FORESHORE MANAGEMENT PLAN

Alkimos Beach





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Disclaimer

SUMMARY

Alkimos Beach Development

Alkimos Beach (formerly known as "South Alkimos") is an approved master planned residential development located approximately 40 kilometres (km) north-west of Perth's Central Business District within the City of Wanneroo (CoW) (Figure 1).

Alkimos Beach Foreshore Management Areas

The Foreshore Management Plan (FMP) study area is centred on the foreshore reserve bounded by the "Urban" zoned portion of the Alkimos Beach to the east and the Indian Ocean to the west, the foreshore reserve continues to the north and south of the site.

The Alkimos Beach foreshore is approximately 1.7 km in length and totals approximately 42 hectares (ha) in area. The foreshore has been separated into the following two distinct management areas (Figure 1):

- Area 1: Southern portion of the Alkimos Beach foreshore, which totals 33.7 ha (being a portion of Lot 9022, owned by LandCorp). The southern portion of the foreshore is identified in the Alkimos Eglinton Coastal Planning Strategy (RPS 2006) and the Perth Coastal Planning Strategy (WAPC 2007) as a conservation and passive recreation area.

  This Foreshore Management Plan (FMP) focuses on Area 1.

- Area 2: Northern portion of the Alkimos Beach foreshore, comprising 8.16 ha of land owned by LandCorp, and bisected by a portion of land owned by the Water Corporation (Lot 9001). This portion of the foreshore was identified in the Alkimos-Eglinton Metropolitan Scheme Amendment, the Alkimos Eglinton Coastal Planning Strategy (RPS 2006) and the Perth Coastal Planning Strategy (WAPC 2007) as a key coastal node / beach activity centre. The Surf Life Saving Western Australia (SLSWA) recommended location for Alkimos Regional Beach Surf Life Saving Club (SLSC) is within the northern portion of the Alkimos Beach foreshore.

  In this context, it is not possible to determine appropriate long-term management actions for this northern area of the foreshore until the design and planning of the coastal node (with a possible marina) is more fully developed. Consequently, the CoW and the Department of Planning (DoP) have outlined their preference for the foreshore reserve to be separated into the two management zones.

  Area 2 will be subject to a future separate FMP post-structure planning and detailed design of the coastal node.

Purpose of the Foreshore Management Plan

The purpose of this FMP, in accordance with the CoW's Environmental Management Plan Guidelines and Draft Foreshore Management Plan Guidelines, is to outline the foreshore location and detail the proposed development (including pathways, car parks) and areas of retained vegetation and revegetation works. In addition, this report includes a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) in accordance with State Planning Policy No.2.6 – State Coastal Planning Policy (SPP 2.6).

Alkimos Beach Foreshore Concept Plan

Lend Lease and LandCorp (development partners) are responsible for developing Alkimos Beach. The development partners have developed a Foreshore Concept Plan to respond to beach access demand. Key elements of this plan are summarised below and provided in Plate A:

- The majority of the foreshore reserve is retained for conservation and rehabilitation (including black cockatoo habitat rehabilitation areas), with the only other activities proposed within the foreshore being for low level (local) beach access and maintenance/safety. Rehabilitation works will be focused on priority areas including the road and path batters, dune blow out and four-wheel drive paths.

- Fenced "southern" pedestrian pathway (3.0 m wide, compacted limestone) providing residents with walkable access (and emergency vehicle access) to the beach. Fencing to the CoW specification will be provided either side of the path. Lockable bollards will positioned at the entry points of the path to prevent public vehicle access.

- A dual use path (3.0 m wide, red asphalt) providing a continuous north to south linkage along the perimeter of the foreshore reserve, connecting into adjacent foreshore areas to the north (Alkimos Coastal Node) and south (Eden Beach). This path will be fenced adjacent to the foreshore reserve. The path also provides a shared maintenance/emergency vehicle access role in the northern portions of the site where there is no nearby public road frontage. The dual use path will be constructed in accordance with the Department of Fire and Emergency Services (DFES) requirements. The indicative location of this dual use path is illustrated in the Foreshore Concept Plan. The final location of this dual use path will be subject to detailed engineering review.

- Fenced public vehicle access asphalt road (6.0 m wide with a 2.4 m wide concrete pedestrian path to one side), located centrally in the foreshore reserve and providing convenient visitor access to the car park. The road has been designed to accommodate informal "overflow" car parking on the edge of the road if required. Fencing, to the CoW specification, will be provided either side of the road / pedestrian path. Key services such as street lighting, power, communications and water will follow this road alignment.

- An emulsion stabilised limestone path to a coastal lookout approximately 25 m west of the car park is proposed.

- Pedestrian and surf lifesaving vehicle access on a 3.0 m wide emulsion stabilised limestone path which will be ramped to the beach from the car park to allow "universal access" and surf lifesaving/emergency vehicles access to the beach. Lockable bollards will prevent public vehicle access, but allow access for maintenance and/or surf lifesaving vehicles from the interim facility for mobile beach patrols. Fencing, to the CoW specification, will be provided either side of the pedestrian path.

- A small site adjacent to the car park has been allocated for an interim facility for mobile beach patrols for SLSWA at Alkimos Regional Beach. The interim (and relocatable) facility comprises a modular structure capable of storage for surf lifesaving but also hosting a variety of flexible community functions such as a community meeting space, fundraising events, etc.

- A single car parking area, accessed via the public vehicle access road, (located behind the modelled 50-year coastal processes line) and providing approximately 30 standard bays that includes ACROD and a single bus parking bays.

The foreshore is planned to operate as a low intensity, passive recreational area providing local beach access for current and future residents. This is a direct response to both the conservation values of the area and the wider coastal context, where higher intensity coastal development and access is planned to be provided further north at the future Coastal Village site.

Plate A: Alkimos Beach Foreshore Concept Plan

Future Foreshore Planning and Environmental Approvals

This FMP will require the approval of both the CoW and the Western Australian Planning Commission (WAPC).

Any proposed development as part of the implementation of the FMP within the Metropolitan Region Scheme (MRS) "Parks and Recreation" reserve (such as the foreshore access proposals subject of this management plan), requires the approval of the WAPC and the City.

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

- Development Application (WAPC and CoW)
- Engineering / landscape construction design drawings (CoW)
- Purpose Permit clearing application approval (Department of Environment Regulation).

The foreshore reserve is owned by the Western Australian Land Authority (LandCorp). The foreshore land (zoned as "Parks and Recreation") will be created as a "Parks and Recreation" reserve and vested to the Crown as agreed by LandCorp with the WAPC.

Upon the transfer of the foreshore to the Crown, the foreshore reserve will be vested to the CoW.

Regional and Local Coastal Requirements

The infrastructure and planning for the Alkimos Beach foreshore was designed primarily in response to the outcomes of key regional and local coastal planning studies.

Local beach access and associated public infrastructure at the locations proposed in the Alkimos Beach Foreshore Concept Plan is supported by all relevant strategic and statutory planning documents, including:

- Perth Coastal Planning Strategy
- Alkimos Eglinton District Structure Plan
- Alkimos Eglinton Coastal Strategy
- South Alkimos Local Structure Plan.

The regional review also confirmed the proposed layout of access infrastructure and associated facilities within the Alkimos Beach FMP are capable of being designed in a manner consistent with the SPP 2.6.

<u>Local and Regional Demand Analysis</u>

Demand analysis undertaken in the regional review has confirmed the planned level of coastal access and facilities along the Alkimos-Eglinton coastline is sufficient to cater for projected peak demand levels, while being flexible enough to cater for future increases in demand. This modelling supports the provision of a local beach being provided within the Alkimos Beach foreshore.

A coastal node is proposed to be developed to the north of the Alkimos Beach site, which will provide beach access and associated facilities for residents in the region. This node is currently the subject of detailed planning investigations. Ultimate delivery of this node, however, will be on a longer time horizon than the majority of the South Alkimos residential development area (west of Marmion Avenue), with some 700 new lots already titled, another 500 lots to be released over the next 12 months, and an ultimate lot yield of over 2,400 lots. It is therefore considered important that facilities and access points are installed within the Alkimos Beach foreshore to meet the immediate to medium term demand generated by the Alkimos Beach development in advance of district and regional level facilities potentially being developed further north.

A review of local beaches and developments in the region has confirmed that other planned developments along the north-western coastal corridor provide a comparable range of beaches and coastal access points to that proposed in this plan. The provision of a local beach in this location is also highly consistent with the relative spacing of similar beaches and coastal access points along the broader regional coastline.

Key Implications for the FMP

The key implications for this plan identified by the regional review include:

- The provision of appropriately controlled beach access for local residents is an important tool in managing the environmental values of the foreshore reserve, and reduces the likelihood of residents/visitors gaining access to the beach in an uncontrolled manner.

- Emergency fire vehicle access is required within the foreshore area given its large size/width, and can provide a dual role in meeting both fire safety and passive recreational needs.

- The provision of local beach access in this location will contribute to a reduction in travel demand by providing a beach and foreshore asset in close proximity to future residents.

Foreshore Management

This FMP provides a framework that describes the proposed management of Area 1 of the Alkimos Beach Local Structure Plan (LSP) foreshore reserve, which forms part of Bush Forever Site 397 and is zoned "Parks and Recreation". It will be predominantly managed as a conservation reserve, while also supporting infrastructure for public and emergency access, allowing the new population at Alkimos Beach to engage with the coast. The key management measures discussed in this report are summarised in Table 1.

Timing and Implementation

The development partners of Alkimos Beach plans to implement the proposed foreshore works at the earliest opportunity, to ensure current and future residents are provided with beach access for the **2015 summer period**. In this regard, the following implementation approach is contemplated:

- The foreshore perimeter to be fenced and southernmost pedestrian access path to be implemented as soon as possible, as an immediate priority. Outside of the foreshore area, road access and a temporary parking area is to be provided within similar time frames. The WAPC approved a Development Application to construct this access path through the "Parks and Recreation" Reserve and Bush Forever site in April 2015.

- After fencing the foreshore and provided a means of controlled access, remaining works and rehabilitation tasks will be undertaken over the remainder of the foreshore area. These works will also be implemented within a short time frame, to ensure convenient and controlled vehicle access is available through this relatively wide foreshore area.

The development partners will hand over the management of the foreshore to the CoW after five years from the practical completion of all proposed works within the foreshore.

Table 1: Foreshore Management Implementation Plan

Issue / Parameter	Description / Location	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Timing	Responsibility
Bushfire Management						
Fire management	Prevent changes in fire regimes within the foreshore reserve.	▪ Fire management will be undertaken in accordance with the Fire Management Plan ▪ Appropriate access for fire control vehicles to the foreshore reserve will be provided. ▪ Implement planning to determine areas where vehicles can be parked safely, away from the foreshore reserve during construction. ▪ Unauthorised access to the foreshore area will be controlled through the use of signage, fencing, bollards and limestone boulders	▪ Fire suppression equipment should be present on site during the clearing and construction phases of the development. ▪ Include information about the impacts of changes to fire regimes and key ways to prevent this in the induction information. This should include, but not be limited to – designate smoking areas away from the foreshore bushland – no littering – parking in designated areas away from vegetation.	▪ Ongoing maintenance of the foreshore reserve should be undertaken to prevent fires in accordance with DFES and CoW's fire management protocols.	Five years from the practical completion of all proposed works within the foreshore	Lend Lease
Erosion and Dune Stability						
Access management		▪ Restricting access within the Alkimos Beach site and foreshore area ▪ Placing large limestone boulders in areas where vehicles access the site if required ▪ Providing signage around the perimeter of the site regarding unauthorised access ▪ If required, site surveillance may be undertaken ▪ Placing brushing on closed tracks will assist in controlling access and at the same time prevent any further erosion	▪ Fencing the Alkimos Beach site and foreshore revegetation areas ▪ "Conservation" fences for the access paths and road will be installed when the final alignments the paths are approved and constructed ▪ The remainder of the foreshore will secured using fencing ▪ Placing limestone boulders in areas where vehicles access the site ▪ Providing signage at foreshore access points	▪ Ongoing control of unauthorised vehicles ▪ Pedestrian access through provision of pathways, fencing and signage	Five years from the practical completion of all proposed works within the foreshore	Lend Lease

Issue / Parameter	Description / Location	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Timing	Responsibility
Stabilisation and erosion control			The following methods will be used to stabilise dune blow out and access paths / road access and reduce erosion as required: ▪ brushing ▪ mulch ▪ fibre matting ▪ revegetation.	▪ Ongoing monitoring and maintenance of erosion control and revegetation areas for five years as outlined in Section 5	Five years from the practical completion of all proposed works within the foreshore	
Access Management						
Signage	Provide appropriate signage regarding trespassing, emergency contacts and environmental values of the foreshore reserve	▪ Where appropriate, place signage around the development boundary indicating that the site is private property and unauthorised access is not permitted. This signage should include contact numbers to report any trespass, vandalism or accidents ▪ Appropriately publicise fines incurred if caught illegally accessing the site or dumping rubbish	▪ Regularly inspect signage. Replace signage if vandalised or removed. ▪ Place appropriate signs at key beach access points	▪ Ensure that temporary signs are removed ▪ Signage will be installed according to the CoW's and the SLSWA requirements and specifications	Five years from the practical completion of all proposed works within the foreshore	Lend Lease Construction Supervisor
Access	Control pedestrian access in the foreshore reserve	▪ Install fencing and signage around the site where necessary to prevent unauthorised access ▪ Place large limestone boulders in any tracks to prevent unauthorised vehicle access to the site	▪ Monitor and maintain all fencing and signage ▪ Pathways constructed through the foreshore reserve will be appropriately fenced	▪ Maintain fencing, pathways and signage through and around the foreshore reserve ▪ The foreshore will be secured using fencing ▪ Fencing will be installed according to the CoW's requirements and specifications	Five years from the practical completion of all proposed works within the foreshore	Lend Lease

Issue / Parameter	Description / Location	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Timing	Responsibility
Illegal waste dumping	Prevent unauthorised access, and illegal dumping within the foreshore reserve	▪ Unless proposed for use as managed access tracks, close informal points that have previously been used for illegal access into the beach	▪ Illegally dumped rubbish will be removed from site and appropriately disposed of	▪ All fence repairs and revegetation of the foreshore reserve will be the responsibility of the landowner for a period of five years	Five years from the practical completion of all proposed works within the foreshore.	Lend Lease until handover to the CoW.
Vegetation Management						
Fencing of vegetation	Fencing to control access onto site and into the foreshore area.	▪ Fence the site boundary to prevent unauthorised access to the site and foreshore reserve	▪ Conduct inspection of fences and repair or reinstate as required	▪ The foreshore will be secured using fencing ▪ Fencing will be installed according to the CoW's requirements and specifications	Five years from the practical completion of all proposed works within the foreshore	Lend Lease Construction Supervisor
Clearing protocol	Undertake any clearing works in or adjacent to the foreshore area in a controlled and sensitive manner to minimise potential impacts.	Clearing protocols are discussed in the Construction Management Plan, including: ▪ Clearing towards areas of bush to be retained ▪ Sound horns prior to commencing clearing works ▪ If appropriate, engage a fauna handler to be on site during clearing works ▪ Leave cleared material in situ overnight to allow animals to escape The foreshore reserve will be clearly marked on drawings, and flagged and pegged on site to prevent any accidental clearing of the reserve.	▪ Implement clearing protocols addressed in the Construction Management Plan		Within 12 months of FMP approval	Lend Lease Construction Supervisor

Issue / Parameter	Description / Location	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Timing	Responsibility
Revegetation	Revegetate areas shown in Figure 3.	▪ Seed collection has been undertaken and tubestock will be propagated from this for use in revegetation works ▪ Assess requirements for further plants and order from appropriately accredited nursery	▪ Undertake revegetation of disturbed areas within the foreshore in accordance with the Foreshore Revegetation Management Plan	▪ Monitoring of revegetation works and weeds will be undertaken for five years from completion of revegetation works and will be based on monitoring locations set up during initial revegetation ▪ Weed management and infill planting will be undertaken based on the monitoring and completion criteria	Five years from the practical completion of all proposed works within the foreshore	Lend Lease until handover to CoW
Weed management	Control the spread of weeds within the foreshore reserve.	▪ Areas of vegetation within the foreshore reserve should be assessed for weed abundance, and where possible treated and revegetated with local provenance species	▪ Monitoring and maintenance of the foreshore reserve should be undertaken to prevent the spread of weeds in accordance with the Foreshore Revegetation Management Plan	▪ Weed monitoring will be undertaken as part of the Foreshore Revegetation Management Plan	Five years from the practical completion of all proposed works within the foreshore	Lend Lease until handover to CoW
Dieback	Avoid the introduction of dieback to the site.	Any revegetation or installation of infrastructure pre-development will involve the following: ▪ All plants and soil will be from accredited nurseries ▪ All equipment and tools will be free from soil on entering the site	▪ Source any landscaping or revegetation materials from reputable, certified suppliers ▪ All machinery entering the site should be clean (i.e. free of mud and soil)		Five years from the practical completion of all proposed works within the foreshore	Lend Lease

Issue / Parameter	Description / Location	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Timing	Responsibility
Fauna Management						
Fauna	Prevent or reduce the number of fauna deaths or injuries during works within the foreshore reserve. Protect and retain fauna habitat within the foreshore reserve.	▪ Inform site workers about fauna expected to be on site	▪ All clearing and construction works will be undertaken in accordance with the Vegetation and Fauna Management Plan ▪ Sound air horns prior to commencing ground disturbing works ▪ Injured, abandoned or otherwise visibly distressed fauna are to be handed over to a DPaW registered wildlife officer or local vet clinic		Five years from the practical completion of all proposed works within the foreshore	Lend Lease Construction Supervisor
Introduced species	Control the impact and spread of invasive species in the foreshore reserve.			▪ Residents in the area will be educated on controlling their pets, especially cats ▪ Signage will be installed according to the CoW's and the SLSWA requirements and specifications	Five years from the practical completion of all proposed works within the foreshore	Lend Lease

Issue / Parameter	Description / Location	Pre-construction Implementation	Construction Implementation	Post-construction Implementation	Timing	Responsibility
Other Management Issues						
Site inductions and toolbox meetings	All staff and contractors to be inducted on the project and site-specific environmental issues.	▪ All site staff should participate in site inductions informing them about the environmental issues relevant to the site. The induction should include, but not be limited to information about – areas not to be accessed by construction personnel – those areas proposed for clearing and retention – value of the foreshore reserve and areas of native vegetation outside of the disturbance footprint – reporting procedures for environmental incidents ▪ An induction program should be developed for visitors to the site	▪ Any new site staff should be inducted and a register kept of those contractors and staff who have been inducted ▪ The induction process will be updated as necessary			Lend Lease Construction Supervisor

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APPENDICES

1.0 INTRODUCTION

1.1 Background

Located in the north-western coastal corridor of Perth, the Alkimos Beach development is one of the largest and most significant coastal developments north of Perth in 50 years. Covering some 710 hectares (ha), the wider Alkimos Beach development area will provide for around 6,000 dwellings catering for over 15,000 people, as well as a city centre, regional shopping centre, commercial and industrial zones, education and employment facilities.

Lend Lease has partnered with LandCorp (development partners) to progress the first stage of Alkimos Beach on the western side of Marmion Avenue, to deliver over 2,400 dwellings for some 6,000 residents. The South Alkimos Local Structure Plan (LSP 72) was adopted by the City of Wanneroo (CoW) in 2012 and the Western Australian Planning Commission (WAPC) in 2013, and development works have commenced with some 500 titled residential lots now released in the first residential stage known as "The Escarpment Village".

The foreshore interface between urban development and the Indian Ocean is a critical component for the Alkimos Beach development, and needs to be designed and managed to provide an appropriate level of access to the coast whilst preserving and enhancing its unique physical and environmental attributes for future generations.

1.2 Site Details

1.2.1 Location

Alkimos Beach is located approximately 40 kilometres (km) north of the Perth Central Business District and 16 km north of the Joondalup Strategic Regional Centre, within the CoW local authority area (Figure 1). It is situated in the North West coastal corridor of Perth, which is experiencing significant urban development as a result of extensive regional and local structure planning carried out over the last 20 years.

The "Eden Beach" development is situated to the immediate south, forming part of the wider Jindalee locality that is also being progressively developed for urban purposes.

The Water Corporation's wastewater treatment plant (WWTP) site is located to the immediate north, effectively dividing Alkimos Beach from the "Shorehaven" residential development further north.

1.2.2 Site Description and Tenure

1.2.2.1 Description

The Alkimos Beach foreshore is approximately 1.7 km in length, has an area of some 41.18 ha and comprises the following two distinct management areas (Figure 1):

- Area 1: Southern portion of the Alkimos Beach foreshore, which totals 33.7 ha (being a portion of Lot 9022, owned by LandCorp). The southern portion of the foreshore is identified in the Alkimos Eglinton Coastal Planning Strategy (RPS 2006) and the Perth Coastal Planning Strategy (WAPC 2007) as a conservation and passive recreation area.

