>3. Development will be compliant with design guidelines that have been prepared, referred to the State Design Review Panel for its advice and recommendations, and adopted by the City of Albany prior to development of the site.</p> <p>4. Notwithstanding that a use is not specifically listed in this schedule, the Local Government may consider the proposed use on its merits as an 'A' use where that use and development complies with the performance criteria set out in Condition 1 and other relevant conditions in this schedule and is compatible with the listed uses in the designated precinct.</p> <p><u>Foreshore Protection and Management</u></p> <p>5. Development within the Hotel/Mixed Use Precinct and/or creation of the Hotel/Mixed Use Lot will be subject to satisfactory arrangements for the implementation and ongoing management of coastal adaptation and protection measures consistent with State Planning Policy 2.6, including but not limited to—</p> <ul style="list-style-type: none"> <li>• Public advertising, adoption and implementation of a Foreshore Management Plan that includes the existing foreshore reserve adjacent to the Special Use zone, prepared in conjunction with the City of Albany in accordance with SPP2.6 Sub-Clause 5.10 Coastal Strategies and Management Plans and endorsed by the WAPC; and</li> <li>• Notification on Title stating that the lot is within a Vulnerable Coastal Area.</li> </ul> <p><u>Bushfire Management</u></p> <p>6. The Middleton Beach Activity Centre has been identified as a bushfire prone area and development and use of the site shall comply with the provisions of the approved Bushfire Management Plan and the Scheme.</p> <p>7. All residential buildings and, as far as is practicable, non-residential developments, are to incorporate the bushfire resistant construction</p>

No.	Description of Land	Special Use	Conditions
			<p>requirements of the Building Code, including as appropriate the provisions of AS3959 <i>Construction of Buildings in Bushfire Prone Areas</i> (as amended), commensurate with the bushfire attack level (BAL) established for the relevant portion of the site.</p> <p><u>Development Requirements</u></p> <p>8. Before commencing or carrying out any development on land within the Special Use zone, the developer must—</p> <ul style="list-style-type: none"> <li>• demonstrate that the proposal aligns with the principles of any relevant State Planning Policy for design of the built environment;</li> <li>• comply with the requirements of the design guidelines referred to in Condition (3) above; and</li> <li>• incorporate the recommendations of an appointed design review panel, where available.</li> </ul> <p>9. Notwithstanding the permissibility of the proposed use, any works proposed to be undertaken within the Special Use zone shall require the planning approval of Council following advertising of the proposal in accordance with clause 64(3) of the Deemed Provisions unless exempted by the provisions of Schedule 2, Cl 61 (1) of the Deemed Provisions to the <i>Planning and Development Regulations 2015</i>.</p> <p>10. Applications for planning approval are to demonstrate appropriate design and management controls to minimise conflict between permanent and short term residential, tourism and mixed uses and, in particular, night time hospitality and entertainment.</p> <p>11. Any approved development is to be constructed to plate height prior to the submission of any diagram or plan of survey (deposited plan) for subdivision of the parent lot to create individual lot(s) for the development(s).</p> <p>12. Basement car parking shall be integrated into the built form and screened from view, such that the car parking area is not directly visible from the street or other public spaces. Car parking areas shall be accessed from a laneway or secondary street where available.</p> <p>13. Car parking shall be provided in accordance with the provisions of the Scheme unless otherwise stated below.</p> <p>14. The following development requirements specifically apply to the following precincts as identified on the Middleton Beach Activity Centre Precinct Plan—</p> <p><b>Hotel / Mixed Use Precinct</b></p> <p>All proposals for development within this precinct are to be referred to the State Design Review Panel to ensure that building design is sympathetic to its iconic location.</p> <p>The scale of any residential development is to complement the tourism component and priority is to be given to locating the tourism component(s) on those areas of the site providing the highest tourism amenity.</p>