- Area 2: Northern portion of the Alkimos Beach foreshore comprising 8.16 ha of land owned by LandCorp, and bisected by a portion of land owned by the Water Corporation (Lot 9001). This portion of the foreshore was identified in the Alkimos-Eglinton Metropolitan Region Scheme Amendment, the Alkimos Eglinton Coastal Planning Strategy (RPS 2006) and the Perth Coastal Planning Strategy (WAPC 2007) as a key coastal node / beach activity centre. Surf Life Saving Western Australia (SLSWA) recommended location for Alkimos Regional Beach Surf Life Saving Club (SLSC) is within the northern portion of the Alkimos Beach foreshore.

  It is not possible to determine appropriate long-term management actions for this northern section (Area 2) of the foreshore until the design and planning of the coastal node is more fully developed. Consequently, discussions with the CoW have indicated their preference for the foreshore reserve to be separated into the two management zones.

This FMP is concerned with Area 1 while Area 2 will be subject to a future separate FMP following detailed design of the coastal node.

1.2.2.2 Tenure

Area 1 is formally described as a portion of Lot 9022 on Deposited Plan 402516, Certificate of Title Volume 2841 Folio 798. Lot 9022 is under ownership of the WA Land Authority (LandCorp).

The foreshore land will be created as a "Parks and Recreation" reserve and vested to the Crown as agreed by LandCorp with the WAPC.

Upon the transfer of the foreshore to the Crown, the foreshore reserve will be vested to the CoW.

1.3 Purpose

The purpose of this FMP, in accordance with the CoW's Draft Foreshore Management Plan Guidelines, is to outline the foreshore location and detail the proposed development (including pathways, car parks) and areas of retained vegetation and revegetation works.

The FMP provides a framework for the management of the foreshore reserve (being Area 1 of the wider Alkimos Beach foreshore), which also forms part of Bush Forever Site No. 397. It will be predominantly managed as a conservation reserve, while also supporting a limited amount of public infrastructure to allow the new population at Alkimos Beach to engage with the coast.

In addition, this report includes a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) in accordance with State Planning Policy No. 2.6 – State Coastal Planning Policy (SPP 2.6).

1.4 Objectives

The overall aim of this FMP is to conserve the key ecological features of the foreshore in a natural state, while facilitating controlled access through the provision of appropriate beach access routes and fencing. Aligned with this aim, the following key objectives are established for the foreshore reserve:

- foreshore reserve to be developed in accordance with the Minister for the Environment's Statement No.722 and SPP 2.6
- places of landscape significance to be managed appropriately
- natural habitats, particularly areas of high ecological value to be protected
- public places, facilities, and public access to the beach in the foreshore reserve to be developed in a manner that does not compromise the ecological values of the area.

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

- coastal allowance
- pedestrian and vehicle access to the beach
- dual use paths along the foreshore reserve
- erosion, drainage, weed / rehabilitation and fire control
- fencing.

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

- Statutory and Policy Context (Section 2.0)
- Existing Environment (Section 3.0)
- Regional Context and Local Demand Factors (Section 4.0)
- Opportunities and Constraints Analysis (Section 5.0)
- Foreshore Design and Function (Section 6.0)
- Coastal Hazard Risk Management and Adaptation (Section 7.0)
- Foreshore Revegetation Program (Section 8.0)
- Foreshore Management (Section 9.0)
- Implementation (Section 10.0)
- Completion Criteria (Section 11.0).

1.5 Statutory Requirements

The requirement to prepare and implement an approved FMP is established by the following statutory mechanisms:

- Ministerial Statement No. 722 on Metropolitan Region Scheme Amendment No.1029/33
- South Alkimos LSP 72
- Condition 11 of the *Environment Protection and Biodiversity Act 1999* (EPBC Act) Commonwealth approval required an FMP.

These matters are described in further detail below.

1.5.1 Ministerial Statement No. 722 on Metropolitan Region Scheme Amendment No.1029/33

The Minister for the Environment's Statement No. 722 (published on 24 April 2006) relates to Amendment 1029/33 to the Metropolitan Region Scheme (MRS), and states that:

> all land reserved for Parks and Recreation shall be managed to protect the integrity, function and environmental values of the bushland and landforms to the requirement of the Western Australian Planning Commission on the advice of the Environmental Protection Authority and shall only be used for conservation, landscape and complimentary purposes.

Statement No. 722 also includes the following condition regarding the management of the implementation of future proposals in accordance with the MRS:

2-1 Prior to approving subdivision or development applications (whichever is sooner) for infrastructure proposals, the Western Australian Planning Commission or local government, as the case requires, may require an Environmental Management Plan to be prepared and implemented to achieve the objective of managing the potential impacts of the proposed subdivision, development of infrastructure on the following:

1) land which is reserved as Regional Open Space in the Scheme; and
2) bushland of land that may be part of an ecological linkage.

The Environmental Management Plan shall include:

1) a description of existing environmental values, and the identification of the environmental outcome to be achieved through the implementation of this plan;

2) clear delineation of boundaries of significant areas to be protected;

3) management of construction, access and rehabilitation;

4) vegetation mitigation strategies;

5) allocation of responsibilities and identification of timing and duration of implementation;

6) provision for routine monitoring and environmental values; and

7) provision of details of contingency plans in the event that the monitoring surveys indicate that the development is having or has had an adverse impact upon the environmental values.

2-2 An Environmental Management Plan prepared pursuant to the condition 2-1 shall be prepared to the satisfaction of the WAPC or the local authority as required, having due regard for advice from relevant government agencies and shall be implemented in accordance with a program defined in the Environmental Management Plan.

A copy of the Ministerial Conditions is provided at Appendix 1.

Given the foreshore reserve is both reserved for "Parks and Recreation" and forms part of a wider ecological linkage, an Environmental Management Plan (or alternatively, a Foreshore Management Plan) is required to be prepared to support subdivision and development. As part of the Ministerial Statement No. 722, the management plan is required to include:

- A description of existing environmental values, and the identification of the environmental outcome to be achieved through the implementation of the EMP;
- Clear delineation of boundaries or significant areas to be protected;
- Management of construction, access and rehabilitation;
- Vegetation mitigation strategies;
- Allocation of responsibilities and identification of timing and duration of implementation;
- Provision for routine monitoring and environmental values; and
- Provision of details of contingency plans in the event that the monitoring surveys indicate that the development is having or has had an adverse impact on environmental values.

The management plan is to be prepared to the satisfaction of the WAPC or local authority as required, having due regard for the advice of relevant agencies, and implemented in accordance with a program defined in the management plan.

The foreshore reserve at Alkimos Beach is reserved for "Parks and Recreation" under the MRS and also forms an ecological linkage, and therefore, the above conditions apply to the site. Consequently, this FMP has been drafted to satisfy the conditions for an Environmental Management Plan and will be assessed by the WAPC and/or CoW as required.

Specifically this FMP responds to the Ministerial Statement No. 722 through:

1. Describing the existing foreshore environment.
2. Setting clear boundaries of the areas to be protected and managed.
3. Outlining the management of access to the beach, construction and revegetation.
4. Allocating construction and management responsibilities including routine monitoring of the environmental values, maintenance and contingencies.

1.5.2 South Alkimos Local Structure Plan No. 72

Clause 6.6 of Part 1 (Statutory Section) of the South Alkimos LSP No. 72 states that:

At the time of subdivision the following conditions may be recommended, as applicable, requiring the preparation and/or implementation of the following strategies:

i) Foreshore Management Plan (WAPC, City of Wanneroo).

This FMP has been prepared in anticipation of any such condition being imposed upon future subdivision approvals for the area.

1.5.3 Condition 11 of Commonwealth Environmental Approval for Alkimos Beach

The Alkimos Beach LSP supports habitat for Carnaby's Black-Cockatoo, which are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Alkimos Beach LSP was referred to the Federal Minister for the Environment for assessment under the EPBC Act in March 2011. The project was deemed a "Controlled Action" due to the potential impacts on Matters of National Environmental Significance, specifically Carnaby's Black-Cockatoo. The project was subsequently approved in 2012.

Condition 11 of the Commonwealth approval requires a FMP (for the same area of foreshore reserve) to be prepared to the satisfaction of the Commonwealth Minister for the Environment. Specifically, the key management actions required by the Commonwealth are concerned with the revegetation to at least 1ha and management of Carnaby's Black-Cockatoo habitat within the foreshore reserve area against identified threats such as weeds, feral pests, bushfires, erosion and foreshore access.

It is important to note that a separate "Commonwealth FMP" has been prepared by Lend Lease and approved by the Commonwealth Minister for the Environment (distinctly separate to this FMP), thereby satisfying Condition 11 of the federal approval. The management approach within the Commonwealth FMP is, however, wholly consistent with the approach included in this plan. A copy of the Commonwealth FMP approval is provided at Appendix 2.

1.6 Foreshore Design Summary

A Foreshore Concept Plan (Figure 3) has been prepared for the FMP area, illustrating the key structural elements of the foreshore design. As outlined in Section 2.11 the implementation of the proposed structure design elements will be subject to future planning approvals e.g. Development Applications and construction drawings. This plan has been developed having regard for the foreshore's regional and local context, environmental characteristics, and a range of practical management requirements (e.g. fire, access, flora/fauna conservation). The design approach is discussed in further detail in Section 6 of this FMP, however, can be summarised as follows:

- The majority of the foreshore reserve is retained for conservation and rehabilitation (including black cockatoo habitat rehabilitation areas), with the only other activities proposed within the foreshore being for low level (local) beach access and maintenance/safety. Rehabilitation works will be focused on priority areas including the road and path batters, dune blow out and four-wheel drive paths.

- Fenced "southern" pedestrian pathway (3.0 m wide, compacted limestone) providing residents with walkable access (and emergency vehicle access) to the beach. Fencing to the CoW specification will be provided either side of the path. Lockable bollards will positioned at the entry points of the path to prevent unauthorised vehicle access.

- A dual use path (3.0 m wide, red asphalt) providing a continuous north to south linkage along the perimeter of the foreshore reserve, connecting into adjacent foreshore areas to the north (Alkimos Coastal Node) and south (Eden Beach). This path will be fenced adjacent to the foreshore reserve and the future Alkimos Beach subdivision. The path also provides a shared maintenance/emergency vehicle access role in the northern portions of the site where there is no nearby public road frontage. The dual use path will be constructed in accordance with the CoW's and Department of Fire and Emergency Services (DFES) requirements. The indicative location of this dual use path is illustrated in the Foreshore Concept Plan (Figure 3). The final location of this dual use path will be subject to detailed engineering review

- Fenced public vehicle access asphalt road (6.0 m wide with a 2.4 m wide concrete pedestrian path to one side), located centrally in the foreshore reserve and providing convenient visitor access to the car park. The road has been designed to accommodate informal "overflow" car parking on the edge of the road if required. Fencing to the CoW specification will be provided either side of the road / pedestrian path. Key services such as street lighting, power, communications and water will follow the road alignment.

- An emulsion stabilised limestone path to a coastal lookout approximately 25 m west of the car park is proposed.

- Pedestrian and surf lifesaving vehicle access on a 3.0 m wide emulsion stabilised limestone path which will be ramped to the beach from the car park to allow pedestrian access and surf lifesaving/emergency vehicles access to the beach. Lockable bollards will prevent public vehicle access, but allow access for maintenance and/or surf lifesaving vehicles from the interim facility for mobile beach patrols. Fencing to the CoW specification will be provided either side of the pedestrian path.

- A small site adjacent to the car park has been allocated for an interim facility for mobile beach patrols for SLSWA at Alkimos Regional Beach. The interim (and relocatable) facility comprises a modular structure capable of storage for surf lifesaving.

- A single car parking area, accessed via the public vehicle access road, (located behind the modelled 50 year coastal processes line) and providing approximately 30 standard bays that includes ACROD and a single bus parking bays.

The foreshore is planned to operate as a low intensity, passive recreational area providing local beach access for current and future residents. This is a direct response to both the conservation values of the area and the wider coastal context, where higher intensity coastal development and access is planned to be provided further north at the future Alkimos Coastal Village site.

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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 Alkimos 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 Metropolitan Region Scheme

2.1.1 Zoning Status

The MRS zonings and reservations (as an outcome of Amendment 1029/33) for the Alkimos Beach foreshore area and adjoining Alkimos Beach residential development are shown in Figure 4. The foreshore area subject of this FMP is reserved for "Parks and Recreation" under the MRS.

The MRS zoning status of Alkimos, supported by metropolitan strategic planning frameworks, confirms the area's intended future development potential for new urban residential development and the establishment of a secondary centre. This level of development activity in a coastal corridor context necessitates the provision of adequate coastal access and recreational facilities, as acknowledged and recognised in the Perth Coastal Planning Strategy (PCPS).

It is also noted that for any proposed development within the MRS "Parks and Recreation" reserve (such as the foreshore access proposals subject of this management plan), the MRS provides clear procedures for such applications to be dealt with. In this case, the approval of the WAPC is required prior to any development works occurring within the MRS "Parks and Recreation" reserve.

2.1.2 Amendment No. 1029/33

MRS Amendment No. 1029/33 effectively facilitated the relocation of the WWTP consistent with the Alkimos Eglinton District Structure Plan (DSP), and made significant changes to the foreshore reserve boundary. A small area was added to the dunes north of Karli Spring adjacent to a 2.8 ha stand of *Allocasurina lehmamniana* closed heath that occurs in that area.

After being referred to the EPA, a formal environmental review (Bulletin 1207) was prepared in response to the environmental assessment. From this the Minister for Environment set environmental management conditions within Ministerial Statement No. 722, including the requirement that:

Prior to approving subdivision or development applications (whichever is sooner) for infrastructure proposals, the Western Australian Planning Commission or local government, as the case requires, may require an Environmental Management Plan to be prepared and implemented to achieve the objective of managing the potential impacts of the proposed subdivision, development or infrastructure on the following:

- Land which is reserved Regional Open Space in the Scheme; and
- Bushland or land that may be part of an ecological linkage.

2.1.3 Approval under the Metropolitan Region Scheme

Clause 16(1) of the MRS Text provides for reserved land to be used without the written approval of the Commission if the land is used for the purpose for which it is reserved under the Scheme. Under Clause 16(1a), development on reserved land may be commenced or carried out without the written approval of the Commission if the development is "permitted development" which does not involve clearing regionally significant vegetation on a Bush Forever site. "Permitted development" includes works on land reserved for "Parks and Recreation" where the works are in accordance with a management plan endorsed by the Commission.

Having regard for the MRS provisions, the following matters are noted:

- The land is reserved under the MRS for "Parks and Recreation".
- The nature of foreshore works/activities presented in this FMP is wholly consistent with the purpose of the reserve.
- Much of the foreshore reserve forms part of Bush Forever Site No. 397. The FMP provides for the restoration of extensively degraded areas of the Bush Forever site, and does not seek to clear areas of regionally significant vegetation.
- The FMP has been prepared to act as the prerequisite management plan (to be endorsed by the Commission), under which "permitted development" can then occur.

Subject to WAPC endorsement of the FMP, it is intended that the "permitted development" proposed by this FMP (i.e. conservation/restoration works and provision of minor access/recreational infrastructure) be undertaken in accordance with Clause 16 of the MRS.

2.2 State Planning Policy No. 2.6

SPP No. 2.6 (WAPC 2013) was revised in early 2013 and it 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.

The Policy provides guidance for the assessment of coastal processes affecting a sandy beach through consideration of three key components:

- S1: distance absorbing acute erosion (extreme storm event)
- S2: distance to allow for the historic trend affecting the shoreline
- S3: distance to allow for sea level rise.

To define the physical processes allowance area consistent with the 2013 SPP 2.6 requirements, coastal engineers M.P Rogers and Associates undertook a further analysis of coastal processes and allowance requirements. The identified coastal processes allowance line, as ultimately endorsed in support of the Alkimos Beach LSP, is illustrated at Figure 5.

Of particular relevance to this FMP, the SPP 2.6 (and supporting guidelines) recognises that in certain circumstances, development may need to occur within an area identified to be potentially impacted by physical coastal processes within the 100-year planning time frame. This includes:

- public recreation facilities with finite life spans
- coastally dependent and easily relocatable development
- coastal nodes.

The proposed foreshore reserve and local access infrastructure proposals for Alkimos Beach have been developed consistent with the policy provisions of SPP 2.6 (WAPC 2012). Previously modelled physical processes are catered for within the foreshore reserve area, which is wide enough to maintain a viable foreshore reserve area at the end of the planning period should such processes be realised. The proposed coastal access works are at a scale that can be catered for within the identified coastal processes area (being easily relocated and/or removed as need be in response to long term coastline movement).

2.3 State Planning Policy No. 2.8 and Bush Forever

State Planning Policy No. 2.8 – Bushland Policy for the Perth Metropolitan Region (WAPC 2010) provides a statutory policy and implementation framework for addressing bushland protection and management issues in the Perth Metropolitan Region. The policy recognises the protection and management of significant bushland areas as a fundamental consideration in the planning process.

The policy requires proposals or decision making to recognise regionally significant bushland protection and its management as a primary purpose, and ensure all reasonable steps are taken to avoid, minimise or offset likely adverse impacts on regionally significant bushland. A set of impact assessment criteria are provided to guide the decision making process, and cover issues such as environmental assets, heritage sites, development siting and detailed design, management considerations and fire protection/ control requirements.

Regionally significant bushland areas to which the framework applies have been identified for protection through an endorsed strategy – Bush Forever (Government of Western Australia 2000). Much of the foreshore reserve at Alkimos Beach forms part of Bush Forever Site No. 397, which comprises a continuous coastal strip of bushland between Wilbinga and Mindarie. The site is identified as being regionally significant due to the importance of foreshore vegetation for the stability of the coastline and the high variation of coastal plant communities.

Since the foreshore reserve is contained within an existing "Parks and Recreation Reserve" under the MRS, the planning and implementation of this FMP needs to be consistent with the Bush Forever Policy and Practice Note 14 (Government of Western Australia 2000b). Bush Forever's starting position is that vegetation in "Parks and Recreation" reserves should be regarded as regionally significant and included as protected sites. Practice Note 14 acknowledges that future recreation, servicing or community objectives may be appropriate in cleared or degraded portions of existing reserved lands forming part of a Bush Forever Site, subject to site assessment, management planning and justification.

Consistent with the policy and practice note provisions, areas of the foreshore have been identified for rehabilitation of native vegetation, while proposed recreational access works have been located so as to minimise any further disruption of vegetation. Importantly, the provision of fenced access routes will further serve to protect the wider priority bushland area, by managing and restricting access in a formalised manner.

2.4 Perth Coastal Planning Strategy (PCPS)

The PCPS has been developed to encourage better planning and protection of the Perth metropolitan coastline to ensure that it maintains its popular character. The strategy provides medium term guidance to support local structure planning and coastal management programs for 56 precincts along 120 km of the Perth metropolitan coastline from Two Rocks in the north to Singleton in the south.

The WAPC endorsed amendments to the PCPS in January 2010. WAPC further resolved to endorse PCPS as an input into the next phase of Directions 2031, including structure planning. The inclusion of PCPS as a consideration for the implementation of the Directions 2031 program will ensure that the centres contained within PCPS precincts are appropriate and complementary to the Directions 2031 activity centres hierarchy.

The PCPS identifies the Alkimos Beach area within Precinct 9 – Alkimos Activity Centre, which covers both this FMP area (Area 1) and the future Coastal Village site not subject of this FMP (Area 2).

2.5 City of Wanneroo District Planning Scheme No. 2

The Scheme Map for District Planning Scheme No. 2 reflects the regional reserve status of the FMP area, with the land identified as MRS "Parks and Recreation" reserve.

2.6 City of Wanneroo Local Biodiversity Strategy

The CoW Local Biodiversity Strategy (City of Wanneroo 2008) sets targets for the biodiversity conservation across broad planning precincts.

The Strategy proposes a number of targets for biodiversity conservation. The Strategy specifies the biodiversity retention target (including land for conservation / passive recreation outside of land reserved for "Parks and Recreation") for the Alkimos-Eglinton Precinct is 3% of the total development area. The Strategy also specifies the following, which the current proposal for the foreshore reserve complies with:

- conservation areas may be considered for passive recreational areas if access is controlled
- biodiversity should be enhanced through non-contiguous green linkage between natural areas
- improving the protection and biodiversity of existing reserves.

2.7 City of Wanneroo Coastal Management Plan

Part 1 of the CoW's Coastal Management Plan provides a broad description of the City's coastline, key issues and potential management actions. Key issues addressed in the management plan that are relevant to the Alkimos Beach development include the following:

- The City requires an additional 1.5 km of dog beach over the next 20 years.
- Potential future uses for South Alkimos to North Jindalee include a marina, horse beach and surf lifesaving club.

The local Alkimos community has expressed a strong desire for a dog recreational area at Alkimos Beach. It is understood the City is currently undertaking its own review of potential dog beach locations in the region. The development partners advocates the consideration of the southern portion of Alkimos Beach as a potential dog walking beach by the CoW.

2.8 Alkimos Eglinton District Structure Plan and Coastal Strategy

The Alkimos-Eglinton DSP was adopted by the WAPC in 2011, following endorsement by the CoW in 2010. It provides a district level planning framework for the creation of a new coastal community comprising over 23,000 dwellings and housing more than 57,000 people.

In regards to the foreshore, a Coastal Strategy was prepared for the entire 7.5 km Alkimos-Eglinton DSP coastline, providing guidance on suitable future land uses, development and management measures for specific portions of the coast. The Coastal Strategy divided the foreshore reserve into five coastal management zones with different management objectives and uses based on evaluation of environmental characteristics and recognition of the land uses in the adjacent development zone in the DSP.

The Coastal Strategy defined this FMP area as sitting within the "Karli Spring Precinct" management zone. The Karli Spring Precinct was classified as a "low use" zone with a focus on conservation and passive recreation. The key objective for this precinct was to:

> Conserve the key ecological features in a natural state. Control access through the provision of appropriate beach access paths and fencing.
>
> (RPS 2006)

In line with this objective, the following management principles for the Alkimos-Eglinton foreshore reserve area were identified by the Coastal Strategy:

- The foreshore reserve is to be developed in accordance with Minister for the Environment Statement No. 722 and SPP 2.6.
- Places of unique landscape, scientific and cultural significance are to be managed appropriately.
- Natural habitats, particularly those areas with high ecological values will be protected.
- Public places, facilities, and public access to the beach in the foreshore reserve will be developed in a manner that does not compromise the ecological values in the area.
- Development in the foreshore reserve will be concentrated in nodes.

The Coastal Strategy also provides the following best management practices that should be incorporated into the management of coastal areas within the Alkimos-Eglinton area where possible:

- clear delineation of public and private areas, and no direct access provided to the reserve from private dwellings/landholdings
- natural vegetation protection, including the retention of a continuous belt of natural vegetation the length of the foreshore reserve
- public areas to be linked by fenced paths and controlled access, with further local planning required establishing the precise location and specifications of such public facilities
- a continuous north to south dual use path network to be provided along the coastline, connecting into neighbouring coastal districts. All paths to be constructed sensitively to minimise disturbance to the native vegetation and fauna
- beach access paths to readily cater for anticipated usage demand and well positioned/managed/signed to prevent uncontrolled access
- fencing designed to discourage uncontrolled access to vegetated areas, and allow movement of fauna species through the reserve
- parking areas provided in areas where ecological values are not compromised, in depressions/relatively flat areas where minimal landform modification is required, and according to anticipated demand
- rehabilitation facilitated through stockpiling of any cleared native vegetation in and adjacent to the foreshore reserve.

This FMP is consistent with the intent of the adopted DSP and the principles/practices advocated by the Coastal Strategy.

2.9 South Alkimos Local Structure Plan

The Alkimos Beach LSP provides the next level of detailed planning for the 224 ha parcel of land. The majority of the LSP area is zoned "Urban" in the MRS. According to the EPA (2005) there are no known areas of regional conservation significance within the "Urban" zoned portion in the Alkimos Beach LSP site.

The LSP was adopted by the WAPC in January 2013, following endorsement by the CoW in May 2012. It comprises land in the south-western portion of the Alkimos Eglinton DSP area, including the area south of the wastewater treatment plant and

buffer, and between Marmion Avenue and the coast. It provides a detailed framework for the provision of at least 2,413 dwellings, catering for a resident population of approximately 6,032 people.

Over 41 ha of foreshore reserve is provided for in the LSP, with development in the reserve to be for public use infrastructure and designed to limit disturbance while allowing people to experience the asset. Public access is to be controlled via a designated and signposted path network linking development from the south and east to the beach and future coastal village. A foreshore management plan is noted as being required prior to any development occurring within the reserve.

The Alkimos Coastal Village is not included in the LSP area, and will be the subject of further detailed planning. The LSP does note, however, that the village will provide a balanced mix of local retail and tourism related facilities, and that optimising the size of the village is a critical factor in effectively and sustainably contributing to the local economy.

2.10 Aboriginal Heritage Sites

A search of the Department of Aboriginal Affairs (DAA) site register identified a listed ethnographic site in the vicinity of the Alkimos Beach LSP project area. The site is identified as Site ID 3509 Karli Spring (Figure 3).

The Alkimos-Eglinton Metropolitan Region Scheme Amendment No. 1029/33 deliberately increased the size of the foreshore reserve around Karli Spring to include additional areas of consolidated Quindalup Dunes to protect Aboriginal Heritage values associated with Karli Spring.

There are no proposed access or recreation works within the Karli Spring listed site as part of the FMP at this stage, with any future works in the vicinity of the listed site (e.g. interpretive signage) being subject to further engagement with the Department of Aboriginal Affairs. Once the management work for Karli Spring has been agreed (in consultation with the Department of Aboriginal Affairs and the Traditional Owners), this FMP will be updated to include the management requirements as an addendum.

2.11 Future Foreshore Planning and Environmental Approvals

This FMP will require the approval of both the CoW and the WAPC.

Any proposed development as part of the implementation of the FMP within the Metropolitan Region Scheme (MRS) "Parks and Recreation" reserve (such as the foreshore access proposals subject of this management plan), requires the approval of the WAPC and the City.

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

- Development Application (WAPC and CoW)
- Engineering / landscape construction design drawings (CoW)
- Purpose Permit clearing application approval (Department of Environment Regulation).

The foreshore reserve is owned by the Western Australian Land Authority (LandCorp). The foreshore land (zoned as "Parks and Recreation") will be created as a "Parks and Recreation" reserve and vested to the Crown as agreed by LandCorp with the WAPC.

Upon the transfer of the foreshore to the Crown the foreshore reserve will be vested to the CoW.

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3.0 EXISTING ENVIRONMENT

3.1 Topography

The South Alkimos LSP is located along the coast, at between 5 m Australian Height Datum (AHD) surrounding Karli Spring to the south and 25 m AHD at the northern portion of the FMP area (Figure 6).

3.2 Soils and Hydrology

3.2.1 Geology

The foreshore reserve is located centrally within the Perth Basin, a geological unit that extends from the southern end of the Carnarvon Basin in the north and Cape Leeuwin to the south. The eastern boundary of the Perth Basin is formed by the Darling Scarp.

3.2.2 Soils

The foreshore area comprises undulating coastal Quindalup sand dune formations, with younger dunes closer to the coast and older dunes inland. Soil mapping by McArthur and Bartle (1980) shows that the area is primarily shallow calcareous (Quindalup) sands over limestone or and yellow–brown (Karrakatta) sands and exposed limestone and stony soils (Figure 7).

The foreshore area is comprised of the calcareous Quindalup dune system, which occurs in a complex series of linear and parabolic dunes. The dominant landform/soil types associated with the Quindalup Dune system within the foreshore reserve are as follows (McArthur and Bartle 1980):

- Quindalup Second Dune Phase (Q2) – the soil profile is calcareous sands with organic staining to about 20 cm, pale brown sand below which shows cementation at about a metre below the surface.

- Quindalup Youngest Dune Phase (Q4) – generally dunes are asymmetric with gentle inner slopes and steep outer faces.

Figure 7 shows the Quindalup dune formation within the foreshore area.

3.2.3 Hydrology and Hydrogeology

3.2.3.1 Groundwater

Regional groundwater contours (Figure 8) indicates that groundwater flow is in a westerly direction towards the Indian Ocean. Groundwater at Alkimos is at sea level, with maximum groundwater levels ranging from 0 m AHD along the coast and within the foreshore reserve to 1 m AHD in the north-east of the site.

3.3 Vegetation and Flora

The Alkimos foreshore area predominantly supports Quindalup vegetation complex. A vegetation and flora survey was undertaken by Bennett in 2004 for ATA Environmental and the following vegetation associations were identified with the foreshore reserve area:

MsLm	*Melaleuca systena and Lomandra maritima* Low Open Heath
MsOaLm	*Melaleuca systena, Olearia axillaris, Lomandra maritima* Low Open Heath
SgSc	*Spyridium globulosum, Scaevola crassifolia* shrubland
SgMsLm	*Spyridium globulosum, Melaleuca systena, Lomandra maritima* Low Open Heath
AlMs	*Allocasuarina lehmanniana, Melaleauca systena* Closed Heath
Alloc	*Allocasuarina lehmanniana* Closed Heath
C	Cleared
Soak	Karli Spring Wetland

The only trees on the site are scattered tuart (*Eucalyptus gomphocephala),* which generally occur in the base of dunes i.e. in locations that are sheltered from the prevailing winds.

Figure 9 shows the vegetation associations across the foreshore area.

3.3.1 Vegetation Condition

The condition of the vegetation was assessed and rated according to the method described by Keighery in Bush Forever (Government of Western Australia 2000). The categories are defined in Table 2.

Table 2: Vegetation Condition Scale

Vegetation Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Vegetation Condition	Description
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the areas are completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora composing weed or crop species with isolated native trees or shrubs.

The vegetation condition across the foreshore area ranged from "Very Good" to "Good" in accordance with the Bush Forever vegetation condition scale rating (Figure 10).

The following plate illustrates vegetation in a "Very Good" condition.

Plate B: "Very Good" Condition Vegetation

3.4 Fauna

Dr Mike Bamford reviewed the existing fauna lists for the South Alkimos LSP area from Alan Tingay and Associates (1996), Thompson (2005) and Bamford and Davies (2005). Based on his extensive experience in the general area, including the Alkimos WWTP site, directly adjacent to the LSP area, Dr Bamford determined the following significant fauna species (under the state *Wildlife Conservation Act 1950* or the EPBC Act) that could occur in the Alkimos foreshore area:

- *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo), is listed as "Schedule 1" fauna under the *Wildlife Conservation Act 1950* and "Endangered" under the EPBC Act. It is likely to regularly over fly the area due to the good quality foraging habitat that exists nearby i.e. Yanchep National Park. There is very limited foraging habitat available within the foreshore area however.

- *Isoodon obesulus fusciventer* (quenda or southern brown bandicoot) a Priority 5 Species protected under the *Wildlife Conservation Act 1950* may potentially occur in good quality dense vegetation within the foreshore area such as around Karli Spring.

- *Neelaps calonotos* (black-striped snake) a Priority 3 Species protected under the *Wildlife Conservation Act 1950* are unlikely to be permanent residents within the site, however if present they would most likely reside in the areas of better quality vegetation in the foreshore.

The assessment of the vegetation communities identified the Karli Spring wetland and the *Allocasuarina lehmanniana* community (Figure 9) as important fauna habitat within the foreshore reserve.

3.5 Coastal Processes

As previously noted, MP Rogers and Associates have undertaken an assessment of coastline processes potentially affecting the Alkimos Beach foreshore, in accordance with SPP 2.6. This work has identified the coastal processes allowance line over 20, 42, 50, 75 and 100 year planning increments, to provide an understanding of potential shoreline movement over the 100 year planning period. This coastal processes allowance is further described in Table 3 below, and illustrated in Figure 5.

Table 3: Coastal Processes Summary

Time Period	S1 Allowance – Severe Storm Erosion	S2 Allowance – Historic Shoreline Movement	S3 – Climate Change	Factor of Safety	Total Coastal Processes Allowance
20 years	42 m	10 m	11 m	4 m	67 m
42 years	42 m	21 m	26 m	8.4 m	98 m
50 years	42 m	25 m	34 m	10 m	111 m
75 years	42 m	37.5 m	62 m	15 m	157 m
100 years	42 m	50 m	90 m	20 m	202 m

The MRS foreshore reserve area is significantly greater than the 100 year physical processes allowance line as identified by M.P Rogers and Associates. This is a result of the previous MRS amendment process, which broadly considered coastal processes in addition to other key environmental factors, and provides further allowance for a meaningful foreshore reserve corridor to be retained at the end of the 100 year planning period, should the full extent of modelled coastal processes be experienced. This is wholly consistent with the approach advocated by SPP 2.6.

These long-term coastal processes are considered further in Section 7.0 of this FMP, having regard for proposed local access works and community infrastructure within the 100-year coastal processes area and the risk management approach to be employed.

3.6 Land Use History

The historical and current land use context is detailed in Table 4.

Table 4: Land Use Past and Present

Time Frame	Land Use
Past	1. The landholdings historically was used for periodic livestock grazing, however a review of the historical aerial photographs indicate the foreshore of Lot 1004 was heavily grazed or cleared. Anecdotally there appears there was some historic clearing around Karli Spring. The spring may have been used as a watering hole for livestock. 2. More recently (last 15 years) the landholdings and in particular the foreshore reserve area are used for more recreational purposes such as fishing, four wheel driving, motorbike riding. All these activities have created an increasing number of informal tracks across the foreshore and the creation of disturbance areas.
Present	1. Uncontrolled access remains a key use within the foreshore. However much of the foreshore remains undeveloped and intact with remnant coastal vegetation.

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4.0 REGIONAL CONTEXT AND LOCAL DEMAND FACTORS

To confirm the level of demand for coastal access at Alkimos Beach, and hence inform the amount of coastal access infrastructure proposed, RPS has undertaken a strategic review of the following factors:

- strategic planning context and planned levels of foreshore access along the wider regional coastline (Jindalee to Two Rocks)
- district-level demand analysis (Alkimos-Eglinton)
- local development considerations (South Alkimos).

The results of this strategic review are summarised below.

4.1 Strategic Context

Alkimos Beach is located within a rapidly developing coastal corridor extending from Jindalee in the south to Two Rocks in the north – one of the largest and comprehensively planned urban land release areas in Australia. All levels of strategic and statutory planning support the progressive urban development of this coastal corridor, including the development of South Alkimos, as evidenced by:

- **Directions 2031** – identifies Alkimos–Eglinton and Yanchep–Two Rocks as urban growth areas capable of supporting significant urban growth over the next 20 years.
- **Metropolitan Region Scheme** – extensive urban-zoned land areas supporting future development.
- **North-West Corridor Structure Plan** – identifies the Alkimos locality as providing a combination of urban and commercial land uses, public utilities, parks and recreation reserves.
- **District and Local Structure Plans** prepared and adopted for the Butler–Jindalee, Alkimos–Eglinton and Yanchep–Two Rocks, as summarised in Table 5 below and illustrated in Figure 11.

Table 5: District and Local Structure Plans within North West Coastal Corridor

DSP/ LSP No.	Name/ Location	Status	Dwelling/Population Yield	Level of Coastal Access Contemplated
DSP 18	Alkimos Eglinton DSP	Agreed (2011)	23,000 dwellings and a population capacity of 57,000 people.	Five local beaches and one regional beach (coastal village).
DSP 39	Butler Jindalee DSP	Agreed (2006)	15,400 dwellings and a population capacity of approximately 40,000 people.	Two–three local centres adjacent/close to the foreshore reserve. No further detail provided on foreshore planning and coastal access.
DSP 42	Yanchep Two Rocks DSP	Agreed (2011)	67,000 dwellings and a population capacity of some 155,000 people (at 2.3 persons per dwelling).	Five local beaches, four district beaches, and one regional beach (initially developed as a district beach).
LSP 19	Yanchep South (Lagoon Drive) LSP	Agreed (2005)	360 dwellings and a population capacity of 800 people (at 2.3 persons per dwelling).	One local beach
LSP 36	Jindalee Lot 12 LSP	Agreed (2011)	850 dwellings and a population capacity of 2000 people (at 2.3 persons per dwelling).	Adjacent to one district beach (provided next to Coastal Village).
LSP 44	Capricorn Coastal Village LSP	Agreed (2007)	3,000 dwellings and a population capacity of 7,000 people (at 2.3 persons per dwelling).	Adjacent to one district beach and one local beach (as per DSP)
LSP 66	South Yanchep LSP	Agreed (2009)	1,500 dwellings and a population capacity of 3,500 people (at 2.3 persons per dwelling).	Adjacent to a local beach.
LSP 69	Two Rocks LSP	Agreed	5,406 dwellings and a residential population capacity of 11,900 people (at 2.2 persons per dwelling).	One local beach (consistent with DSP).
LSP 70	Two Rocks Town Centre LSP	Proposed	113 dwellings and a residential population capacity of some 260 people (at 2.3 persons per dwelling).	No beaches provided (provides for marina associated facilities consistent with DSP).
LSP 72	South Alkimos (Alkimos Beach) LSP	Agreed (2013)	2413 dwellings and a residential population capacity of 6,032 people (at 2.5 residents per dwelling)	One local beach (subject of this FMP) and one regional beach in northern portion of site (associated with Coastal Village, subject to further planning).
LSP 73	North Alkimos (Shorehaven) LSP	Proposed	3,000 dwellings and a population capacity of 8,000 people (at 2.5 persons per dwelling).	Adjacent to one local beach and one regional beach (as per DSP).
LSP 75	Capricorn Coastal Node LSP	Proposed	475 dwellings/accommodation units and a population capacity of 1000 people (at two persons per dwelling).	Adjacent to a district beach.

DSP/ LSP No.	Name/ Location	Status	Dwelling/Population Yield	Level of Coastal Access Contemplated
LSP 78	Jindalee Coastal Village LSP	Agreed (2013)	200 dwellings and a population capacity of 500 people (at 2.3 persons per dwelling).	One district beach.
LSP 82	Eglinton LSP	Agreed (2013)	6,290 dwellings and a population capacity of 16,000 people (at 2.5 persons per dwelling).	Provides three possible foreshore recreation development nodes (local nodes), along with a Marina.
LSP 84	Jindee LSP	Proposed	921 dwellings and a population capacity of 2100 people (at 2.3 persons per dwelling).	One regional beach
LSP 88	Jindalee North LSP	Agreed (2012)	1,600 dwellings and a population capacity of 3600 people (at 2.3 persons per dwelling).	Two foreshore node/beach access points.

Please Note:
- The information provided above has been sourced and interpreted from publicly available/accessible sources including published structure plans and online Council/WAPC datasets. Actual dwelling/population yields and coastal access facilities delivered may vary from that quoted, as a result of further detailed planning.
- Where population information is unavailable, an assumed 2.3 persons per dwelling has been assumed.
- Beach typologies referenced (regional, district, local) are consistent with SPP2.6 classifications and those used in the MP Rogers & Associates study of "Predicted Future Demand for Coastal Facilities" for the Yanchep Two Rocks area.

The amount and type of coastal access and recreational infrastructure required along this coastline has also been considered by documents including the PCPS and Alkimos-Eglinton Coastal Strategy. Both of these coastal strategies identify the Alkimos Beach foreshore area (Area 1) as suitably accommodating public access to the foreshore, subject to adequate protection/conservation of Aboriginal heritage sites and environmental assets.

It is evident that Alkimos Beach comprises a small component of the wider coastal development corridor between Jindalee and Two Rocks, which is planned to accommodate significant dwelling and population growth with a commensurate level of coastal access and facilities. Beaches and coastal facilities of varying scale and function are planned along this stretch of coastline, ranging from low level local beach access to larger district and regional scale beaches offering a more diverse and active coastal interface.

In this context, the foreshore area subject of this FMP can most appropriately be classified as a "local beach", given its position and proximity to other planned coastal facilities (along with demand factors as considered below).

4.2 Demand and Supply Analysis

Using a similar methodology to that employed in the study "Predicted Future Demand for Coastal Facilities (Yanchep–Two Rocks Project)" (MP Rogers and Associates 2008), RPS has assessed the levels of likely demand arising for coastal access and beach facilities along the Alkimos-Eglinton coast. This demand assessment is summarised as follows:

- The Alkimos-Eglinton District Structure Plan area is planned to deliver some 23,884 dwellings catering for up to 57,321 people over the next 20–25 years.

- By applying a usage ratio of 4% (same as that used in the MP Rogers and Associates study), peak daily demand for beach access is projected to increase from 480 people in the next five years, to at least 2,254 people in 25 years' time.

- Within a hierarchy of regional, district and local beaches, the following beach capacities are applied
  - **regional beach** – 2,700 persons per day
  - **district beach** – 960 persons per day
  - **local beach** – 140 persons per day.

- By applying these ratios to the beach types generally contemplated by district and local level plans for the area, the population-carrying capacity for the district coast can be summarised as follows.

Table 6: Capacity of Planned Beach Access along Alkimos-Eglinton District Coastline

Coastal Zone	Beach Type	Nominal Daily Capacity
1 – Alkimos Beach (subject of this FMP)	1 × local	140
2 – Alkimos Coastal Village	1 × district	960
3 – Shorehaven	1 × local	140
	1 × district	960
4 – Eglinton Marina	2 × local	280
5 – Eglinton ROS / South Yanchep	1 × local	140
Total		**2,620**

* Note:
- Marinas have been excluded given their unique role/function distinct from other beach types.
- Assumed beach types reflect the most recent plans available, and in some cases vary from that depicted in earlier district level planning.
- The Southern Coastal Node is identified as ultimately accommodating a regional beach, however, for the purpose of this assessment has been classified as a district beach, given its delayed delivery profile and time frames required to establish itself as a regional beach.

This hierarchy of beach types and locations is illustrated in Figure 12.