No.	Description of Land	Special Use	Conditions
			<p><u>Key Principles for Hotel/Mixed Use Precinct</u></p> <p>Any application within the Hotel/Mixed Use Precinct for development in excess of 5 storeys (21.5 metres) in height is to—</p> <ul style="list-style-type: none"> <li>• Demonstrate excellent design outcomes</li> <li>• Be informed by a Visual Impact Assessment consistent with the guidelines set out in the WAPC's Visual Landscape Planning manual.</li> <li>• Contribute positively to the public realm;</li> <li>• Provide a landmark element on the axis of Adelaide Crescent and Flinders Parade;</li> <li>• Present no adverse impacts on the locality by overshadowing;</li> <li>• Respond to the site and its context and step built form away from the beach with additional height located towards Mt Adelaide;</li> <li>• Effectively mitigate bulk and scale of the proposed development; and</li> <li>• Achieve the criteria in Condition (1) above</li> </ul> <p><u>Building Height—</u></p> <ul style="list-style-type: none"> <li>• 1-3 storey height limit along Primary Active Frontages abutting Public Open Space, with additional height located on the southern portion of the site towards Mount Adelaide.</li> <li>• Except as provided for below, 5 storey (21.5 metres) height limit elsewhere on the site;</li> <li>• Development of a hotel use and/or holiday accommodation and/or multiple dwellings above 5 storeys (21.5 metres) may be considered to a maximum of 12 storeys (46 metres) if the proposed development accords with— <ul style="list-style-type: none"> <li>o The key principles as outlined above;</li> <li>o The design guidelines referred to in Condition (3) above; and</li> <li>o The recommendations of the State Design Review Panel.</li> </ul> </li> </ul> <p><u>Setbacks—</u></p> <ul style="list-style-type: none"> <li>• Generally nil street and side setbacks.</li> </ul> <p><u>Car Parking—</u></p> <ul style="list-style-type: none"> <li>• Hotel 1 bay per 2 employees + 1 per bedroom + 1 per 4m<sup>2</sup> in other public areas.</li> <li>• Retail—1 bay per 40m<sup>2</sup> NLA.</li> <li>• No visitor car parking requirement for permanent residential developments.</li> </ul> <p><u>Bicycle Parking—</u></p> <ul style="list-style-type: none"> <li>• 1 bicycle parking space per residential dwelling and 1 bicycle parking space per 10 dwellings for residential visitors.</li> </ul> <p><u>Access—</u></p> <p>Delivery services are prohibited on the Flinders Parade frontage of the Hotel / Mixed Use site.</p>

No.	Description of Land	Special Use	Conditions
			<p><b>Mixed Use Precinct</b></p> <p><u>Building Height</u>—</p> <ul style="list-style-type: none"> <li>• 2 storey (11 metres) minimum / 3 storey (14.5 metres) maximum between Barnett Street and the Public Access Way.</li> <li>• 2 storey (11 metres) minimum / 4 storey (18 metres) maximum for development fronting the southern extent of the Public Access Way;</li> <li>• 2 storey (11 metres) minimum / 5 storey (21.5 metres) maximum for development south of the Public Access Way, fronting Adelaide Crescent or Flinders Parade.</li> </ul> <p><u>Setbacks</u>—</p> <p>Generally nil street and side setbacks.</p> <p><u>Car Parking</u>—</p> <ul style="list-style-type: none"> <li>• Single attached dwelling—resident parking as determined by Council.</li> <li>• No visitor car parking requirement for permanent residential developments.</li> <li>• Retail—1 bay per 40m<sup>2</sup> NLA.</li> </ul> <p><u>Bicycle Parking</u>—</p> <ul style="list-style-type: none"> <li>• 1 bicycle parking space per residential dwelling and 1 bicycle parking space per 10 dwellings for residential visitors.</li> </ul> <p><b>Residential Precinct</b></p> <p><u>Building Height</u>—</p> <ul style="list-style-type: none"> <li>• 2 storey (10 metres) minimum / 3 storey (13.5 metres) maximum between Barnett Street and the Public Access Way.</li> </ul> <p><u>Setbacks</u>—</p> <ul style="list-style-type: none"> <li>• Generally nil street and side setbacks.</li> </ul> <p><u>Car Parking</u>—</p> <ul style="list-style-type: none"> <li>• Single attached dwelling—resident parking as determined by Council.</li> <li>• No visitor car parking requirement for permanent residential developments.</li> </ul> <p><u>Bicycle Parking</u>—</p> <ul style="list-style-type: none"> <li>• 1 bicycle parking space per residential dwelling and 1 bicycle parking space per 10 dwellings for residential visitors.</li> </ul> <p><b>Active Frontages</b></p> <p>Areas marked as ‘Active Frontage’ on the Precinct Plan encourage a range of active uses at the pedestrian level. Specifically this shall be achieved by—</p> <ul style="list-style-type: none"> <li>• Residential uses at the pedestrian level in areas delineated as ‘Primary Active Frontage’ are prohibited.</li> <li>• Areas delineated as either ‘Primary Active Frontage’ or ‘Secondary Active Frontage’ shall demonstrate measures have been undertaken to build adaptability into the development at ground floor level.</li> </ul>



#### Middleton Beach Activity Centre Precinct Plan

3. Introduce the following land use definition to the City of Albany Local Planning Scheme No. 1  
**single attached dwelling** means one of a group of two or more attached dwellings each being separated by a common wall and may include a row house, terrace house or town house, not located above or below another dwelling.
4. Amend the Scheme Maps accordingly.