As demonstrated above, planned beach facilities along the Alkimos-Eglinton coastline are modelled as accommodating some 2,620 daily visitors. This is sufficient to meet estimated levels of demand generated by district residents, while allowing flexibility to cater for future increases in demand (either from visitors outside the district and/or higher levels of population growth/density) through the provision of regional beach facilities. Importantly, it includes allowance for a local beach being provided in Zone 1, consistent with the current FMP proposal.

Demand modelling supports the provision of a local beach being provided within the Alkimos Beach foreshore, particularly in meeting immediate to medium term demand generated by the Alkimos Beach development in advance of district/regional level facilities being developed further north.

5.0 OPPORTUNITIES AND CONSTRAINTS ANALYSIS

Having regard for the preceding sections of this report and the assessment of current statutory and policy frameworks, existing environment conditions and the wider regional context for the site, the following key opportunities, constraints and key issues have been identified and summarised as follows.

Table 7: Opportunities, Constraints and Key Issues

Opportunities	Constraints
▪ Existing cleared tracks/degraded areas provide opportunity to provide paths/access with limited clearing required. ▪ Ability to fence and control access to the area, thereby preventing further uncontrolled off-road vehicle access. ▪ Topography of the site presents view corridors and passive recreational opportunities within a natural setting. ▪ Ability to provide immediate coastal access and community facilities/services for new residents, in advance of further facilities being provided at the Coastal Village site.	▪ Coastal processes are modelled as potentially affecting a 200 m wide area over a 100 year planning period. ▪ Topography is a key limiting factor in the design of access routes and location of infrastructure.
Key Design and Management Issues to be Addressed	
▪ Integration of urban and foreshore environment ▪ Provision of appropriate beach access and limited passive recreational opportunities ▪ Coastal Hazard Risk Management and Adaptation ▪ Management of erosion and dune stability ▪ Fire management ▪ Access management ▪ Revegetation management	

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6.0 FORESHORE DESIGN AND FUNCTION

6.1 Design Philosophy

The design philosophy underpinning the foreshore design and function is underpinned by acknowledgement of the following key factors:

- Stage 1 of the Alkimos Beach development is currently underway and is capable of supplying more than 2,400 dwellings and housing over 6,000 people. Consequently, beach usage and pressure on the foreshore reserve adjacent to the Alkimos Beach development is likely to increase. In the long term, Alkimos Beach residents will be able to utilise the foreshore and access the beach through the Coastal Village to the north. However, local development staging and the delayed planning and delivery of the Alkimos Coastal Village will generate sufficient short to medium term demand from future Alkimos Beach residents to warrant proposed beach access adjacent to the Alkimos Beach development.

- The foreshore reserve contains significant environmental values and requires careful management to preserve its conservation and heritage value. The provision of appropriate controlled beach access for local residents is an important tool in managing the reserve. Appropriate beach access will reduce the likelihood of beach goers gaining access to the beach in an uncontrolled manner and any roads or pathways will be fenced to prevent unauthorised access by pedestrians or vehicles (which would otherwise be the case without such facilities).

- The reserve poses a potential fire hazard risk, and requires appropriate fire access and control arrangements to maintain the safety of residents and visitors, including
  - Emergency vehicle access within the foreshore reserve is required given its large size area and width; this can provide a dual role in meeting both fire safety and passive recreational needs.

  - Pathways and roads along the edge of the reserve to act as an interface between the development and reserve.

- The provision of local beach access in this location will contribute to a reduction in travel demand by providing a beach/foreshore asset in close proximity to future residents, and reducing the need to travel further afield (by car) to access the coast.

Having regard for the above considerations, the design philosophy for the Alkimos Beach foreshore reserve is focused on the provision of low intensity, passive recreational opportunities and controlled access in a manner that maintains and conserves the ecological assets of the area. This is wholly consistent with the DSP Coastal Strategy vision for this foreshore area, and the stated key objective to:

> Conserve the key ecological features in a natural state. Control access through the provision of appropriate beach access paths and fencing.
>
> (RPS 2006)

The design focus is therefore concerned with enhancing and managing the natural features of the environment within the Alkimos Beach (Area 1) foreshore, whilst providing an appropriate level of controlled beach access and passive recreational opportunities.

The proposed Alkimos Coastal Node to the north in Area 2 of the foreshore will be designed for a more intensive coastal and foreshore use with the provision of retail and significant public infrastructure and recreation areas to attract people. The development and planning of this node is, however, likely occur over a long-term time frame. There is therefore a requirement for appropriate beach access adjacent to the Alkimos Beach development for beach users in the immediate term.

6.1.1 Anticipated Beach / Foreshore Uses

The development partners undertook a survey of the Alkimos Beach database, which includes purchasers and parties interested in the development. The survey covered a range of questions about how people use the foreshore and the beach. The purpose of this questionnaire was to help the guide the design of the foreshore reserve. While the majority of the questions focused on more active beach and foreshore use, there were some questions on use of conservation elements of the foreshore reserve. Based on the questionnaire results, the types of low-key activities expected to occur in the FMP Area 1 in the future are listed in Table 8.

Table 8: Typical Activities Expected to Occur in the FMP Study Area

Water Related	Beach Related	Foreshore Related
Swimming	Sunbathing	Jogging
Wading	Fishing	Walking
Boogie boarding	Walking	Cycling
	Jogging	Viewing scenery
	Possible future dog walking	

Most of these activities do not require provision of significant support facilities. Activities that will require facilities are:

- cycling and walking – dual use paths, bike racks, rest points, drinking fountain and shower facilities
- viewing scenery – conservation area lookouts
- beach access – vehicle access and car parking area, pedestrian access paths, fencing and bollards to control access

Acknowledging that it may take some time before more substantial facilities and amenities are provided at the Coastal Village site further north, there is also a requirement for temporary/relocatable facilities and activities catering for interim demand, such as:

- An interim facility for mobile beach patrols for SLSWA at Alkimos Regional Beach. This includes a multi-purpose facility potentially catering for a community meeting space and/or storage for surf lifesaving equipment, etc.

The local Alkimos Beach community has expressed a strong desire for a dog beach walking area along the beach foreshore. It is understood the CoW is currently reviewing the regional demand and future beach location(s) for dog walking. The development partners advocates the consideration of the southern portion of Alkimos Beach as a potential dog walking beach by the CoW.

6.2 Design Concept – Structural Elements

The Foreshore Concept Plan prepared for the FMP area (Figure 3) illustrates the key structural design elements proposed within the foreshore reserve, including pathways, vehicle access and parking, passive recreational areas and areas to be fenced and conserved/rehabilitated. As outlined in Section 2.11 the implementation of the proposed structure design elements will be subject to future planning approvals, e.g. Development Applications and construction drawings. The key structural elements are summarised below, with further detailed description of these elements provided in Sections 6.2.1 to 6.2.11:

- The majority of the foreshore reserve is retained for conservation and rehabilitation (including black cockatoo habitat rehabilitation areas), with the only other activities proposed within the foreshore being for low level (local) beach access and maintenance/safety. Rehabilitation works will be focused on priority areas including the road and path batters, dune blow out and four-wheel drive paths.

- Fenced "southern" pedestrian pathway (3.0 m wide, compacted limestone) providing residents with walkable access (and emergency vehicle access) to the beach. Fencing to the CoW specification will be provided either side of the path. Lockable bollards will positioned at the entry points of the path to prevent public vehicle access.

- A dual use path (3.0 m wide, red asphalt) providing a continuous north to south linkage along the perimeter of the foreshore reserve adjacent to the future residential subdivision, connecting in the north to the Alkimos Coastal Node and Eden Beach in the south. This path will be fenced adjacent to the foreshore reserve. The path also provides a shared maintenance/emergency vehicle access role in the

northern portions of the site where there is no nearby public road frontage. The dual use path will be constructed in accordance with the DFES requirements. The indicative location of this dual use path is illustrated in the Foreshore Concept Plan. The final location of this dual use path will be subject to detailed engineering review.

- Fenced public vehicle access asphalt road (6.0 m wide with a 2.4 m wide concrete pedestrian path to one side), located centrally in the foreshore reserve and providing convenient visitor access to the car park. The road has been designed to accommodate informal "overflow" car parking on the edge of the road if required. Fencing to the CoW specification will be provided either side of the road / pedestrian path. Key services such as street lighting, power, communications and water will follow the road alignment.

- An emulsion stabilised limestone path to a coastal lookout approximately 25 m west of the car park is proposed.

- Pedestrian and surf lifesaving vehicle access on a 3.0 m wide emulsion stabilised limestone path which will be ramped to the beach from the car park to allow "universal access" and surf lifesaving/emergency vehicles access to the beach. Lockable bollards will prevent public vehicle access, but allow access for maintenance and/or surf lifesaving vehicles from the interim facility for mobile beach patrols. Fencing to the CoW specification will be provided either side of the pedestrian path.

- A small site adjacent to the car park has been allocated for an interim facility for mobile beach patrols for SLSWA at Alkimos Regional Beach. The interim (and relocatable) facility comprises a modular structure capable of storage for surf lifesaving.

- A single car parking area, accessed via the public vehicle access road, (located behind the modelled 50 year coastal processes line) and providing approximately 30 standard bays that includes ACROD and a single bus parking bays.

The landscape foreshore facilities plan is provided in Appendix 3.

6.2.1 Pedestrian Pathways

Safe and controlled pedestrian beach access paths will be constructed on existing tracks and degraded areas where possible within the foreshore reserve.

The pedestrian pathway in the foreshore reserve will be fenced in accordance with the CoW's fencing specifications.

All beach signage will be to the agree CoW standard.

6.2.2 Dual Use Pathway

A dual use pathway will be located along the edge of the foreshore and adjacent to the future residential subdivision as indicatively depicted in Figure 3. The dual use path provides the main north-south movement linkage and is a combined emergency access path. The pathway will be designed for use by pedestrians, cyclists, wheelchairs, prams and emergency vehicles and will comprise red asphalt. This dual use path will be constructed as per DFES and the CoW requirements.

A core requirement of the dual use path is to guide and facilitate people towards beach access routes or to the future Village Coastal Node. This dual use path will be the key link to beach access paths and, public facilities.

The pathway adjacent to the foreshore reserve will be fenced in accordance with the CoW's fencing specifications.

Any beach signage will be to the agree CoW standard.

6.2.3 Public Vehicle and Shared Access

Access for public vehicles will be provided through a 6.0 m wide asphalt, with a concrete pedestrian path (2.4 m wide) provided on one side. Fencing will be offset approximately 2.0 m from each path edge, and will ensure that access to the beach is formal and controlled and will prevent any off-road vehicles from driving through the foreshore reserve.

This access will also form part of the emergency vehicle access network. Any connections to the maintenance or emergency access tracks will be fenced or have bollards in accordance with DFES requirements.

Street lighting will be provided along the length of the access road and car park.

6.2.4 Pedestrian and SLSWA and Emergency Vehicle Beach Access

A fenced, 3.0 m wide pedestrian path is to be provided between the car park area and the beach. In addition to the pedestrian path, there is also potential to provide restricted access for surf lifesaving and/or maintenance vehicles along this path alignment, accessed from the car park. The path will be constructed of compacted crushed limestone (or to SLSWA requirements). Lockable bollards will be provided at the top of the access way to prevent public vehicle access from the car park/loop road.

6.2.5 Fencing

Fencing will be installed along all pathways and the car parking area to control access and preserve conservation values of the foreshore.

Conservation fences for the access paths and road will be installed when the final alignments the paths are approved and constructed. The remainder of the foreshore will be secured using fencing

Fencing will meet the CoW's specifications.

6.2.6 Car Park

The car park (along with the interim SLSWA patrol facility) is to be located behind the 50 year coastal process line. Situated behind the primary dune, the car park and associated beach facilities are designed to have minimal impact on the natural landscape values of the area.

The foreshore facilities plan showing the proposed configuration of the car park and facilities are provided in Figure 3 and Appendix 3; however, these elements are generally described as follows:

- car park providing approximately 30 standard bays including two ACROD bays and a single bus parking site, designed to CoW standards
- landscaped areas with shade trees (indicative proposed as *Melaleuca lanceolata*), outdoor showers and bike racks. Sufficiently sized to accommodate an interim SLSWA facility (described further below).

The interim (and relocatable) facility comprises a modular structure capable of storage for surf lifesaving.

6.2.7 Lookout

A lookout has been proposed (after discussions with the City) approximately 25 m west of the car park and adjacent to the dual use path (Figure 3). The lookout will be constructed in accordance with the CoW specifications and subject to approved construction drawing. The lookout site closest to the car park was chosen for the following reasons:

- close to beach access pathway so it minimises potential for uncontrolled access to occur
- convenient in terms of maintenance access
- close to water supply and facilities in terms of public safety and amenity
- lightweight and recyclable nature of the lookout structure is simple to dissemble and reassemble in new location if necessary in 25–50 years.

- elevated vantage point to capture views
- nestled into the dunes so low visual impact from the coast
- close to future SLSC interim facilities for beach surveillance
- visible from car park providing good access to security surveillance and limiting anti-social behaviour.

6.2.8 Continuity with the Adjacent Development

The design of the movement network provides for the continuity of the primary dual use pathway infrastructure along the foreshore from the adjacent landholdings to the north (Lot 101) and the Jindalee development to the south.

6.2.9 Foreshore Environment Education and Community Awareness

The potential degradation of the foreshore environment from an influx of visitors, tourists and recreational users has been identified as a key management issue. The use of educational signage will promote awareness of the natural foreshore environment, foster stewardship and assist in minimising detrimental impacts on the foreshore.

To prevent people from moving away from the dedicated paths, access paths to the beach will be fenced and located at intervals suitable not to encourage people to make their own direct access routes to the beach.

Signage will be positioned at prominent beach access points. The signage will be used to:

- direct people and inform the foreshore and beach users parking and beach access.

The signage will be to the CoW's and SLSWA standards and specifications.

6.2.10 Interim Surf Lifesaving Facility for Mobile Beach Patrols at Alkimos Beach

Given the level of local demand for beach access, particularly in advance of permanent facilities being provided further north, the Foreshore Concept Plan has identified an interim facility for mobile beach patrols by SLSWA near the primary beach access point. The provision of restricted surf club vehicle access at this location will enable surf lifesaving vehicles to access the beach and set up the beach patrols, without the need to construct permanent club facilities in this portion of the foreshore. A letter supporting the proposed foreshore access and facilities from SLSWA is provided in Appendix 7.

6.2.11 Rehabilitation and Conservation Areas

Rehabilitation of select areas, as identified on Figure 3, is to be carried out in the manner described in Section 8.0. The remainder of vegetated foreshore reserve areas are to be securely fenced to restrict access and conserve the remnant vegetation in a natural state.

6.2.12 Stormwater Management

The stormwater drainage along the access road, car park and around the interim facility will be managed using best practice stormwater drainage design solutions to the City's satisfaction. The design will be finalised for the City's approval as part of a future Development Application.

7.0 COASTAL HAZARD RISK MANAGEMENT AND ADAPTATION

Under SPP No. 2.6, a CHRMAP is required for any development located in an area deemed to be at risk of being affected by coastal hazards. Given the proposed location of some foreshore access and recreation elements within the modelled 100 year coastal processes allowance area, issues of risk management and adaptation planning are required to be addressed in this FMP.

7.1 Consultation with the Department of Planning

In a meeting with officers from the Department of Planning's (DoP) Policy Development and Review Team in April 2014, coastal hazard risk management and adaptation matters to be addressed in relation to proposed Alkimos Beach foreshore works were identified. Importantly, it was confirmed that the scope of any CHRMAP should be in line with the relative scale of the proposed works within the identified physical processes allowance. In the case of relatively low level access works such as that proposed for Alkimos Beach, the following scope was confirmed by DoP officers as being appropriate (via email correspondence dated April 2014):

- Identify / describe the foreshore / beach in its regional and local context.
- Define the proposed role and function of the foreshore / beach.
- Outline the proposed infrastructure within the foreshore area.
- Identify coastal hazard risks for such infrastructure, and outline key management processes for the infrastructure over a 100 year planning period.

The first three matters identified above have already been addressed in earlier sections of this FMP. Importantly, the approach to risk management and adaptation planning for this beach is commensurate with the role, function and level of infrastructure proposed (i.e. low intensity beach access infrastructure), with a more comprehensive CHRMAP typically required for larger and more significant infrastructure proposals.

7.2 Consultation with the City of Wanneroo

RPS and the development partners of Alkimos Beach presented in 2014 an initial draft of the FMP and Concept Plan to the City of Wanneroo for review and comment. This version positioned the car park and associated beach facilities behind the 20 year coastal processes line. The key concerns raised by the City included:

- Detailed life-cycle/asset management costings should be undertaken and included in the FMP.

- The car park should be moved to a location that is relative to its lifespan, i.e. behind the 50-year coastal processes line.

- Provide a Coastal Aquatic assessment of the beach.

- Fencing will be as per CoW Standards.

- Signage will be as per CoW Standards.

- Revegetation requires further detail.

RPS and the development partners in 2015 April 2015 met with the City and discussed the City's position on Coastal Assets within the defined beach hierarchy, acceptable assets, location and costs in relation to the Alkimos Beach foreshore.

Key agreed outcomes from the meeting include:

- The car park and access road infrastructure was relocated to behind the 50 year coastal processes line.

- The development partners of Alkimos Beach also have used the City's asset template to provide an indicative estimate of the lifespan, asset value, maintenance costs and adaptation plan, noting the City can update the table upon the review of the detailed construction drawings. The coastal asset template is provided in Appendix 4.

- SLSWA has undertaken a Coastal Aquatic Risk Assessment in 2014 and is provided in Appendix 5.

- A foreshore Revegetation Management Plan is provided in Appendix 6.

Figure 3 also shows an indicative location (as part of a coastal retreat) for the relocation of the car park and road assets outside of the 100 year coastal processes line.

This signage and fencing will be constructed to the City's specifications.

7.3 Coastal Aquatic Risk Assessment

The development partners engaged SLSWA to assess the Alkimos Beach foreshore to provide advice on the following (Appendix 5):

- The most suitable location to be designated as a recreational and leisure beach primarily for swimming and wading activities and within the Alkimos Beach development boundaries.

- The best location for a permanent surf lifesaving club (noting this is subject to the City's input and a separate approval) and additional outpost facilities based on the risk profile and proposed use by the community.

- An assessment of coastal risks present at Alkimos Beach and development of risk management plan and treatments including beach accessibility, proposed access signage, prevention and lifesaving services and awareness and education.

The locations of beach access paths in the Foreshore Concept Plan has been correlated with SLSWA advice in positioning beach access and swimming activities to areas that will be subject to interim mobile surveillance by SLSWA.

The FMP promotes surf lifesaving presence at Alkimos Beach at the early stage of development by establishing an interim mobile surveillance outpost, designed and constructed into the proposed car park area. The proposed interim facility location is behind the 50 year coastal processes line consistent with the City's advice.

7.4 Coastal Hazard Risk

As previously noted, MP Rogers and Associates have undertaken an assessment of coastal processes potentially affecting the Alkimos Beach Foreshore over a 100 year planning period, in accordance with SPP2.6 requirements. This work identified the coastal processes allowance line over 20, 42, 50, 75 and 100 year planning increments, to provide an understanding of potential shoreline movement over the 100 year planning period. The projected long term movement of the coastal process allowance line (measured from the established "Horizontal Shoreline Datum") is summarised as follows:

- 20 years – 67 m
- 42 years – 98 m
- 50 years – 111 m
- 75 years – 157 m
- 100 years – 202 m.

The position of the coastal processes line, at each of these interval periods, is illustrated with respect to the Foreshore Concept Plan elements at Figure 14.

7.5 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.
- 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.

As identified in this FMP, all future private properties and significant public assets are to be located outside of the 100 year coastal process line, to avoid coastal hazards. As identified above, however, some key community infrastructure items required within the foreshore area to effectively manage public access and provide a basic level of recreation facilities within proximity to the beach. In this regard, a managed retreat of these public assets is recommended over the 100 year planning period.

As discussed with the City the key infrastructure items, the public car park and access road are located behind the 50 year coastal process line.

With regard to the managed retreat of coastal infrastructure, the following key matters are noted:

- The linear nature of much of the proposed coastal infrastructure lends itself to a relatively straightforward retreat, with discrete sections of infrastructure capable of being removed /relocated by the relevant management authority at the appropriate time depending on the rate of coastal movement.
- As the foreshore reserve area reduces in width over time, the requirement for certain infrastructure items is subsequently reduced or removed. For example, the requirement for a north-south aligned emergency vehicle access is potentially negated if the foreshore width is substantially reduced.
- All foreshore access and community infrastructure works will be undertaken by the proponent, and then maintained for a period of five years after practical completion, before being handed over to the CoW to manage. Typical handover requirements with regard to asset standard and the transfer of as-constructed drawings and asset management data will also apply.