D. WELLINGTON, Mayor.  
 A. SHARPE, Chief Executive Officer.

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## DECEASED ESTATES

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ZX401

### TRUSTEES ACT 1962

#### DECEASED ESTATES

##### Notice to Creditors and Claimants

Marie Theresa Catherine Sherrington late of Parkview, G1/165 Derby Road, Shenton Park, Western Australia

Creditors and other persons having claims (to which Section 63 of the *Trustees Act 1962* relates) in respect of the estate of the deceased who died on 23 October 2016 at Mercy Aged Care, 18 Barrett Street, Wembley aforesaid are required by the Executors and Trustees of care of Messrs Dwyer Durack Lawyers of 8th Floor, 40 St Georges Terrace, Perth to send particulars of their claims to them by 23 February 2017 after which date the Trustees may convey or distribute the assets having regard only to the claims of which they then have notice.

**ZX402****TRUSTEES ACT 1962****DECEASED ESTATES**

## Notice to Creditors and Claimants

In the estate of Arthur Edward McCall who died on 10 May 2016 of Opal Applecross, Riverway, Western Australia.

Creditors and other persons having claims (to which Section 63 of the *Trustees Act 1962* relates) in respect of the estate of the said deceased person are required by the Executor of the deceased's estate being Peter Angus Tibbits of care of Angus Tibbits Solicitors, Suite 9, 73 Calley Drive, Leeming Western Australia, to send particulars of their claims to him by 17 February 2017, after which date the Executor may convey or distribute the assets having regard only to the claims of which he then has notice.

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# Appendix F

## Foreshore Assets

## Appendix F Foreshore Assets

**Table F-1 Life Cycle and Cost of Foreshore Assets**

Asset Type	Structural Lifespan	Asset Value (excl. GST)	Low/Med/High Value	Key Maintenance Milestones and Costings	Proposed Location (Refer to Foreshore Concept Plan)	Proximity to Coastal Vulnerability (Years)	Adaptation Plan (i.e. – Asset Will Be Relocated to Location X in Approximately 25–30 Years)
Middleton Beach Foreshore Landscape Master Plan							
Paving Types							
P1: exposed aggregate concrete paving	35 years	\$100,000	Med	High pressure clean and replace cracked/heaved panels every 5 years (\$10,000)	As Shown	100+	
P2: broomed concrete paving	35 years	\$40,000	Low	High pressure clean and replace cracked/heaved panels every 5 years (\$4,000)	As Shown	100+	
P3: Interpretive banding paving and TGSIs	35 years	\$4,000	Med	Replace cracked/heaved panels every 5 years (\$1,000)	As Shown	100+	
P4: Decking (Parkland)	25 years	\$1,600,000	High	Oil and repair every 2 years (\$8,000) N.B. A recycled plastic substitute for hardwood would reduce maintenance costs	As Shown	100+	
PS1: Play surface sand	1 year	\$1,200	Low	Replenish and sift every 6 months (\$600)	As Shown	100+	
PS2: Play surface rubber	5 years	\$20,000	High	High pressure clean and repair cracks every 5 years (\$1,000)	As Shown	100+	

Asset Type	Structural Lifespan	Asset Value (excl. GST)	Low/ Med/ High Value	Key Maintenance Milestones and Costings	Proposed Location (Refer to Foreshore Concept Plan)	Proximity to Coastal Vulnerability (Years)	Adaptation Plan (i.e. – Asset Will Be Relocated to Location X in Approximately 25–30 Years)
<b>Fence &amp; Wall Types</b>							
W1: Granite drystone terrace walls	50 years	\$130,000	High	High pressure clean, graffiti coating and repair cracks every 10 years (\$1300)	As Shown	100+	
W2: Mass granite / off-form concrete walls	50 years	\$375,000	High	High pressure clean, graffiti coating and repair cracks every 10 years (\$3750)	As Shown	100+	
W3: Granite Boulders	1000 years	\$20,000	Med	Remove marks as required (\$100)	As Shown	100+	
W4: blockwork backing walls	50 years	\$50,000	Med	Reposition if undercut by erosion (\$10,000)	As Shown	100+	
<b>Furniture / Facilities</b>							
Picnic tables	20 years	\$5,600	Med	Remove marks annually (\$500) Recycled plastic construction is preferable	As Shown	100+	
Bench Seats & Lounges	10 years	\$40,000	Med	Remove marks annually (\$500)	As Shown	100+	
Bike racks	20 years	\$4,500	Med	Remove marks annually (\$500)	As Shown	100+	
Beach shower and foot washer	10 years	\$10,000	High	Remove sand fortnightly and repair plumbing as required (\$200)	As Shown	100+	
Drinking fountains	20 years	\$5,000	High	Remove marks annually and repair plumbing as required (\$500) Same as product used in Town Square development with integrated dog water bowl	As Shown	100+	
Rubbish bins	20 years	\$16,000	Med	Remove marks annually (\$500)	As Shown	100+	
Bollards	30 years	\$6,000	Med	Remove marks annually and repair as required (\$500)	As Shown	100+	

Asset Type	Structural Lifespan	Asset Value (excl. GST)	Low/ Med/ High Value	Key Maintenance Milestones and Costings	Proposed Location (Refer to Foreshore Concept Plan)	Proximity to Coastal Vulnerability (Years)	Adaptation Plan (i.e. – Asset Will Be Relocated to Location X in Approximately 25–30 Years)
Dune lookout	20 years	\$60,000	High	Repair and oil timberwork and paint steelwork annually (\$1500)	As Shown	100+	
Tree Grates	30 years	\$4,000	High	Remove marks annually (\$500)	As Shown	100+	
Lighting - All energy efficient & products to be consistent with concurrent CoA developments							
Park lights on poles	50 years	\$20,000	High		As Shown	100+	
Street lights on poles	50 years	\$300,000	High	Non-standard Western Power standard lighting to be on separate circuit for metered supply (\$1000)	As Shown	100+	
Up lighting	20 years	\$100,000	High		As Shown	100+	
Events power outlets	30 years	\$50,000	High		As Shown	100+	
Revegetation Areas							
Rehabilitation planting (including preparation protective fencing)	10 Years	\$150,000	Med	Weed control quarterly (\$5,000)	As Shown	25+	Asset will be reinstated as required following severe erosion events
Parklands							
Proposed tree 45L-1000L	200 years	\$100,000	Low	Prune & stake annually (\$5,000)	As Shown	100+	
Roll-on Turf	10 Years	\$70,000	Low	Mowing fortnightly (\$1,000) Easily accessible surrounds are preferable for mowing and maintenance	As Shown	100+	
Mass Planting	5 years	\$60,000	Low	Weed control quarterly (\$5,000)	As Shown	100+	

Asset Type	Structural Lifespan	Asset Value (excl. GST)	Low/ Med/ High Value	Key Maintenance Milestones and Costings	Proposed Location (Refer to Foreshore Concept Plan)	Proximity to Coastal Vulnerability (Years)	Adaptation Plan (i.e. – Asset Will Be Relocated to Location X in Approximately 25–30 Years)
Irrigation to parkland soft works (turf & planting)	5 years	\$120,000	Med	Repair as required annually (\$10,000)	Co-located with mass planting and turf areas. Rehabilitation areas would not be irrigated.	100+	
Mulching	1 year	\$10,000	Low	Top up annually (\$5,000)	As shown for planting areas	100+	
Drainage infrastructure extensions/connections to new culvert system	100 years	\$75,000	Med	Remove blockages and repair leaks as required (\$750)	As shown	100+	
Decking to promenade surface (4m wide)	30 years	\$450,000	High	Oil and repair every 2 years (\$2250) A recycled plastic substitute for hardwood would reduce maintenance costs	As shown	100+	
Ramps – beach access	20 years	\$285,000	Med	Oil and repair every 2 years (\$1425) A recycled plastic substitute for hardwood would reduce maintenance costs	As shown	25+	Asset will be reinstated as required following severe erosion events
Decorative concrete paving to promenade pavement surface (4m wide)	50 years	\$43,200	Med	High pressure clean and replace cracked/heaved panels every 5 years (\$4,320)	At path connection nodes to promenade and SLSC forecourt	100+	
Precast concrete sand control edging (seating wall - 500 high)	50 years	\$240,000	Med	High pressure clean, graffiti coating and repair cracks every 10 years (\$2400)	As shown	100+	
Subtotal		\$4,564,500					



Asset Type	Structural Lifespan	Asset Value (excl. GST)	Low/ Med/ High Value	Key Maintenance Milestones and Costings	Proposed Location (Refer to Foreshore Concept Plan)	Proximity to Coastal Vulnerability (Years)	Adaptation Plan (i.e. – Asset Will Be Relocated to Location X in Approximately 25–30 Years)
Coastal Engineering							
Coastal Protection Structure	50 years	\$4.2 million (does not include costs associated with drainage connection or landscaping works)		Annual coastal structures monitoring by the City of Albany - \$1,000 per annum Allowance for additional more detailed inspection of structures - \$5,000 per decade Allowance for maintenance of vertical wall (culvert) and the small seating/overtopping wall at the rear of the promenade - \$25,000 per decade Allowance for maintenance of rock armoured section at years 30 and 40 (~5% of capital cost for rock armoured section per occurrence) - \$50,000 per occurrence	Seaward extent of foreshore area	N/A	Asset will be replaced or upgraded at some stage over the next 50 year period as part of a future foreshore upgrade or to respond to issues associated with increased erosion or inundation risk.
Subtotal		\$4,200,000					
<b>Total</b>		<b>\$8,764,500</b>					

**K1265/2, LandCorp - Middleton Beach Activity Centre  
Preliminary Cost Estimate for Sheet Pile Wall Around Hotel Site**