- It is contemplated that this CHRMAP will feed into and inform any future consolidated review(s) of coastal infrastructure vulnerability and asset management planning along the wider CoW coastline. Such an approach allows coastal infrastructure assets to be considered and managed in an efficient and coordinated manner, rather than on a piecemeal basis for each local access node along with district/regional coast.

- According, the only significant CHRMAP action required (in accordance with SPP 2.6) is the ongoing monitoring and review of the foreshore. At a future time as appropriate (estimated to be after 50 years) when the amenity is potentially at risk of becoming vulnerable a re-assessment of new location(s) is undertaken and then implemented. Figure 3 also shows an indicative location (as part of a coastal retreat) for the relocation of the car park and road assets outside of the 100 year coastal processes line.

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8.0 FORESHORE REVEGETATION PROGRAM

This section provides a summary of the key revegetation actions. The actions are based upon the Tranen's Revegetation Management Plan, which is provided in Appendix 6.

8.1 Revegetation Methodology

8.1.1 Plant Propagation

Tubestock will be propagated from provenance seed at an accredited nursery. Tubestock should be appropriately prepared and hardened and be free from pest and disease.

8.1.2 Revegetation Site Preparation

To maximise the potential for revegetation success, the area(s) that are subject to revegetation will be prepared in the following manner:

- weed spraying commenced, rubbish and debris will be removed and disposed of appropriately if required
- brushing and / or mulching if required may be used to assist stabilising soil in erosion prone locations as required.

8.1.3 Revegetation Method

Planting and seeding are the key methods to be employed in the revegetation areas within the foreshore reserve. Species selection is the key to reaching a successful outcome for the project. Species must be carefully selected based on the surrounding 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.

Species selected will take into account of existing and identified use of the area. Revegetation species will be subdivided into four categories:

1. Beach grasses and herbaceous species adopted for the most exposed locations.
2. Semi-stable dune colonisers adapted to partially protected areas.
3. Plants of protected dunal situations.
4. Plants of protected well stabilised and vegetated areas.

8.1.4 Alkimos Beach Local Provenance Seed Bank

A seed bank has been established for Alkimos Beach, and there are significant quantities of local provenance seed available of a wide range of species for use in the revegetation program. Where possible, seedlings will be propagated from this seed bank. Where seed is not available of desired species, seed and seedlings will be sourced from the nearest available provenance. Some species are grown from cuttings and where possible these will be sourced from on site.

Seedlings will be grown by nurseries that are accredited by the Nursery Industry Accreditation Scheme of Australia (NIASA), which will guarantee the quality of supplied material.

8.1.5 Scheduling

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

To the extent possible, seedlings will be propagated from plant material (seed, cuttings, transplants) recovered from the site or local area to protect the genetic integrity of the native vegetation, and to ensure that the plants are adapted to the local environmental conditions. If provenance seedlings are unavailable for planting, then general nursery stocks will be required to achieve the required plant numbers.

If this is the case, plant orders will be placed in winter the year before planting to ensure sufficient seedlings are available. Seedlings will be grown by nurseries that are accredited by the Nursery Industry Accreditation Scheme of Australia (NIASA), which will guarantee the quality of supplied material.

Planting will be carried out in winter around June to 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.

Tube stock will mostly be planted at a density of one to two plants per square metre (as a minimum, species dependent) as discussed in Appendix 6.

8.1.6 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 will also be initiated to provide longer term protection to seedlings. This will include a combination of warren destruction, rabbit haemorrhagic disease virus (RHDV) release, and Pindone baiting. Baiting and 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.

8.1.7 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 required irrigation or extensive hand watering.

8.2 Weed Management

Weed management is an important component for the establishment of native vegetation. However, in some locations (i.e. dune blowout) 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.

Implementation of the revegetation will commence with a spraying program to eradicate weed species, prior to installation of seeds and seedlings. Control events will take place each spring and autumn prior to initial revegetation.

In addition to herbicide application, other practises to control weeds will include:

- Prior to the application of weed control, install safety warning signage around the perimeter of the area to be controlled. The warning signage shall include information on the control mechanism and timing and will remain in place until the area has dried.

- Only undertake spraying when the weather is calm, in order to minimise spray drift. Therefore, spraying will occur on days with a wind speed less than two kilometres per hour in accordance with the Department of Health WA Codes and Regulations.

- Spraying will be avoided at time when the plants are under stress such as very hot days and dry to dusty conditions to assist with maximum herbicide uptake.

Weed spraying will be undertaken to manage the abundance and spread of weed species into and within the foreshore reserve.

8.3 Key Actions

The key actions / target completion criteria to monitor the success of the revegetation efforts are specified in Table 9. Revegetation efforts will be undertaken and monitored for a period of five years from the commencement of the revegetation plantings. If completion criteria are not met, further infill planting will be required.

Table 9: Revegetation and Weed Management Key Actions

Year after Planting	Year 1	Years 2–5	Responsibility for Five Years after Commencement of Works
Survival of planted seedlings	90%	90%	Lend Lease
Minimum plant density (stems/m^2)	5	4	Lend Lease
Minimum plant diversity (% of original number of planted species in project area that have survived)	70%	70%	Lend Lease
Plant coverage (% area of visual ground cover measured by a botanist/revegetation consultant)	25%	50%	Lend Lease
Weeds coverage	10% cover	10% cover	Lend Lease

8.4 Corrective Measures

If planting success falls below 90% 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 or re-mulching areas
- ongoing weed management
- replanting in areas
- tree guard repair / replacement
- undertake fence, sign and pathway maintenance as required.

All the contingency measures listed in Table 10 below will be reviewed if the target completion criteria fall below 90% in two consecutive events.

Table 10: Revegetation and Weed Management Contingency Measures

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

8.5 Monitoring and Reporting

The revegetation areas will be monitored biannually (includes weed monitoring) each spring and autumn, and maintained for a five-year period after installation within each site.

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.

Monitoring and management activities that may be required in the first two years include but are not limited to the following:

- repairs and replacement of damaged or failed areas of revegetation to meet the completion criteria
- replacement of seedlings that have died to meet the completion criteria
- weed control.

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 highest mortality, as the seedlings propagated if required. The emergence of summer weeds will also be assessed, so that control can be scheduled as required.

After each formal monitoring event the development partners will be provided a monitoring report, these reports can be forwarded to the City. Tranen is contracted to achieve the completion criteria. Remedial action will be undertaken continuously throughout the maintenance period in response to the results of each formal monitoring event to ensure that the completion criteria are met.

Table 11 provides a summary of the revegetation actions as summarised above.

Table 11: Revegetation Management Summary

Issue	Description	Implementation	Timing	Responsibility
Species selection and sourcing	Only species naturally occurring on site should be used in revegetation.	Locally native species should be sourced as follows: ▪ Tubestock should be grown from seeds collected from site, if this is not possible tubestock will be sourced from an accredited nursery and be weed and disease free.	Seed collection has been undertaken If additional tubestock is required, this should be ordered one year prior to revegetation works.	Lend Lease
Weeds	Weeds within the foreshore reserve need to be managed so they do not compete with native vegetation and inhibit the success of revegetation works.	Weeds will be managed through chemical and manual control as required. Weeds within the foreshore reserve will also be managed through the following: ▪ controlling access within the reserve through fencing and signage ▪ education and signage to prevent the disposal of garden waste within the reserve.	Weeds will be managed prior to revegetation works being undertaken. Monitoring of weeds within the revegetation areas will be undertaken as part of revegetation monitoring for two years after initial planting.	Lend Lease

Issue	Description	Implementation	Timing	Responsibility
Soil stabilisation	For revegetation works to be successful, many of the revegetation areas will need to be stabilised to control erosion using the following techniques: ▪ brushing ▪ matting ▪ mulch. Stabilisation techniques will be determined according to the environmental condition of each degraded area.	Brush should be collected from cleared vegetation within the South Alkimos site and will be used in the following situations: ▪ slopes requiring protection from erosion or soil movement. Matting will be used in all unstable areas requiring revegetation. Mulch will be used in lower lying areas and along pathways. It should be sourced from cleared vegetation elsewhere within the site.	Soil stabilisation will be undertaken at the time of revegetation Monitoring of success will be undertaken as part of revegetation monitoring.	Lend Lease
Revegetation	Revegetation is required in areas of the foreshore reserve that are degraded to improve the environmental and aesthetic value of the foreshore area.	Revegetation using locally native species in degraded areas.	April to September	Lend Lease
		Installation of plant guards	At time of planting	Lend Lease
Disease management	Disease management will be undertaken during all soil disturbing activities within the foreshore area, including revegetation works.	▪ Removal of soil on all vehicles and equipment on entry to the site. ▪ All plants, soil and mulch will be sourced from an accredited nursery. This is detailed further in the Construction Environmental Management Plan.	Throughout all ground disturbing activities within the foreshore area.	Lend Lease
Monitoring	Review the success of revegetation against the success criteria.	▪ Monitor compliance with completion criteria prior to handover. ▪ Identify areas requiring further attention and maintenance.	Revegetation monitoring will be undertaken before April to allow for any required infill planting.	Lend Lease

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9.0 FORESHORE MANAGEMENT

This FMP addresses the following potential impacts and management issues in accordance with the best management practices in coastal management:

- bushfire risk
- erosion control
- access management
- vegetation management
- protection of Karli Spring
- fauna management.

9.1 Fire Management

Management Objectives

- Avoid and mitigate the potential ignition of fires during development and revegetation of the foreshore reserve.
- Protect human life.
- Protect property and infrastructure.
- Protect ecological integrity and biodiversity values of the foreshore.

Potential Impact

Potential bushfire ignition sources associated with the development of the foreshore may include:

- construction equipment and machinery
- stockpiles of cleared vegetation from pathways, etc.
- litter (particularly cigarette butts)
- deliberately lit fires due to unauthorised third party access.

Changes in fire regimes may result in loss of biodiversity through changes in species abundance (particularly the spread of weeds), damage to property and equipment, and loss of fauna and fauna habitat.

9.1.1 Pre-works

9.1.1.1 Fire Management Plan

Potential bushfire ignition sources associated with land development and construction include; construction equipment and machinery, stockpiles of cleared vegetation, litter (particularly cigarette butts) and deliberately lit fires due to unauthorised third party access. Prior to commencement of site work, a Fire Management Plan was prepared for the approved Alkimos Beach LSP. The Fire Management Plan incorporated a risk assessment of potential fire sources associated with the construction phase and fire management measures required under relevant industry regulations. The Fire Management Plan included:

- storage of flammable materials, away from potential ignition sources
- stockpiling methods of materials that may be potential ignition sources (e.g. combustible green waste)
- appropriate buffers and ventilation areas
- smoking areas and management
- maintenance of machinery in compliance with relevant fire safety standards
- establishment of fire breaks, where appropriate
- identification of the potential fire emergency risks and details of the recommended response, including emergency exit routes
- locations of fire extinguishers on site
- details of training on bushfire emergency response, fire prevention and safety, personnel responsibilities and basic fire suppression to be included in the site induction.

9.1.1.2 Fencing

Unauthorised access to the foreshore area will be controlled pre-works using fencing, signage, bollards and positioning large limestone boulders. Reducing unauthorised public access to the site should reduce the risk of fire pre works.

9.1.2 During Works

9.1.2.1 Fire Fighting

The construction site will include appropriate fire-fighting equipment in accordance with the requirements of the Western Australian Fire Protection Regulations.

Where possible, clearing work within the development area or foreshore reserve during high fire risk conditions should be avoided, if work operations occur in high fire risk areas and conditions, appropriate equipment, such as earthmoving machinery and water trucks will be on standby for fire control if required.

Ensure fire extinguishers are available on all machinery and on site. Ensure fire-fighting equipment is tagged, inspected and certified according to relevant standards. Site supervisors shall be aware of contact details for the nearest emergency services, including fire, ambulance and police.

The dual use pathway will be constructed in accordance with DFES and the City's requirements.

9.1.2.2 Fencing

During construction, the site engineering contractor will monitor any vandalism to the fencing or any trespassing to the foreshore area to prevent people accessing the site.

9.1.2.3 Vegetation

No rubbish or vegetation will be burnt on site.

9.1.2.4 Smoking

Smoking will be prohibited in all areas within the development except clearly designated "Smoking Areas".

9.1.3 Post-works

9.1.3.1 Interface

Interface treatments such as roads and pathways will be maintained between the development and foreshore reserve.

9.1.3.2 Emergency Access

Provision of emergency access is via the pedestrian access paths and the public road and carpark areas as depicted in Figure 3.

9.1.4 Fire Management Summary

Table 12: Fire Management Summary

Issue	Description	Responsibility
Pre-works		
Access	▪ Unauthorised access to the foreshore area will be controlled through the use of signage, bollards and limestone boulders. A sign warning people of the track closures and trespassing will be installed at the perimeter of the foreshore.	Lend Lease
Management Plan	▪ A Fire Management Plan has been prepared	Lend Lease
During Works		
Fire fighting	▪ Construction site will include appropriate fire-fighting equipment in accordance with the requirements of the Western Australian Fire Protection Regulations. ▪ Ensure fire-fighting equipment is tagged, inspected and certified according to relevant standards. ▪ Site supervisors shall be aware of contact details for the nearest emergency services, including fire, ambulance and police.	Lend Lease
Fencing	▪ During construction the fencing along the foreshore work areas will be monitored	Lend Lease
Smoking	▪ Smoking will be prohibited in all areas within the development except clearly designated “Smoking Areas”. ▪ Smoking areas will be positioned away from the foreshore reserve	Lend Lease
Post-works		
Interface	▪ Interface treatments such as roads and pathways will be maintained between the development and foreshore reserve.	Lend Lease
Emergency Access	▪ Emergency access will be provided within the foreshore reserve via access paths and the asphalt road and carpark area	Lend Lease

9.2 Dune Stability / Erosion Control

Management Objectives

- Prevent the formation of further blowouts within the foreshore reserve around access points.
- Stabilise existing areas susceptible to erosion.

Potential Impacts

Sections of the foreshore reserve have become degraded and denuded as a result of unauthorised off-road vehicle access to the area. A combination of natural wind erosion and removal of vegetation through unauthorised access such as off-road vehicles have resulted in a small number of tracks and sections of blowouts. Due to topography of the dunes in this area, the majority of the foreshore has remained free of uncontrolled access paths.

Increased pressure on these areas, if not managed appropriately, may result in further erosion of the dune system, and mobilisation of the sand inland towards the development.

9.2.1 Pre-works Management

Control of vehicle access early in the erosion control stage will prevent damage to areas of stabilisation and rehabilitation. Consequently, the main form of erosion control undertaken pre works will include control of unauthorised vehicles entering the site through the following.

9.2.1.1 Access

- Restricting access within the Alkimos Beach site through fencing.
- Placing large limestone boulders in areas where vehicles access the site if required.
- Providing signage at key foreshore entry points regarding beach access warning people of the track closures and trespassing will be installed.
- Placing brushing / revegetating closed tracks will assist in controlling access and at the same time prevent any further erosion.

9.2.2 During Works Management

To manage areas of existing erosion that will not be developed as beach access paths or other infrastructure, a dune stabilisation program will be implemented during the construction and revegetation phase. Proposed methods for erosion control are summarised below.

9.2.2.1 Access

Vehicle access management during the construction phase will be as detailed in Section 6.0.

- Fencing along pathways will discourage pedestrians from entering the foreshore areas and damaging foreshore vegetation and contributing to erosion. Conservation fences for the access paths and road will be installed when the final alignments the paths are approved and constructed. The remainder of the foreshore will be secured using fencing

- Barriers to unauthorised access such as bollards and large limestone boulders will be placed in areas where informal four wheel drive vehicles have historically accessed the foreshore. A sign warning people of the track closures and trespassing will be installed at the perimeter of the foreshore.

All fencing and long term barriers such as bollards will be durable to coastal conditions and fencing will be consistent with requirements of the CoW.

Table 13: Dune Stabilisation Summary

Method	Benefits	Constraints	Implementation
Brushing: ▪ Use of branches from native plants (preferably sourced from clearing activities on site) as a ground cover. ▪ Plants most suitable for use includes those with tight stem arrangements	▪ Biodegrades over time to provide a mulch ▪ Minimises sand erosion ▪ Branches may hold native seeds and also provide a microclimate for seedlings ▪ Able to be applied to steep slopes ▪ Can be used from clearing activities on site	▪ Potential for brush to contain some non-native plants ▪ Increased fire risk	▪ Brush should be laid with the stems facing the prevailing wind, starting at the top of the dune ▪ Successive layers of brush should overlay the stem of the preceding brush
Mulch	▪ Provides moisture for seedlings ▪ Visually aesthetic	▪ Potential to contain non-native species ▪ May inhibit growth if applied to thickly or too close to the plant stem	▪ To be applied on gentle slopes
Fibre matting: ▪ Fibre matting is generally made from jute and coconut fibre	▪ Biodegrades over approximately two years to provide a natural mulch ▪ Suppresses weed growth ▪ Moulds to the existing land formation ▪ Minimises erosion	▪ Unlikely to deter pedestrian access to dunes ▪ May detract from visual amenity	▪ Matting should be fixed with fastener pins (preferably biodegradable) ▪ Cut mating to insert and plant seedlings

9.2.3 Post-works

Dune stabilisation and erosion control works proposed post-works are summarised below:

- ongoing access control within the foreshore reserve, including
  - control of unauthorised vehicles
  - control of pedestrian access through pathways, fencing and signage.

Erosion control will be achieved through the methods discussed in Table 14.

9.2.4 Dune Stability and Erosion Control Management Summary

Table 14: Dune Stability and Erosion Control Management Summary

Issue	Description	Responsibility
Pre-works		
Access	▪ Restricting access within the Alkimos Beach site and foreshore area ▪ Placing large limestone boulders in areas where vehicles access the site. A sign warning people of the track closures and trespassing will be installed at the perimeter of the foreshore. ▪ Providing signage at key foreshore entry points regarding beach access ▪ If required, site surveillance may be undertaken ▪ Placing brushing on closed tracks will assist in controlling access and at the same time prevent any further erosion	Lend Lease
During Works		
Access	▪ Fencing the Alkimos Beach site and foreshore and access pathways and entry road. ▪ Placing large limestone boulders in areas where vehicles access the site ▪ Providing signage at foreshore access points ▪ If required, site surveillance may be undertaken ▪ Placing brushing / revegetating closed tracks will assist in controlling access and at the same time prevent any further erosion	Lend Lease
Post-works		
Access	▪ Ongoing control of unauthorised vehicles ▪ Pedestrian access through provision of pathways, fencing and signage	Lend Lease
Stabilisation	▪ Ongoing monitoring and maintenance of erosion control and revegetation areas	Lend Lease

9.3 Access

Management Objectives

- Provide appropriate access through the foreshore reserve for passive recreation and fire management.
- Prevent inappropriate access to the foreshore reserve.
- Prevent unauthorised third party access to the foreshore reserve before, during and after construction works.

Potential Impact

Current impacts from unauthorised access within the foreshore area includes creation of new tracks, damage to native vegetation, potential spread of weeds and increased erosion.

The beach adjacent to the site is designated as a regional beach and it is anticipated that it will be a popular location for swimming and other recreational uses. The northern section of the beach will most likely attract the majority of visitors due to its protected orientation. Consequently, access to the beach and foreshore area is likely to increase once development is complete. However, it is anticipated that, as this will be controlled access as discussed below that impacts to the foreshore area will be reduced.

9.3.1 Pre-works Management

Pre-works access management will include the following.

9.3.1.1 Fencing

- Access to the Alkimos Beach foreshore will be restricted through site management, signage and fencing.
- Placing large limestone boulders in areas four wheel drive vehicles currently access the foreshore. A sign warning people of the track closures and trespassing will be installed at the perimeter of the foreshore.

9.3.1.2 Signage

Signage will be placed at strategic locations along the foreshore reserve to inform that the areas are prohibited for construction activities.

9.3.2 During Works Management

Management measures will be ongoing throughout the construction phase. Further access management measures proposed during the works or construction Phase are discussed below.

9.3.2.1 Fencing

- Fencing will be installed around the development site during construction to restrict and control third party access to and through the foreshore reserve.
- Contractors should check fences on a weekly basis during the construction phase and repair and report any damage.

9.3.2.2 Pathways, Roads and Parking

There are currently a number of sand access paths leading to the beach, some of which have become badly eroded and have started cutting into the side of dunes. To reduce the vegetation clearing required for pathway and infrastructure installation within the foreshore, it is proposed that these degraded areas and existing paths will form the basis of managed pathways within the foreshore area where possible. If not upgraded to formal pathways, these existing pathways and other degraded areas will be revegetated.

Maintaining existing paths that the public have already chosen or created is also beneficial as it is less likely that pedestrians will try to create their own pathways rather than use those provided or try to continue using closed pathways.

Proposed access through the foreshore to link the beach and proposed residential development is detailed in Table 15 and summarised below:

- Access will be controlled through the use of fencing and signage where required. This will protect the remainder of the foreshore from erosion and allow revegetation works to become established.

Details on proposed pathways within the foreshore are provided in Table 15 and indicative locations for the access paths to the beach and the dual-use pathway are shown on Figure 3.