Prepared by: B Smith

Checked by: C Doak

Date: 26 July 2016

Item	Activity	Quantity	Units	Unit Rate	Subtotal	Total for Item
<b>1</b>	<b>Preliminaries, Supervision, Mobilisation &amp; Demobilisation</b>					<b>\$ 85,000</b>
1.1	Site establishment, insurances and BCITF	1	Item	\$ 15,000	\$ 15,000	
1.2	Management and supervision, survey, testing etc	1	Item	\$ 20,000	\$ 20,000	
1.3	Mobilisation to site	1	Item	\$ 35,000	\$ 35,000	
1.4	Demobilisation and site clean up	1	Item	\$ 15,000	\$ 15,000	
<b>2</b>	<b>Sheet Piles</b>					<b>\$ 643,550</b>
2.1	Supply and install sheet piles (12 m length AZ52-700)	600	m <sup>2</sup>	\$ 650	\$ 390,000	
2.2	Paint top 4 m of piles for corrosion protection <sup>2</sup>	200	m <sup>2</sup>	\$ 200	\$ 40,000	
2.3	Concrete pile capping	50	m <sup>2</sup>	\$ 2,000	\$ 100,000	
2.4	Excavate natural surface to enable placement of scour protection	700	m <sup>3</sup>	\$ 10	\$ 7,000	
2.5	Temporary shoring works around 5 Norfolk Island Pines	5	Item	\$ 5,000	\$ 25,000	
2.6	Supply and place geotextile for scour protection	240	m <sup>2</sup>	\$ 25	\$ 6,000	
2.7	Supply and place rock filter for scour protection	65	m <sup>3</sup>	\$ 170	\$ 11,050	
2.8	Supply and place granite armour (0.8 to 3.0t; 50%>1.5t)	500	t	\$ 115	\$ 57,500	
2.9	Backfill site after scour protection placement	700	m <sup>3</sup>	\$ 10	\$ 7,000	
<b>3</b>	<b>Rock Seawall</b>					<b>\$ 301,000</b>
3.1	Excavate natural surface to enable the construction of the seawall	3,040	m <sup>3</sup>	\$ 10	\$ 30,400	
3.2	Trim slope, supply and place geotextile	810	m <sup>2</sup>	\$ 25	\$ 20,250	
3.3	Supply and place filter material (0.1 to 0.6 m; 50%>0.35,)	340	m <sup>3</sup>	\$ 170	\$ 57,800	
3.4	Supply and place granite armour (0.8 to 3.0t; 50%>1.5t)	1,410	t	\$ 115	\$ 162,150	
3.5	Backfill site after seawall construction	3,040	m <sup>3</sup>	\$ 10	\$ 30,400	
<b>4</b>	<b>Vertical Retaining Wall</b>					<b>\$ 32,900</b>
4.1	Trim surface and cast concrete slab footing (unreinforced) as foundation for wall	70	m	\$ 120	\$ 8,400	
4.2	Construct 3 block high retaining wall (limestone or ferricrete blocks)	70	m	\$ 350	\$ 24,500	
	<b>Subtotal 1</b>				<b>\$ 1,062,450</b>	<b>\$ 1,062,450</b>
	<b>Management &amp; Design Fees</b>	<b>5</b>	<b>%</b>		<b>\$ 53,123</b>	<b>\$ 53,123</b>
	<b>Total Estimated Cost</b>				<b>\$ 1,115,573</b>	<b>\$ 1,115,573</b>

Notes 1. Total cost is exclusive of GST

# Appendix G

## Weed Control Methods

## Appendix G Weed Control Methods

**Table G-1: Approach to Controlling Weed Species**

Weed Species	Control Method		Optimal Control Time											
Scientific Name	Herbicide	Manual	J	F	M	A	M	J	J	A	S	O	N	D
<i>Carpobrotus edulis</i>			Naturalised Stabiliser (Keep)											
<i>Tetragonia decumbens</i>			Naturalised Stabiliser (Keep)											
<i>Asparagus aethiopicus</i>	Spray 0.2 g metsulfuron methyl + Pulse® in 15 L water (or 2.5 - 5g/ha + Pulse®). Best results when flowering.								J	A				
<i>Trachyandra divaricata</i>	Wipe with 50% glyphosate solution before flowering. For dense infestations in degraded areas spot spray 0.4 g chlorosulfuron plus 25 ml wetting agent in 10 L of water when plants actively growing.	Manually remove isolated or small infestations prior to flowering.						J	J	A				
<i>Conyza sumatrensis</i>	Most susceptible to glyphosate at early development of rosette stage. Apply 25 ml/ 10L glyphosate after stem elongation and before flowering in late spring to summer each year when the plants are actively growing. A mixture of 50% glyphosate can be used to wipe the stems of plants. Lontrel® 4 g/ 10 L (200 g/ha) + wetting agent can be spot sprayed for fairly selective control.	Hand pulling of small and/or isolated infestations after stem elongation prior to seed set is effective on loose soils, but difficult on heavier soils. Mowing is ineffective.						J	J	A	S	O	N	
<i>Senecio elegans</i>	Apply Lontrel® at 10 ml/10 L + wetting agent before stem elongation in late spring.	Hand remove isolated/small populations.										O	N	
<i>Sonchus asper</i>	Apply Lontrel® at 10 ml/10 L + wetting agent preferably when plants are at the rosette stage.	Slashing is often ineffective as plants can continue producing flowers and seed. Remove small and/or isolated populations manually prior to seed set.						J	J					

RPS

Weed Species	Control Method		Optimal Control Time											
Scientific Name	Herbicide	Manual	J	F	M	A	M	J	J	A	S	O	N	D
<i>Crassula glomerata</i>	Cut down close to ground and then immediately paint stump with straight Roundup®.	Be careful to remove all pieces of plant, as fragments easily resprout.								J	A	S		
<i>Euphorbia paralias</i>	When actively growing, spray with 50 mL glyphosate (360 g/L) + 0.2 g metsulfuron + Pulse® in 10 L water.	Hand remove small isolated infestations, ensuring use of appropriate personal protective equipment and safety guidelines. Consider possible dune erosion.	J									S	O	N
<i>Medicago polymorpha</i>	Lontrel® at 10 ml/10 L + wetting agent provides effective control in early winter. Otherwise metsulfuron methyl 0.1 g/10 L + wetting agent or 1 g/10 L of Logran® applied in early winter provides reasonably selective control. Repeat annually for several years.	Relatively tolerant to glyphosate, grazing and mowing. Hand pull isolated plants in winter before flowering.						J	J	A				
<i>Melilotus albus</i>	2,4-D, MCPA, MCPB, 2,4-DB, dicamba, chlorsulfuron, clopyralid, triclopyr	Conn and Seefeldt (2009) suggest that a combination of a range of herbicides and non-chemical methods may be most effective in the long term.	J	F	M									N
<i>Trifolium angustifolium</i>	Spot spray with 1% glyphosate before flowering, otherwise spot spray Lontrel® 3 ml/10 L (150 ml/ha) up to the 6 leaf stage.									J	A	S		
<i>Trifolium tomentosum</i>	Spot spray with 1% glyphosate before flowering, otherwise spot spray Lontrel® 3 ml/10 L (150 ml/ha) up to 6 leaf stage.									J	A			
<i>Pelargonium capitatum</i>			Naturalised Stabiliser (Keep)											
<i>Orobancha minor</i>	Soil fumigation to kill seeds (methyl bromide or metham sodium) Selective control through very low rates of glyphosate applied to hosts, which concentrates in attached broomrapes. Selective control through growth of host crops with tolerance to Group B herbicides. Host denial through maintaining broadleaf weed free cereals, grass pastures.								J	J	A	S	O	N

RPS

Weed Species	Control Method		Optimal Control Time													
Scientific Name	Herbicide	Manual	J	F	M	A	M	J	J	A	S	O	N	D		
<i>Ehrharta longiflora</i>	Alternatively spray with Fusilade Forte® 30 ml/10 L or 1.6 L/ha (based on 500 L water/ha) + wetting agent or for generic fluazifop-p (212g/L active ingredient) 18ml/10L or 1L/ha + wetting agent before flowering stem emerges, or at 3-5 leaf stage. Secondary seedling flush often occurs, repeat treatment if necessary.	Hand remove small infestations.											A	S	O	
<i>Ehrharta villosa</i>	Spray with Verdict 520® 10 ml/10 L (500 ml/ha) or glyphosate 1% + penetrant. Several sequential applications will likely be required.		J	F	M	A								O	N	D
<i>Lagurus ovatus</i>	In selective situations spray with 16 ml/10 L (800 ml/ha) Fusilade® Forte + spray oil or for generic fluazifop-p (212g/L active ingredient) 10ml/10L or 500ml/ha + spray oil any time before flowering. A lower rate of 13 ml/10 L Fusilade® Forte or for generic fluazifop-p (212g/L active ingredient) 8ml/10L can be used in winter at the 2-8 leaf stage before stem elongation.	Prevent seed set. Hand removal small isolated infestations.						J	J	A						
<i>Lolium rigidum</i>	Spray with grass selective herbicide such as Fusilade® Forte in winter 4-6 weeks after opening rains. For larger plants up to flowering, increase rates of grass selective herbicide 3 to 4 fold. In agricultural areas, populations may be resistant to these herbicides and glyphosate may be needed. Spray 10 ml/10 L glyphosate when plants are vegetative up to when seed heads are emerging. Late season applications of herbicide can reduce the numbers of seeds produced, viability and seedling fitness.	Prevent seed set. Hand pull.						J	J	A	S	O				
<i>Dischisma arenarium</i>	Spot spray 0.2% glyphosate.							J	A	S						
<i>Spinifex sericeus</i>			Naturalised Stabiliser (Keep)													
<i>Ammophila arenaria</i>	Spray with 1% glyphosate + penetrant. Grass selective herbicides are less effective. Requires ongoing manual removal and/or treatment of regrowth. Fire may provide an effective window for control, as it removes thatch and stimulates regrowth, creating ideal conditions for effective herbicide uptake.	Dig out small infestations. Consider staggering removal to manage erosion and allow native species to re-establish.											S	O	N	