All fencing and paths will be aligned, designed, constructed and managed to the satisfaction of the CoW in accordance with the approved Development Application and construction drawings.

Table 15: Proposed Paths and Roads

Pathway Type	Material / Dimension	Edge Treatment	Other Features
Southern Pedestrian Access Paths	Compacted crushed limestone, 3.0 m wide	Fencing both sides of the path	Controlled access (i.e. bollards) and signage
Dual Use Pathway and Emergency Vehicle Access	Red asphalt, 3.0 m wide.	Fencing both sides of the adjacent to the foreshore reserve	Controlled access (i.e. bollards) and signage
Vehicle Access Road and pedestrian path	Bitumen, 6.0 m wide with 2.4 m concrete path.	Fencing both sides of the road / pathway	Street lighting to one side of the access road
Beach path from the car park with restricted vehicle access i.e. for SLWA mobile patrols	Emulsion stabilised limestone, 3 m wide.	Fencing both sides of the path	Lockable bollards to control vehicle access from car park.

Where possible, a road will be located along the outer edge of the foreshore reserve to act as an interface treatment. Where a road is not provided along the reserve edge, public open space areas will define this edge.

Approximately 30 parking bays including two ACROD and a single bus parking bays will be provided, and constructed to CoW standards.

9.3.2.3 Signage

Signage will be placed on the fence during construction informing people that the area is a construction site and the public are not authorised to enter the site. A sign warning people of the track closures and trespassing will be installed at the perimeter of the foreshore.

9.3.3 Post-works Management

9.3.3.1 Fencing

Following the construction of residential development adjacent to the foreshore reserve, a permanent fence will be established, interspersed with beach access pathways (Figure 3).

Bollards or other obstructions will be used to prevent unauthorised vehicular access to the beach along these paths.

Fences for the access paths and road will be installed when the final alignments the paths are approved and constructed. The remainder of the foreshore will be secured using fencing as per CoW's requirements.

9.3.3.2 Signage

Interpretive and directional signage will be positioned at strategic locations along the dual-use pathway as well as along access paths to the beach.

Signage will be constructed as per CoW's and SLSWA specification and requirements.

9.3.4 Access Management Summary

Table 16: Access Management Summary

Issue	Description	Responsibility
Pre-works		
Fencing	▪ Alkimos Beach development will be fenced to deter unauthorised access ▪ Large limestone boulders will be placed where required to prevent off road vehicles from entering the site. A sign warning people of the track closures and trespassing will be installed at the perimeter of the foreshore.	Lend Lease
Flagging	▪ Proposed pathways within the foreshore reserve will be surveyed and flagged as part of the pre-works activities	Lend Lease
Signage	▪ Signage will be placed at strategic locations along the foreshore reserve to inform that the areas are prohibited for construction activities as well as unauthorised access.	Lend Lease
During Works		
Pathways	▪ Access along pathways will be controlled through the use of fencing and signage.	Lend Lease
Roads	▪ A single beach access road is proposed for the central area of the foreshore. No other roads are proposed within the foreshore reserve.	Lend Lease
Fencing	▪ Fencing will be provided around the construction site to prevent unauthorised access ▪ Contractors will inspect fencing and repair any damage	Lend Lease
Signage	▪ Signage will be placed on the fence during construction informing people that the area is a construction site and the public are not authorised to enter the site.	Lend Lease
Post-works		
Fencing	▪ Establishment of fencing along the paths and road in the foreshore reserve ▪ Installation of bollards at pathway entry into the foreshore to restrict access	Lend Lease
Signage	▪ Signage will inform pedestrians to remain on the paths provided ▪ Signage will be installed according to the City of Wanneroo's and the SLSWA requirements and specifications.	Lend Lease

9.4 Flora and Vegetation

Management Objectives

- Minimise the extent of clearing as much as practical while constructing or installing infrastructure within the foreshore area.
- Maximise opportunities for re-vegetation with local native species following construction and any clearing of vegetation.

Potential Impact

Development of the residential subdivision or infrastructure within the foreshore reserve may lead to loss of native vegetation through accidental clearing.

Indirect impacts may also include; a loss of floristic diversity, the degradation of vegetation as a result of increased pressure from the potential increase in public usage of the foreshore and beach area and the spread of weeds and pathogens through changes in fire regimes, unauthorised third party access, and from nearby domestic gardens in urban areas.

9.4.1 Pre-works

9.4.1.1 Seed Collection and Plant Propagation

- Tubestock will be propagated from this seed or sourced from an accredited nursery. Tubestock should be appropriately prepared and hardened and be free from pest and disease.

9.4.2 During Works

9.4.2.1 Site Access

- Construction personnel access will be restricted to the construction area and not permitted entry into the foreshore reserve except for installation of any pathways or infrastructure.

9.4.2.2 Clearing Protocol

- Appropriate cleared material should be stockpiled for use as mulch or brush in rehabilitation works.
- When installing pathways and infrastructure within the foreshore reserve, only those areas flagged by the surveyor will be cleared.
- Areas proposed for infrastructure and pathways will be clearly delineated on figures to reduce the area of clearing necessary for installation.

9.4.2.3 Revegetation and Weed Management

Appropriately qualified contractors will begin revegetation works, including weed management, in the areas depicted in Figure 15. Revegetation works are discussed further in Section 8.0.

9.4.2.4 Potential Disease Management

- All site contractors will employ hygienic practices if moving into the foreshore reserve. Vehicles, machinery and equipment are to be free of mud, soil and "hitchhikers" (invasive species that are introduced through transportation from one site to another) when arriving at the site. There is a reduced need for cleaning if operations are completed in dry soil conditions. Cleaning will also be easier, and have a lower risk of spreading Phytophthora Dieback if it is completed at an offsite depot. However, if clean-down is to occur on the site, the following management should be employed
  - Park vehicles and machinery on cleared land only, away from the foreshore reserve.
  - Minimise the use of water, and firstly attempt to remove mud and soil with a brush.
  - Wash-down if required should occur on a hard, well-drained surface, well away from the foreshore reserve.
- Employ hygienic practices. Vehicles, machinery and equipment to be free of mud and soil when arriving at a site.
- All plants used on site for revegetation will be certified dieback and weed free.

9.4.2.5 Fire Management

- All flammable materials will be stored appropriately and away from the foreshore reserve and other potential ignition sources.
- All machinery used on site should comply with relevant fire safety standards.
- The construction site should have appropriate fire-fighting equipment in accordance with the requirements of the Western Australian Fire Protection Regulations.
- Where possible, clearing work as part of the proposed development and as part of pathway and infrastructure installation within the foreshore should be avoided during high fire risk conditions (i.e. hot, dry and windy). If work operations occur in high fire risk areas and conditions, appropriate equipment, such as earthmoving machinery and water trucks will be on standby for fire control if required.

- Smoking should only be permitted in designated smoking areas (in the civil compound) away from the foreshore reserve. Cigarette butts should be disposed of in a provided purpose specific bins.

- Site supervisors shall be aware of contact details for the nearest emergency services, including fire, ambulance and police.

- Prevent unauthorised third party access on the development site during the clearing and development phases of the project.

9.4.3 Post-works

9.4.3.1 Revegetation

Revegetation and weed management will be undertaken for five years after construction. Revegetation monitoring is discussed further in Section 8.0.

9.4.4 Vegetation Management Summary

Table 17: Vegetation Management Summary

Issue	Description	Responsibility
Pre-works		
Flagging	▪ To avoid accidental clearing from adjacent construction activities and prevent unauthorised access, the foreshore reserve will be surveyed and flagged ▪ Proposed pathways within the reserve will be surveyed and flagged to reduce the risk of vegetation clearing during works	Lend Lease
During Works		
Revegetation and weed control	▪ Revegetation and weed control within the foreshore area will be undertaken where required	Lend Lease
Access	▪ Construction personnel access will be restricted to the construction area and not permitted entry into the foreshore reserve except for installation of any pathways or infrastructure ▪ During development, areas for parking, storage, rubbish disposal and smoking should be clearly demarcated and located as far from the foreshore reserve as practical.	Lend Lease
Fencing	▪ Fencing will be installed ▪ Contractors will inspect fencing and repair any damage	Lend Lease
Clearing	▪ Cleared material will be stockpiled for use as mulch or brush in rehabilitation works. ▪ Stockpiles will be located in a cleared area. ▪ Areas proposed for infrastructure and pathways will be clearly flagged and delineated on figures to reduce the area of clearing necessary for installation.	Lend Lease Contractors

Issue	Description	Responsibility
Disease	▪ Hygienic practices will be undertaken by all site contractors ▪ Plants used on site for revegetation works will be certified weed and dieback free	Lend Lease
Fire Management	▪ All flammable materials will be stored away from the foreshore reserve ▪ All machinery used on site should comply with relevant fire safety standards ▪ The construction site will have appropriate fire-fighting equipment ▪ Where possible, clearing work as part of the proposed development and as part of pathway and infrastructure installation within the foreshore should be avoided during high fire risk conditions ▪ Smoking will only be permitted in designated smoking areas away from the foreshore reserve. ▪ Site supervisors shall be aware of contact details for the nearest emergency services ▪ A Fire Management Plan will be prepared for the site	Lend Lease
Post-works		
Fencing	▪ The foreshore boundary will be fenced.	Lend Lease
Revegetation	▪ Revegetation and weed management will be undertaken for five years after construction	Lend Lease

9.5 Fauna Management

Management Objectives

- Maintain the abundance, diversity, geographic distribution and productivity of fauna species through the avoidance or management of adverse impacts (where reasonably practicable).
- Comply with state and Commonwealth legislation applicable to fauna.
- Prevent the introduction and spread of invasive fauna species into the foreshore reserve.

Potential Impacts

Construction of access paths and beach infrastructure may result in the injury or death of fauna within the foreshore reserve, mostly likely as a result of vehicular movements. Additional causes of death or injury of fauna may be changes in abundance and competition for resources, increase in the population of feral predators due to the adjacent residential development (e.g. cats) and loss of habitat.

The development of Alkimos Beach will result in the clearing and fragmentation of habitats in residential areas adjacent to the foreshore reserve. This loss of habitat in will increase the importance of the foreshore reserve as a fauna corridor and refuge.

Fragments of native vegetation within urban areas often attract new species both native and / or introduced. This may result in changes in the species composition and the spread of invasive species within the foreshore reserve.

Infrastructure and pathways in the foreshore have been designed to avoid any significant habitat and consequently significant species and habitat within the foreshore reserve is unlikely to be impacted.

9.5.1 Pre-works

Fauna Surveys have previously been undertaken by Alan Tingay and Associates (1996) and Thompson (2005). This data has also been reviewed by Mike Bamford.

Significant habitat surveys and mapping has been undertaken to identify significant habitat such as potential black cockatoo.

9.5.2 During Works

9.5.2.1 Fauna Injury

Impacts to fauna are likely to be low as minimal infrastructure is proposed for the foreshore area. However, any potential impacts will be managed through undertaking all works in accordance with the Vegetation and Fauna Management Plan (RPS 2012).

9.5.2.2 Habitat Loss

Revegetation of areas that are currently eroded and which will not be included in the infrastructure development within the foreshore reserve.

Where practical, paths will have natural surfaces to enable fauna movement across the path.

Appropriately qualified contractors will start the rehabilitation of degraded areas within the foreshore reserve in accordance with Section 8.

9.5.2.3 Introduced Species

Contractors engaged to construct paths and other beach infrastructure, and to undertake revegetation works in the foreshore reserve will be required to ensure that all vehicles on site are cleaned and checked for any dirt or vegetation that may contain weeds or disease.

9.5.3 Post-works

Signage to the CoW specification would be provided along access tracks including warning people against trespassing and accessing the closed tracks. .

9.5.4 Fauna Management Summary

Table 18: Fauna Management Summary

Issue	Description	Responsibility
Pre-works		
Surveys	▪ Significant habitat surveys have been undertaken within the foreshore reserve to ensure this habitat is not impacted by proposed paths and infrastructure	No further action
During Works		
Fauna injury	▪ Fauna injury will be prevented through undertaking all clearing and construction activities in accordance with the Vegetation and Fauna Management Plan.	Lend Lease
Habitat loss	▪ Areas proposed for clearing will be clearly marked on figures and flagged on site ▪ Revegetation and weed management will be undertaken to improve and protect habitat quality	Lend Lease
Paths	▪ Paths will have a natural surface to enable fauna movement across	Lend Lease
Introduced species	▪ All materials and machinery bough on site will be weed free	
Post-works		
Introduced species	▪ Residents in the area will be educated on controlling their pets, especially cats.	Lend Lease

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10.0 IMPLEMENTATION

10.1 Timing

The development partners of Alkimos Beach plans to implement the proposed foreshore works at the earliest opportunity, to ensure current and future residents are provided with beach access for the 2015 summer periods. In this regard, the following implementation approach is contemplated:

- The foreshore perimeter to be fenced and southern pedestrian access path to be implemented as soon as possible.

- After securely fencing the foreshore and provided a means of controlled access, remaining works and rehabilitation tasks will be undertaken over the remainder of the foreshore area. These works will also be implemented within a short time frame, to ensure convenient and controlled vehicle access is available through this relatively wide foreshore area.

10.2 Implementation and Management Responsibilities

All foreshore access and community infrastructure works will be undertaken by the proponent, and then maintained for a period of five years after practical completion, before being handed over to the CoW to manage. Handover requirements with regard to asset standard and the transfer of as-constructed drawings and asset management data will also apply.

Life cycle/asset management indicative cost estimate for the works proposed in this FMP have been provided using the City's asset template in Appendix 4. This template can be updated once the City has the final construction drawings. Prior to the City accepting handover of any reserved land upon which works are approved and constructed, either the City or the state may (having regard to the life cycle/asset management costings of those works) will review the implementation of the works.

Implementation and management responsibilities for the South Alkimos foreshore area are detailed in Table 1.

The foreshore land (zoned as "Parks and Recreation") will be transferred to the state as agreed by LandCorp with the WAPC.

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11.0 COMPLETION CRITERIA

11.1 Infrastructure

Handover of all infrastructure within the foreshore reserve will be in accordance with the CoW's Local Planning Policy 4.3 – Public Open Space that details that:

- The POS is in a healthy, functioning condition at completion of the five year developer maintenance period.
- The standard of POS completion is acceptable to the CoW at completion of the developer maintenance period, with any issues fixed prior to handover.
- The annual review process will ensure that the POS is being maintained to the standard expected by the City.

11.2 Vegetation

The completion criteria for revegetation within the foreshore are provided in Section 10. On handover to the City, a report detailing revegetation areas, existing vegetation and species diversity, coverage and condition will be presented.

A handover meeting will be undertaken with the CoW to confirm that all criteria are met.

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12.0 REFERENCES

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FIGURES

38 Station Steet, Subiaco | T +61 8 92111111 | F +61 8 92111122 | www.rpsgroup.com.au

LEGEND

- Alkimos Beach LSP Boundary
- Foreshore Reserve

Foreshore Management Areas

- Area 1
- Area 2

RPS

Job Number: L12036
Doc Number: 001 - Figures L12036
Date: 27.11.13
Scale: 1:20,000 @ A3
Drafted by: MA
Source: Orthophoto - Landgate, 2013 StreetSmart, 2008

Figure 1

Site Location

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LEGEND

Structure Plan Area

Reserves

- Public Use - (PS) Primary School
- Regional Parks & Recreation (Foreshore Reserve)
- Village 1 Boundary
- Conservation POS
- Active POS

Zones

- Residential
- Commercial
- Mixed Use

Other

- Indicative STS Route
- Precinct Boundary
- Social / Pedestrian / Cycle Linkage
- Indicative Foreshore Pedestrian and Cycle Link (as per Alkimos-Eglinton District Structure Plan)

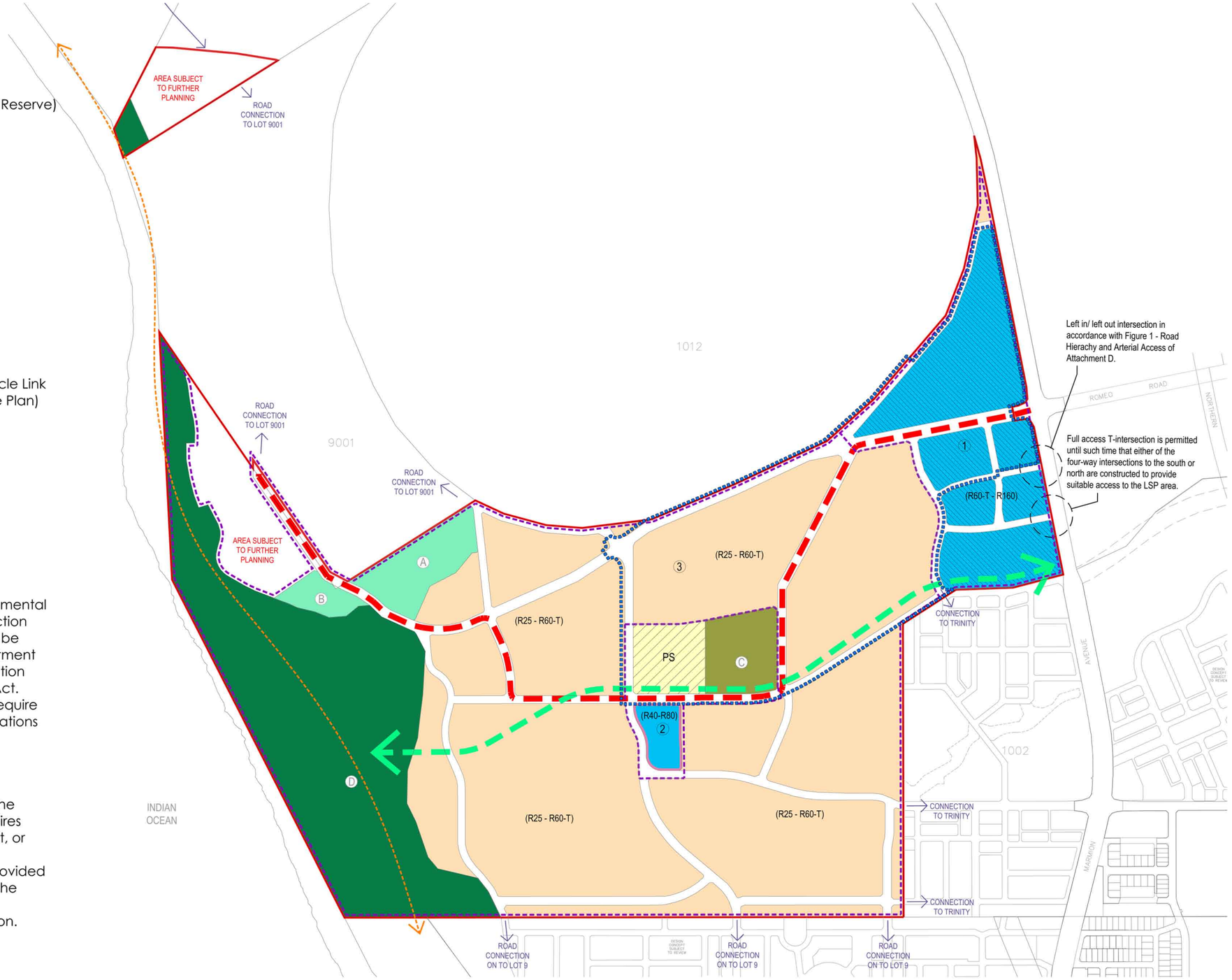
Precincts

- (1) Gateway
- (2) Central Village
- (3) Residential
- (A) Strategic Public Open Space - Refer to Table 3 of Part 1 - Statutory Section

NOTES:

1. Areas identified as being of National Environmental Significance under the Environmental Protection and Biodiversity Conservation Act 1999 may be subject to assessment by the Federal Department of Sustainability, Environment, Water, Population and Communities, in accordance with this Act. The outcome of any such assessment may require either a modification to the LSP or minor variations from the LSP at the subdivision and/or development stage.

2. The clearing of habitat such as Lomandra hermaphrodita and Maritima that includes the taking of individual Graceful Sun Moths requires the permission of the Minister for Environment, or their delegate, pursuant to the Wildlife Conservation Act 1950. Evidence is to be provided to the WAPC at the time of subdivision that the licence (if required) has been issued by the Department of Environment and Conservation.