Weed Species	Control Method		Optimal Control Time											
Scientific Name	Herbicide	Manual	J	F	M	A	M	J	J	A	S	O	N	D
<i>Cakile maritima</i>	Fairly selective control can be achieved by spot spraying Logran® at 0.5 g/10 L. Wick application with 50% glyphosate or foliar spraying with 1% glyphosate provides reasonable control and can be used at flowering to reduce seed set.	Assess carefully whether it is displacing native taxa or possibly having other impacts at the site prior to considering any control program. Manual removal is effective but must be done at least every 8-10 weeks. Ensure material is removed off-site, as once pods are formed, seed will often mature if plants have been uprooted.							J	J	A	S	O	N
<i>Arctotheca calendula</i>	For large infestations apply Lontrel® 6 ml/10 L (300 ml/ha) in early growth stages. Glyphosate at 0.2% will provide some selective control if the plants are young or at the budding stage, otherwise spot spraying glyphosate at 10 ml/L will control capeweed at all growth stages.	Chip out small infestations, ensuring root is severed well below ground level to prevent re-sprouting from the crown. A combination of chemical and physical control with follow up treatment provides optimal control.							J	J	A	S	O	N

# Appendix H

## Revegetation Species

## Appendix H Revegetation Species

Table H-1 Dunal Revegetation Species

Life Form	Scientific Name	A Beach Grass 1722 m <sup>2</sup>	B Dune Colonising 2313 m <sup>2</sup>	C Protected/ Fenced 1697 m <sup>2</sup>	M Mass Planting 2307 m <sup>2</sup>
Tree	<i>Agonis flexuosa</i>			20	
Shrub <5m	<i>Acacia cyclops</i>		243		
Shrub <5m	<i>Spyridium globulosum</i>		243		
Shrub <3m	<i>Olearia axillaris</i>		243	226	1318
Shrub <3m	<i>Allocasuarina humilis</i>		243	226	
Shrub <3m	<i>Leucopogon parviflorus</i>	383	243		
Shrub <3m	<i>Atriplex isatidea</i>	383	243		
Shrub <3m	<i>Rhagodia baccata</i>	383	243		
Shrub <3m	<i>Hibbertia cuneiformis</i>			226	1318
Shrub <3m	<i>Hibbertia furfuracea</i>		243	226	
Shrub <3m	<i>Acacia cochlearis</i>		243	226	
Shrub <3m	<i>Acacia littorea</i>		243	226	
Shrub <3m	<i>Scaevola crassifolia</i>				
Shrub <3m	<i>Scaevola nitida</i>	383	243		1318
Shrub <1m	<i>Chorizema ilicifolium</i>			226	
Shrub <1m	<i>Eutaxia parvifolia</i>			226	
Shrub <1m	<i>Gompholobium tomentosum</i>			226	
Shrub <1m	<i>Dampiera fasciculata</i>		243	226	
Shrub <1m	<i>Opercularia hispidula</i>		243	226	
Sedge/ Rush	<i>Ficinia nodosa</i>	383	243	226	1318
Sedge/ Rush	<i>Lepidosperma gladiatum</i>		243	226	1318
Climber	<i>Hardenbergia comptoniana</i>				
Climber	<i>Billardiera fusiformis</i>			226	1318
Herb	<i>Carpobrotus virescens</i>	383	243		1318
Herb	<i>Tetragonia implexicoma</i>	383	243		
Herb	<i>Tetragonia tetragonoides</i>	383	243		
Herb	<i>Lyginia barbata</i>	383	243	226	
Total	27	3444	4626	3414	9228

## Proposed Planting Density

Dune areas – 2 plants per m<sup>2</sup>

Irrigated areas – 4 plants per m<sup>2</sup>

An estimated 20 units per tree species will be planted in predetermined locations.