RPS

Job Number: L12036
Doc Number: 002 - Figures L12036
Date: 09.07.14
Scale: NTS @ A3 Coordinate System : Perth Coastal Grid 94 (PCG94)
Drafted by: MA
Source: Roberts Day Ref No: DLL ALK, Dwg No: RD1 008 Rev F

0 50 100 200 300 400 m

Figure 2

Alkimos Beach Local Structure Plan

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LEGEND

- Foreshore Management Plan Boundary (Alkimos Beach Area 1, 33.7ha)
- Indicative Fenced Dual Use Pathway & Emergency Vehicle Access (Red asphalt, 3.0m wide)
- Fenced Vehicle Access Road (Asphalt, 6.0m wide with 2.4m wide pedestrian path to one side)
- Fenced Pedestrian and Emergency Vehicle Access Road (emulsion stabilised limestone, 3.0m wide)
- Surf Lifesaving WA (SLSWA) Interim Facility for Mobile Beach Patrols at Alkimos Regional Beach
- Vegetation Rehabilitation Areas
- Hardstand for Interim Surf Lifesaving WA (SLSWA) Facilities
- Pedestrian Lookouts
- Car Parking Area
- Replacement Car Park Outside 100 year Coastal Process Line
- 50 Year Coastal Process Line
- 100 Year Coastal Process Line
- Karli Spring

N

STAGE 2
(SUBJECT TO SEPARATE FMP)

'SUBJECT TO SEPARATE PLANNING PROCESS'

ALKIMOS BEACH

RPS

Job Number: L12036
Doc Number: 025 - Figures L12036
Date: 27.10.15
Scale: 1: NTS @ A3
Created by: MR
Source: Concept Plan - DLL ALK RD1 177G (RD 2015).

Figure 3

Foreshore Concept Plan

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LEGEND

- Cadastre
- Alkimos Beach LSP Boundary
- Foreshore Reserve

Foreshore Management Areas

- Area 1
- Area 2

Metropolitan Regional Scheme

- Urban
- Urban Deferred
- Central City Area
- Parks and Recreation
- WSD Public Purposes - Water Authority of WA
- Railway
- Other Regional Road

RPS

Job Number: L12036
Doc Number: 003 - Figures L12036
Date: 27.11.13
Scale: 1: 10,000 @ A3
Drafted by: MA
Source: Orthophoto, MRS, Cadastre - Landgate, 2013

0 62.5 125 250 375 500 metres

Figure 4

MRS Zoning

Legend

Foreshore Reserve

20 Year Physical Processes Line

42 Year Physical Processes Line

50 Year Physical Processes Line

75 Year Physical Processes Line

100 Year Physical Processes Line

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RPS

Job Number: L12036
Doc Number: 013 - Figures L12036
Date: 09.07.14
Scale: 1: NTS @ A3
Created by: MA
Source: Setback Plan - MP Rogers, 2013.

Figure 5

Coastal Setback Assessment

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LEGEND

Contours (mAHD)

Cadastre

Alkimos Beach LSP Boundary

Foreshore Reserve

Foreshore Management Plan

Area 1 (33.77 ha)

Area 2 (8.16 ha)

Area 2
0.76 ha

Area 2
7.4 ha

Area 1
33.77 ha

9003 9002 9001 1012 15450 3052

Job Number: L12036
Doc Number 006 - Figures L12036
Date: 27.11.13
Scale: 1: 6,000 @ A3
Drafted by: MA
Source: Cadastre, Contours - Landgate, 2012. Orthophoto - Landgate, 2013 Survey- RPS 2012.

0 25 50 100 150 200 m

RPS

Figure 6

Topography

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LEGEND

Alkimos Beach LSP Boundary

Foreshore Reserve

Foreshore Management Plan

Area 1 (33.77 ha)

Area 2 (8.16 ha)

9003
9002
211Qu__Q1
211Sp__Kls
211Qu__Qp
211Qu__Qs
1012
9001
15450
211QuU_BEACH
211Qu__Q3
211Qu__Q4
3052
9

Landforms

211Qu__Q1 - Quindalup Oldest Dune Phase - Calcareous sands with organic staining to about 30cm, overlying pale brown sand with definite cementation below 1m

211Qu__Q2 - Quindalup Second Dune Phase - Calcareous sands with organic staining to about 20cm, passing into pale brown sand, some cementation below 1m

211Qu__Q3 - Quindalup Third Dune Phase - Loose calcareous sand with little surface organic staining and incipient cementation at depth

211Qu__Q4 - Quindalup Youngest Dune Phase - Loose pale brown calcareous sand with no soil profile development

211Qu__Qp - Quindalup Deep Sand Flat Phase - Dark grey-brown sand to about 50 cm and then pale brown sand

211Qu__Qs - Quindalup Shallow Sand Flat Phase - Shallow calcareous sands over limestone

211Sp__Kls - Karrakatta Shallow Soils Phase - Bare rock, yellow/brown shallow sands and stony soils

211Sp__Ky - Karrakatta Sand Yellow Phase - Yellow deep sands

211QuU_Beach

RPS

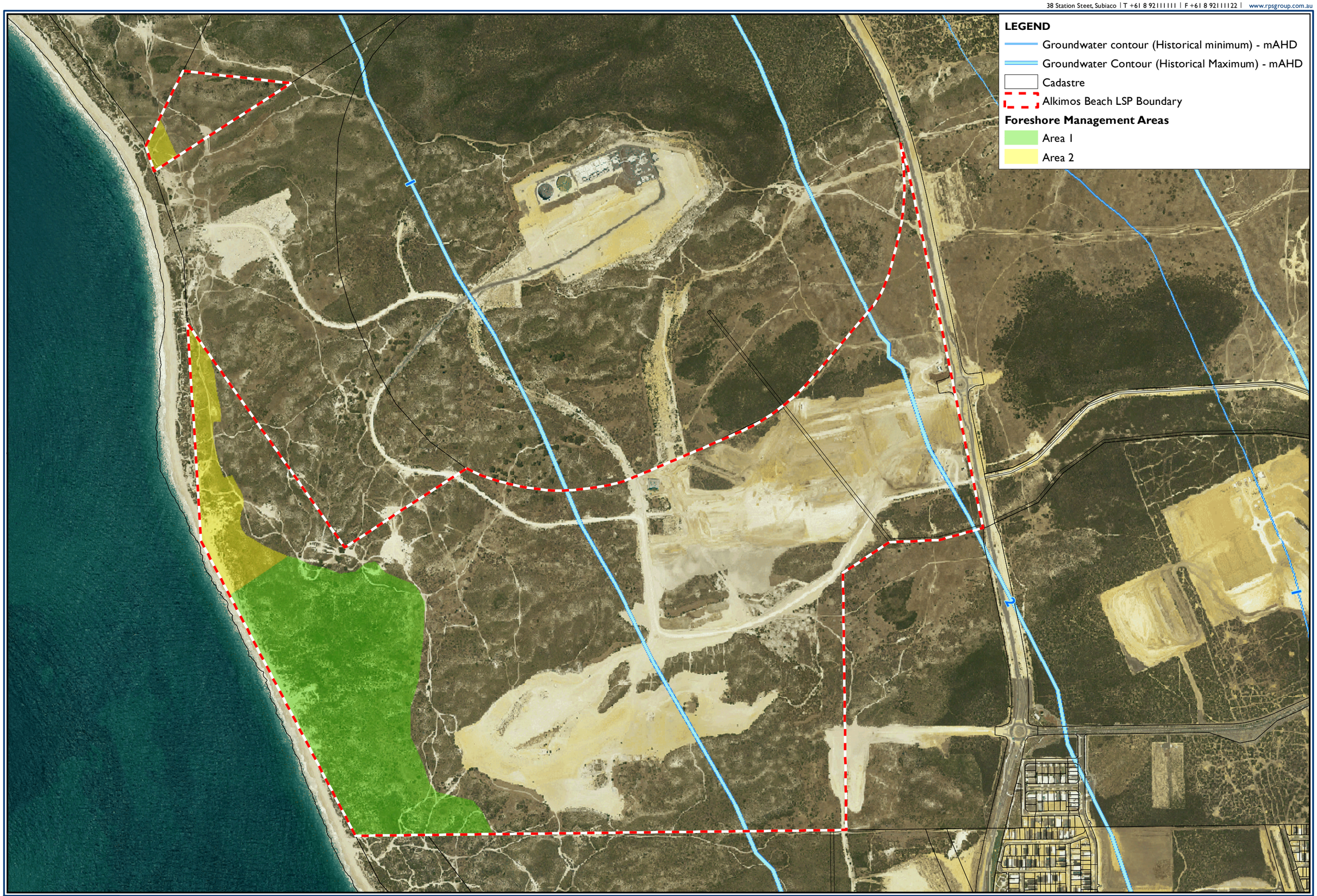
Job Number: L12036
Doc Number 007 - Figures L12036
Date: 11.08.15
Scale: 1: 6,000 @ A3
Drafted by: MA
Source: Cadastre, Soils - Landgate, 2012. Orthophoto - Landgate, 2013. Preliminary Road Grading - Cossill and Webley 24.08.2012

0 25 50 100 150 200 m

Figure 7

Geology

38 Station Steet, Subiaco | T +61 8 92111111 | F +61 8 92111122 | www.rpsgroup.com.au



RPS

Job Number: L12036
Doc Number: 008 - Figures L12036
Date: 11.08.15
Scale: 1: 10,000 @ A3
Drafted by: MR
Source: Orthophoto, Cadastre - Landgate, 2013 Groundwater Contours - DoW, 2006

0 62.5 125 250 375 500 metres

Figure 8

Groundwater Contours

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Vegetation Type

- Ap - *Acanthocarpus preissii, Hemiandra pungens* Low Open Heath
- Ar - *Acacia rostellifera* Closed Scrub/Heath/Low Closed Forest
- ArAs - *Acacia rostellifera, Acacia saligna* Open shrubland
- ArMs - *Acacia rostellifera, Melaleuca systena* Low Open Heath
- AsJf - *Acacia saligna and Jacksonia furcellata* Open Scrub
- AsMs - *Acacia saligna, Melaleuca systena* Shrubland
- Ba - *Banksia attenuata Low Woodland*
- BaXp - *Banksia attenuata* Low Woodland over *Xanthorrhoea preissii*
- C - Cleared
- Ds - *Dryandra sessilis* Open to Closed Heath
- DsCqAp - *Dryandra sessilis, Calothamnus quadrifidus, Acacia pulchella* Closed Heath
- DsCqMs - *Dryandra sessilis, Calothamnus quadrifidus, Melaleuca systena* Closed Heath
- Eg - *Eucalyptus gomphocephala* (Tuart) Open Woodland to Woodland over *Banksia attenuata, Acacia saligna*, *Xanthorrhoea preissii*
- EgMs - *Eucalyptus gomphocephala* (Tuart) Open Woodland to Woodland over *Melaleuca systena*
- EtBaBm - *Eucalyptus todtiana, Banksia attenuata, B. menziesii* Low Open Woodland
- MhMsAt - *Melaleuca heugelii, Melaleuca systena, Acacia truncata* Low Open Heath
- Ms - *Melaleuca systena* Low Shrubland to Shrubland
- MsLm - *Melaleuca systena, Lomandra maritima* Low Open Heath
- SgMsLm - *Spyridium globulosum, Melaleuca systena, Lomandra maritima* Low Open Heath

RPS

Job Number: L12036
Doc Number 009 - Figures L12036
Date: 27.11.13
Scale: 1: 6,000 @ A3
Drafted by: MA
Source: Cadastre - Landgate, 2012. Orthophoto - Landgate, 2013

0 25 50 100 150 200 m

Figure 9

Vegetation Associations

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RPS

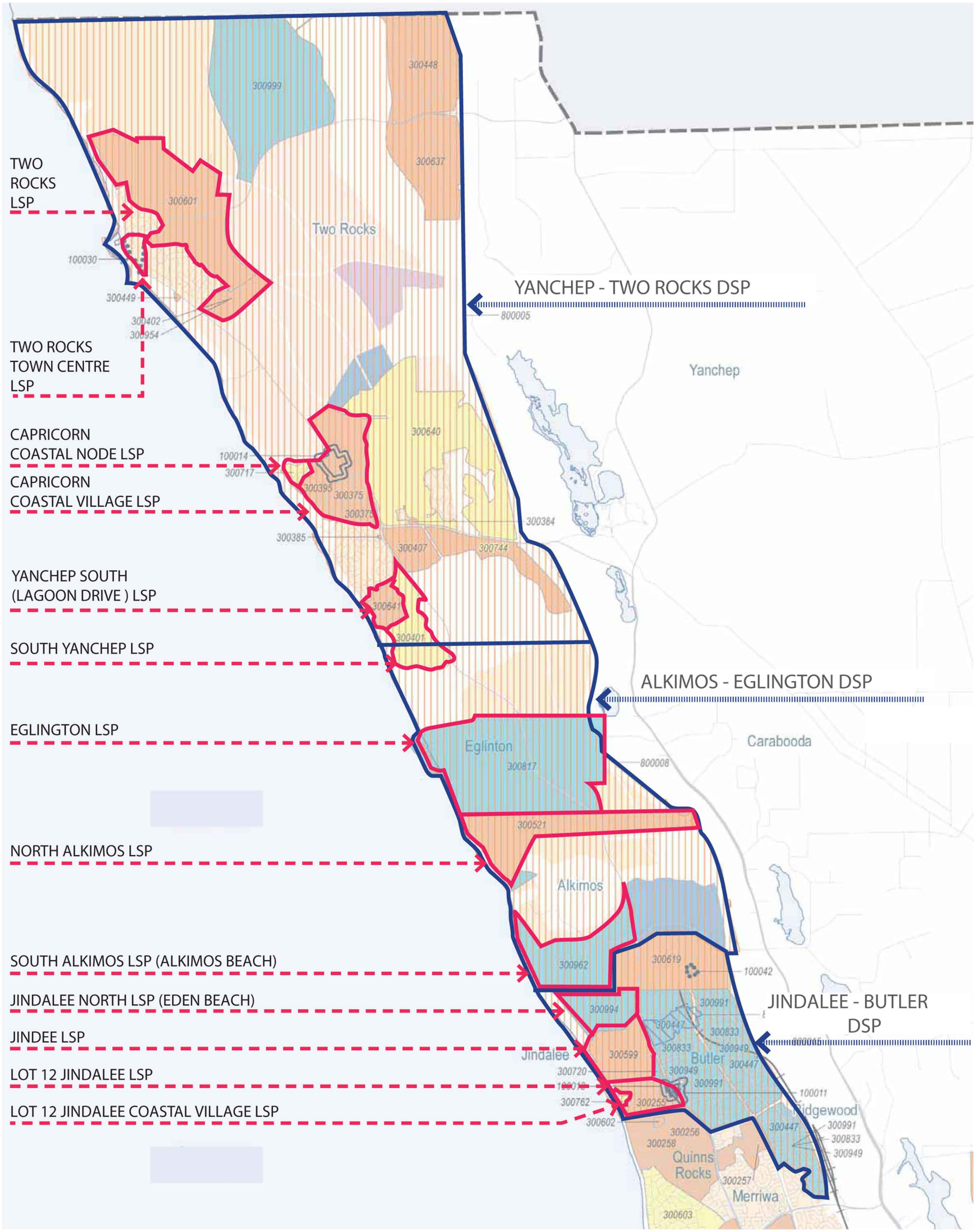
Job Number: L12036
Doc Number 010 - Figures L12036
Date: 11.08.15
Scale: 1: 6,000 @ A3
Drafted by: MR
Source: Cadastre - Landgate, 2012. Orthophoto - Landgate, 2013

0 25 50 100 150 200 m

Figure 10

Vegetation Condition

38 Station Street, Subiaco | T +61 8 9211111 | F +61 8 9211122 | www.rpsgroup.com.au

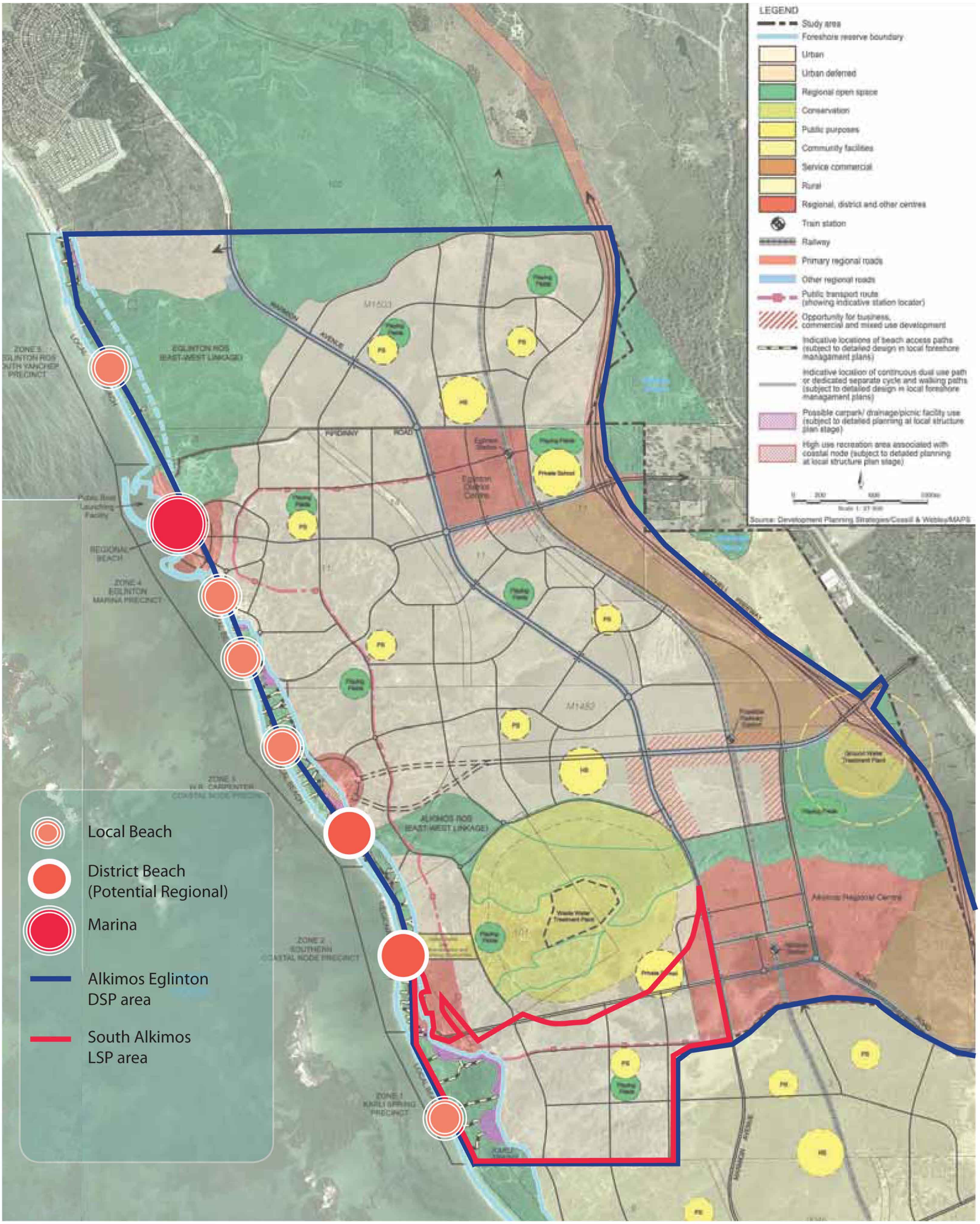


Job Number: L12036
Doc Number: 014 - Figures L12036
Date: 09.07.14
Scale: NTS @ A3
Created by: MA
Source: District and Local Structure Plan Areas - WAPC, 2012.

Figure 11

District and Local Structure Plan Areas

38 Station Street, Subiaco | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au



RPS

Job Number: L12036
Doc Number: 016 - Figures L12036
Date: 09.07.14
Scale: NTS @ A3
Created by: MA
Source: Alkimos Eglington Coastal Strategy - RPS BBG, 2006.

Figure 12

Beach Hierarchy Plan

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LEGEND

- Karli Spring
- Pedestrian Lookout
- SLSWA Interim Facility for Mobile Beach Patrols at Alkimos Regional Beach
- Dog Walking Beach
- Indicative Fenced Emergency Vehicle Maintenance and Access Track (Compacted crushed limestone, 3.0 m wide with 5.0 m wide passing nodes at selected locations)
- Indicative Fenced Dual Use Pathway and Emergency Vehicle Access (Red asphalt, 3.0 m wide)
- Fenced Pedestrian and Emergency Vehicle Access Road (emulsion stabilised limestone, 3.0 m wide)
- Fenced Vehicle Access Road (Asphalt, 6.0 m wide with 2.4 m wide pedestrial path to one side)
- Car Parking Area
- Replacement Car Park Outside 100 Year Coastal Process Line
- Foreshore Management Plan Boundary (Alkimos Beach Area 1, 33.7 ha)
- Vegetation Rehabilitation Areas

Coastal Vulnerability Lines

- 20 Year Physical Processes Line
- 42 Year Physical Processes Line
- 50 Year Physical Processes Line
- 75 Year Physical Processes Line
- 100 Year Physical Processes Line

9002

15450

3052

9

RPS

Job Number: L12036
Doc Number: 026 - Figures L12036
Date: 28.10.15
Scale: NTS @ A3
Created by: MA
Source: RPS 2015

0 12.5 25 50 75 100 m

Figure 13

Coastal Hazard Risk

RPS

APPENDIX 1

Ministerial Conditions for MRS Amendment of Alkimos Eglinton

file copy.