**Table H-2 Dunal Revegetation Species**

Life Form	Scientific Name	A Lower Slopes	B Upper Slopes
		1397 m <sup>2</sup>	2756 m <sup>2</sup>
Tree 10-30m	<i>Eucalyptus marginata</i>		20
Tree 10-30m	<i>Corymbia calophylla</i>		20
Tree 10-30m	<i>Agonis flexuosa</i>		20
Tree <10m	<i>Melaleuca cuticularis</i>		20
Tree <10m	<i>Banksia ilicifolia</i>		20
Tree <10m	<i>Banksia attenuata</i>		20
Tree <10m	<i>Allocasuarina fraseriana</i>		20
Shrub >2m	<i>Hibbertia furfuracea</i>		212
Shrub >2m	<i>Bossiaea linophylla</i>		212
Shrub >2m	<i>Taxandria parviceps</i>		212
Shrub 1-2m	<i>Pultenaea reticulata</i>		212
Shrub 1-2m	<i>Leucopogon obovatus</i>		212
Shrub 1-2m	<i>Melaleuca thymoides</i>		212
Shrub 1-2m	<i>Acacia pulchella</i>		212
Shrub 1-2m	<i>Bossiaea praetermissa</i>		212
Shrub 1-2m	<i>Hibbertia cuneiformis</i>		212
Shrub <1m	<i>Xanthosia rotundifolia</i>	349	212
Shrub <1m	<i>Boronia crenulata</i>	349	212
Shrub <1m	<i>Hypocalymma strictum</i>	349	212
Shrub <1m	<i>Tremandra diffusa</i>	349	212
Sedges/rushes	<i>Anarthria scabra</i>	349	689
Sedges/rushes	<i>Hypolaena exsulca</i>	349	689
Sedges/rushes	<i>Anarthria prolifera</i>	349	689
Sedges/rushes	<i>Loxocarya cinerea</i>	349	689
Sedges/rushes	<i>Lepidosperma gladiatum</i>	349	689
Sedges/rushes	<i>Ficinia nodosa</i>	349	689

Life Form	Scientific Name	A Lower Slopes	B Upper Slopes
		1397 m <sup>2</sup>	2756 m <sup>2</sup>
Herbs	<i>Billardiera fusiformis</i>	349	689
Herbs	<i>Clematis pubescens</i>	349	689
Herbs	<i>Opercularia hispidula</i>	349	689
Herbs	<i>Hardenbergia comptoniana</i>	349	689
Herbs	<i>Patersonia umbrosa</i>	349	689
Herbs	<i>Platysace filiformis</i>	349	689
Herbs	<i>Cassytha racemosa</i>	349	689
Herbs	<i>Phlebocarya ciliata</i>	349	689
Herbs	<i>Billardiera laxiflora</i>	349	689
Herbs	<i>Lindsaea linearis</i>	349	689
Total	36	6985	13920

### Proposed Planting Density

Shrubs – 1 plant per m<sup>2</sup>

Sedges/rushes & Herbs – 4 plants per m<sup>2</sup>

An estimated 20 units per tree species will be planted in predetermined locations.

# Appendix I

## Landscape Management Items

# LANDSCAPE MANAGEMENT ITEMS

## A. GRANITE - ORNAMENTAL

Remove marks as required

## B. GRANITE DRYSTONE TERRACE WALLS

High pressure clean, graffiti coating and repair cracks every 10 years

## C. MASS MASONRY WALLS

High pressure clean, graffiti coating and repair cracks every 10 years

## D. DECKING PROMENADE

Oil and repair every 2 years

## E. BEACH SAND NOURISHMENT

Refill to 700 below promenade seasonally

## F. PLAY SURFACE SAND

Replenish and sift every 6 months

## G. PARKLAND ACCESS PAVING

High pressure clean and replace cracked/heaved panels every 5 years  
Universal access by use of TGSIs, signage and lighting

## H. MASS PLANTING

Weed control quarterly | Top up mulch annually

## I. ROLL-ON TURF

Mowing fortnightly

## J. IRRIGATION TO PARKLAND

Repair as required annually

## K. PROPOSED TREES

Prune and stake annually

## L. PRECAST CONCRETE SAND CONTROL EDGING & SEATING WALL

High pressure clean, graffiti coating and repair cracks every 10 years

## M. MASS ROCK SEA-WALL STRUCTURE & BEDDING LAYER

Re-grouted as required, safety barrier mesh repaired as required

## N. DRAINAGE EXTENSIONS / CONNECTIONS TO CULVERT SYSTEM

Debris removed as required, inspections annually

## O. DECORATIVE CONCRETE PAVING TO PROMENADE

High pressure clean and replace cracked/heaved panels every 5 years

## P. BEACH ACCESS - DECKING RAMP

Oil and repair every 2 years, backfill sand as required

## Q. SURF CLUB INTERFACE - PAVING

High pressure clean and replace cracked/heaved panels every 5 years  
Remove sand / debris fortnightly

## R. DUNE LOOKOUT

Repair and oil timberwork and painted steelwork annually

## S. DUNE ACCESS PATHWAYS

Access is controlled by use of fencing, defined pathways and signage

## T. REHABILITATION PLANTING

(Including preparation and protection fencing) Weed control quarterly

## U. STREET FURNITURE

Remove marks annually, repair as required

## V. PLAY SURFACE RUBBER

High pressure clean and repair cracks every 5 years



Aerial Perspective East