(AH)

163488 APR27'06 09:51

APPEALS CONVENOR
ENVIRONMENTAL PROTECTION ACT 1986

GENERAL MANAGER
LANDCORP

ALKIMOS-EGLINTON MRS AMENDMENT No. 1029/33
(Assessment No. 1365)

The Minister for the Environment has issued a statement setting out the environmental conditions to which the above planning scheme should be subject if it is to be implemented.

As required under section 48F(2) of the *Environmental Protection Act 1986* and at the request of the Minister for the Environment, I now provide you with a copy of that statement.

Darren Walsh
APPEALS CONVENOR

Att

24 APR 2006

13th FLOOR, ALLENDALE SQUARE, 77 ST. GEORGE'S TERRACE, PERTH WA 6000
TEL: (08) 9221 8711 FAX: (08) 9221 8244
Email: appeals@environment.wa.gov.au Website: www.appealsconvenor.wa.gov.au

Hon Mark McGowan MLA
Minister for the Environment;
Racing and Gaming

197 St George's Terrace, Perth WESTERN AUSTRALIA 6000
Telephone: (+61 8) 9222 9111 Facsimile: (+61 8) 9222 9410
Email: mark.mcgowan@dpc.wa.gov.au • Website: www.ministers.wa.gov.au/mcgowan/

Statement No.

STATEMENT THAT A SCHEME MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF DIVISION 3 OF PART IV OF THE ENVIRONMENTAL PROTECTION ACT 1986)

ALKIMOS-EGLINTON METROPOLITAN REGION SCHEME AMENDMENT 1029/33

Scheme Purpose: To amend reservations and zonings in the Metropolitan Region Scheme consistent with the Alkimos-Eglinton Structure Plan.

Responsible Authority: Western Australian Planning Commission

Responsible Authority Address: 469 Wellington Street, PERTH WA 6000

Assessment Number: 1365

Report of the Environmental Protection Authority: Bulletin 1207

Subject to the following conditions, there is no known environmental reason why the amendment to the Metropolitan Region Scheme to which the above report of the Environmental Protection Authority relates should not be implemented:

1 **Additional Land to be Reserved**

1-1 All or portions of the following sites shall be reserved, in accordance with the requirements set out in Attachment 1 of the Minister for the Environment's "Statement that a Scheme may be Implemented" No. (insert number) published on (date):

1) Public Purpose reserve surrounding the Wastewater Treatment Plant;
2) Parks and Recreation Reserve north of Ningana Bushland;
3) Parks and Recreation Reserves south of Ningana Bushland;

Published on

24 APR 2006

4) Parks and Recreation Reserve north of the Waste Water Treatment Plant;
5) Town park immediately north of the Alkimos Regional Centre;
6) Rationalisation and reductions to the coastal foreshore Regional Open Space reservation; and,
7) East-west parabolic dune linkage.

2 Environmental Management Plans

2-1 Prior to approving subdivision or development applications (whichever is sooner) for infrastructure proposals, the Western Australian Planning Commission or local government, as the case requires, may require an Environmental Management Plan to be prepared and implemented to achieve the objective of managing the potential impacts of the proposed subdivision, development or infrastructure on the following:

1) land which is reserved as Regional Open Space in the Scheme; and,

2) bushland or land that may be part of an ecological linkage.

The Environmental Management Plan shall include:

1) a description of existing environmental values, and the identification of the environmental outcome to be achieved through the implementation of this plan;

2) clear delineation of boundaries or significant areas to be protected;

3) management of construction, access and rehabilitation;

4) vegetation mitigation strategies;

5) allocation of responsibilities and identification of timing and duration of implementation;

6) provision for routine monitoring and environmental values; and

7) provision of details of contingency plans in the event that the monitoring surveys indicate that the development is having or has had an adverse impact upon environmental values.

2-2 An Environmental Management Plan prepared pursuant to condition 2-1 shall be prepared to the satisfaction of the WAPC or the local authority as required, having due regard for advice from relevant government agencies and shall be implemented in accordance with a program defined in the Environmental Management Plan.

3 **Areas of Public Purpose Reservation to be protected for conservation purposes**

3-1 Portions of the Public Purpose reservation for the Wastewater Treatment Plant shall be set aside and managed for conservation purposes in accordance with the requirements set out in Attachment 1 of the Minister for the Environment's "Statement that a Scheme may be implemented" No. (insert number) published on (date):

4 **Lifting of Urban Deferment – Wastewater Treatment Plant Buffer**

4-1 Lifting of Urban Deferment within the southern portion of the Wastewater Treatment Plant Buffer shall not occur unless it is demonstrated to the requirements of the Environmental Protection Authority that the area within which Urban Deferment is to be lifted is not subject to odour at a level likely to cause adverse impacts on the amenity of odour sensitive land uses.

5 **Development within areas reserved for Parks and Recreation**

5-1 With the exception of the areas specified in condition 5-2, all land reserved for Parks and Recreation shall be managed to protect the integrity, function and environmental values of the bushland and landforms to the requirements of the Western Australian Planning Commission on the advice of the Environmental Protection Authority and shall only be used for conservation, landscape and complimentary purposes.

5-2 A maximum of 25 percent of the area of the land to be reserved for Parks and Recreation identified as Areas 6a and 6b on the attached Figure may be developed for Parks and Recreation purposes in accordance with an Environmental Management Plan prepared to the requirements of the Environmental Protection Authority.

HON MARK McGOWAN MLA
MINISTER FOR THE ENVIRONMENT;
RACING AND GAMING

24 APR 2006

STATEMENT THAT A SCHEME MAY BE IMPLEMENTED – METROPOLITAN REGION SCHEME AMENDMENT 1029/33

SPECIFICATIONS FOR RESERVATION FOR THE WASTE WATER TREATMENT PLANT AND ADDITIONAL LAND TO BE RESERVED

1 Additional Land to be Reserved

Prior to finalisation of the scheme the following land shall be reserved:

1-1 Public Purpose Reserve surrounding the Wastewater Treatment Plant

Land surrounding the Wastewater Treatment Plant as detailed in the attached Figure shall be reserved for Public Purposes to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for complementary purposes.

1-2 Parks and Recreation Reserve north of Ningana Bushland

A portion of Lot M1503 (Area 1b as detailed in the attached Figure), Eglinton shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation, landscape and complementary purposes.

1-3 Parks and Recreation Reserve south of Ningana Bushland

A portion of Lot M1503, Eglinton (Area 2b as detailed in the attached Figure) shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation, landscape and complementary purposes.

1-4 Parks and Recreation Reserve south of Ningana Bushland

A portion of Lots M1503 and 11, Eglinton (Area 3a as detailed in attached Figure) shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation, landscape and complementary purposes.

1-5 Parks and Recreation Reserve north of the Waste Water Treatment Plant

A portion of Lots M1482 and 102, Alkimos (Areas 5a and 5d as detailed in attached Figure) shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland to the requirements of the Western Australian Planning Commission on advice of the

Environmental Protection Authority, and shall only be used for conservation, landscape and complementary purposes.

1-6 **Town Park immediately north of the Alkimos Regional Centre**

A portion of Lot 102, Alkimos (Areas 6b and 6c as detailed in attached Figure) shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation, landscape and complementary purposes.

1-7 **Rationalisation and reductions to the coastal foreshore Regional Open Space reservation**

A portion of Lot 102, Alkimos (Area 7c as detailed in attached Figure) shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation, landscape and complementary purposes.

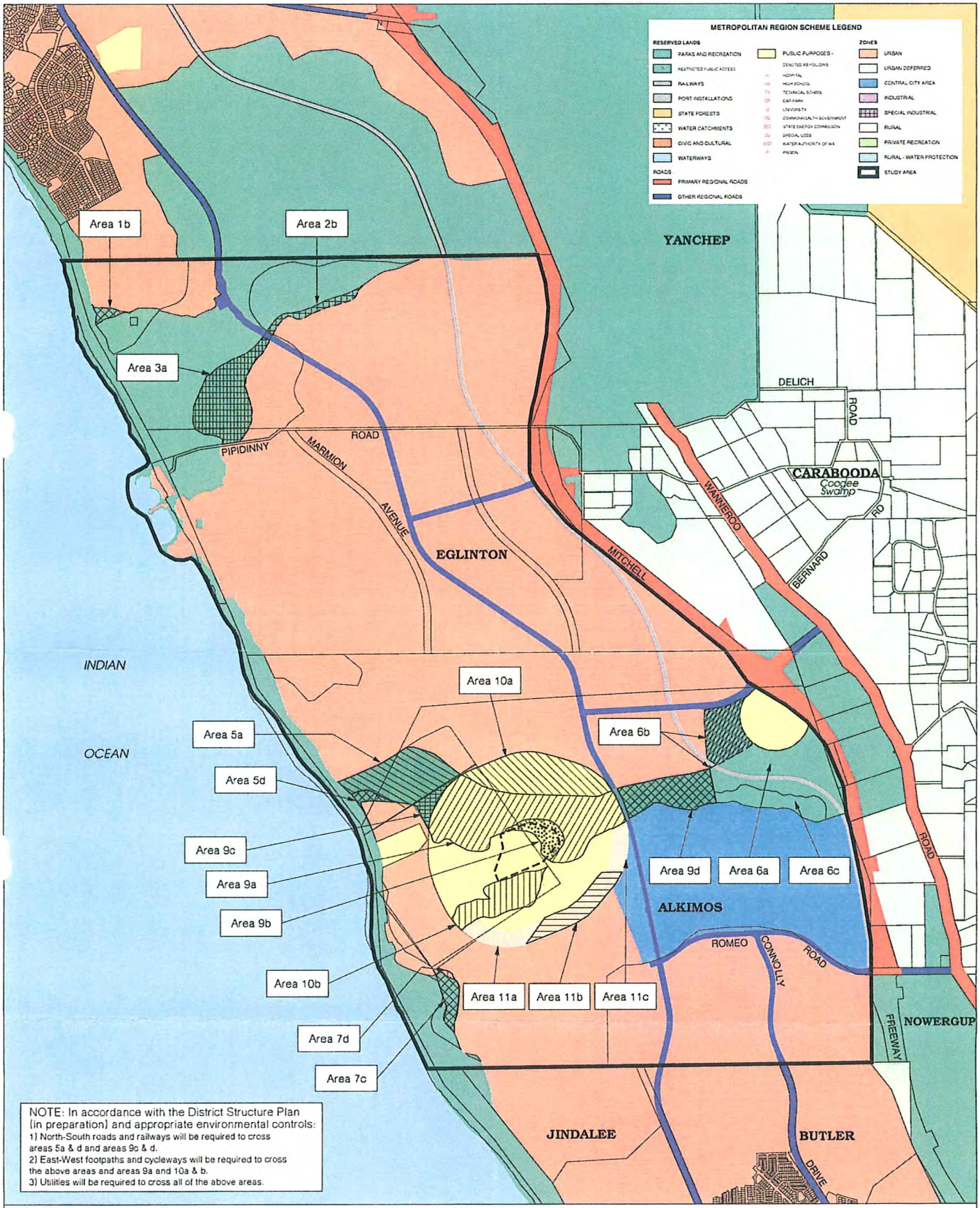
1-8 **East-west parabolic dune linkage**

A portion of Lots 101 and 102, Alkimos (Areas 9c and 9d as detailed in attached Figure) shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation, landscape and complementary purposes.

2 **Areas of Public Purpose reservation to be protected for conservation purposes**

2-1 **Portions of Lots 101 & 102, Alkimos to be reserved for Public Purposes**

(Areas 9a, 10a and 10b in the attached Figure) shall be protected and managed for conservation purposes to protect the integrity, function and environmental value of the bushland to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation, landscape and complementary purposes. Minor infrastructure may be installed within these areas, providing the work is undertaken in accordance with a Management Plan approved by the Environmental Protection Authority



Western Australian Planning Commission

GDA

MRS AMENDMENT 1029/33 ALKIMOS-EGLINTON
As determined by Minister for the Environment

N

1.5 km 0 1.5 km

SCALE 1:30000

Base information supplied by DLI PA 23-2003
mindeterm.dgn
20 Apr 2006
Produced by Statutory Mapping Section, Spatial Information & Research - Mapping & GeoSpatial Data.
Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth WA

RPS

APPENDIX 2

Commonwealth Department of the Environment Approval

Australian Government

Department of the Environment

Our reference: 2013/09699

Mr Martin Gaedke
Regional Development Manager - WA
Lend Lease Communities (Australia)
Level 2, 10 Ord Street
WEST PERTH WA 6005

Dear Mr Gaedke

Urban Development – Lot 1004, 80L Romeo Road and 2611 Marmion Avenue, Alkimos, WA (EPBC 2011/5902)

I refer to your email of 18 March 2014 to Sam Wagstaff requesting approval of three management plans required under conditions 10, 11 and 12 of the approval decision for EPBC 2011/5902 dated 30 June 2012.

The plans have been reviewed by officers of the Department and have been found to meet the requirements of their respective conditions of approval. On this basis and as delegate of the Minister for the Environment I have decided to approve the following plans:

- Conservation Area Management Plan (Rev 1)
- Foreshore Management Plan (Rev 3)
- Precinct Landscape and Revegetation Management Plan (Version 3)

The approved plans must now be implemented.

In accordance with EPBC 2011/5902 condition 4, if the approval holder wants to act other than in accordance with the approved plans, the approval holder must submit a revised plan/s for approval. Until the Minister (or the Minister's delegate) has approved a revised plan/s, the approved version of the plans must continue to be implemented.

If you have any enquiries please contact Sam Wagstaff on 02 6274 2741.

Yours sincerely

S. Gaddes

Shane Gaddes
Assistant Secretary
Compliance & Enforcement Branch
Environment Assessment and Compliance Division

8 April 2014

RPS

APPENDIX 3

Alkimos Beach Foreshore Facilities Plan

100 YR

50 YR

20 YR

ALKIMOS BEACH ESTATE

Beach Shower and Footwasher

Precedent - Mullaloo Dune Lookout

Proposed - Recycled Plastic & FRP Grating

Conservation Area Management Plan (CAMP)

Foreshore Management Plan (FMP)

Dune fencing to council standard beach fence detail

WAPC Coastal erosion setback boundaries

Proposed tree planting
Melaleuca lanceolata

Dune lookout platform

Beach shower and foot washer

Rehabilitation to disturbed / cut and fill areas

Emulsion stabilised beach access path (3m wide)

Broomed concrete footpath (2.4m wide)

Red Asphalt Regional Shared Path (2.4m wide) / Road / Carpark

Date 06-08-2015 | Scale 1:3000 @ A3 | 1:1500 @ A1

0 50 100 150 200 250m

Alkimos Beach

Foreshore Facilities Plan - Development Application

AECOM

RPS

APPENDIX 4

City of Wanneroo Coastal Asset Template

Asset Type	Structural lifespan	Asset Value	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)
Paving Types							
P1: 3 m red asphalt path/ vehicle access road	35 years	$221,040	Med	Seal cracks (cost $11,052) every 10 years	As shown	30–50	Asset relocated east as required
P2(B): 3 m compacted limestone (emergency vehicle maintenance and access track)	15 years	$59,115	Med	Fill potholes and spot re-compact (cost $1,478) every five years	As shown	30–50+	Retreat from asset if required
P3: Path transition to beach (e.g. stairs, TBC)	20 years	$12,500	Low	Touch up / batten replacement, Spot fix chain corrosion (cost $620) every 10 years	Beach	10–30	Retreat from asset if required
Fence Type							
F1: City of Wanneroo coastal foreshore accessway fencing	25 years	$284,175	Med	Repair posts / restrain as required, Spot fix chain corrosion (cost $14,209) every five years	Edge of conservation zone and path edges	30–50+	Adjust asset as required (posts can be moved)
Furniture / Facilities							
Picnic tables	20 years	$5,500 ea.	Low	Touch up / batten replacement, graffiti removal (cost $55 each) annually	Behind Foredune	10–30	Move asset east if required (it is readily transportable) to behind the 100 year coastal processes line.
Seats	20 years	$2,601.73	Low	Touch up / batten replacement, graffiti removal (cost $26) annually	Behind Foredune	10–30	Move asset east if required (it is readily transportable) to behind the 100 year coastal processes line.
Bike racks	15 years	$500 ea.	Low	Touch up / graffiti removal (cost $15) annually	Behind Foredune	10–30	Move asset east if required (it is readily transportable)

Asset Type	Structural lifespan	Asset Value	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)
Beach shower and foot washer	15 years	$15,000	Low	Touch up / graffiti removal (cost $150) annually	Behind Foredune	10–30	Move asset east if required (it is readily transportable) to behind the 100 year coastal processes line.
Bubbler –drinking fountain	15 years	$5000	Low	Touch up corrosion /graffiti removal (cost $50) annually	Behind Foredune	10–30	Move asset east if required (it is readily transportable) to behind the 100 year coastal processes line.
Rubbish bins	20 years	$2,500	Low	Cleaning (cost $25) annually	Behind Foredune	10–30	Move asset east if required (it is readily transportable) to behind the 100 year coastal processes line.
Bollards (solar)	20 years	$2000 ea	Low	Touch up corrosion / graffiti removal (cost $240) annually	Behind Foredune	10–30	Move asset east if required.
Dune lookout	30 years	$37,500	Med	Touch up / batten replacement, graffiti removal (cost $375 each) annually	As shown	10–30	Move asset east if required to behind the 100 year coastal processes line.
Vegetation Areas							
Rehabilitation planting (including preparation protection)	NA	$476,324	Med	Initial Maintenance (cost $59045.84) annually Other maintenance, Replanting if required (cost $476.32) annually	As shown	NA	NA

Asset Type	Structural lifespan	Asset Value	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)
Vegetation							
Proposed tree 200L	NA	$10,935	Med	Tree care (cost $382.73) annually Temporary Water Tank (Cost $132,000)	As shown	NA	NA
Civil Engineering							
Northern access track and car park							
6 m wide asphalt access road and car park	30 years	$342,000	Med	Seal cracks, replace sections of kerbing (cost $10,000) every 10 years	As shown	30–50+	Remains in current location
2.4 m wide grey footpath along access track	30 years	$60,500	Med	Fix cracks/panels (cost $500 every three years)	As shown	30–50+	Remains in current location
3 m wide limestone emulsion beach access path	15 years	$34,000	Med	Fill potholes and spot re-compact (cost $3,000) every five years	As shown	10–30	Retreat from asset if required
Ramp down to beach	15 years	$20,000	Low	Maintain surface (cost $2000 every winter)	Beach Dune	10–15	Retreat from asset if required
Water reticulation	30 years	$50,400	Med	Water Corporation Asset	In verge alongside road	30–50+	Behind 50 year line.
Communications	30 years	$28,900	Low	Opticomm Asset	In verge alongside road	30–50+	Behind 50 year line.
Power and street lighting	30 years	$70,800	Med	Western Power Asset	In verge alongside road	30–50+	Behind 50 year line.
Conservation fencing	25 years	$73,200	Med	Repair posts / restrain as required (cost $15,000) every five years	Alongside road, car park and access track	10–30	Behind 50 year line.

Asset Type	Structural lifespan	Asset Value	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)
Southern Access Track							
3 m compacted limestone (emergency vehicle maintenance and access track)	15 years	$118,800	High	Fill potholes and spot re-compact (cost $15,000) every five years	As shown	10–30	Retreat from asset if required
Conservation fencing	25 years	$74,400	Med	Repair posts / restrain as required (cost $13,000) every five years	Either side of access track	10–30	Retreat from asset if required

RPS

APPENDIX 5

SLSWA Coastal Aquatic Risk Assessment

Coastal Aquatic Risk Assessment

Alkimos Beach Development

SURF LIFE SAVING WESTERN AUSTRALIA

Commercial-in-confidence

Prepared For:
Lend Lease

This information and contents used in this document has been collected and prepared by:

Rachel Duczynski/Endorsed Coastal Safety Assessor;
E: coastalrisk@slswa.com.au

and

Chris Peck/Community Safety Manager;
E: CPeck@slswa.com.au

_____ _____
Signature Date

Surf Life Saving Western Australia Inc.
7 Delawney Street, BALCATTA WA 6021
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T (+61 8) 9207 6666

Date	Version	Number	Author/Reviewer	Organisation
06/03/2014	DRAFT	0.1	R. Duczynski	SLSWA
06/03/2014	FINAL DRAFT	1.0	C. Peck	SLSWA
11/03/2014	FINAL DRAFT	1.1	C.Peck	SLSWA
04/04/2014	FINAL DRAFT	1.1	K. Saunders	Lend Lease
01/05/2014	FINAL DRAFT	1.2	C. Peck	SLSWA
27/05/2014	FINAL VERSION	1.2	C.Peck	SLSWA

TABLE OF CONTENTS

1. Summary

Assessed Locations:

1 Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]

1.1 BACKGROUND

Alkimos Beach is a residential site currently under a joint venture development between Lend Lease and Land Corp. The site is situated within the City of Wanneroo, some 8.5km from the Yanchep SLSC in the north and 6.5 km from Quinns Mindarie SLSC in the south.

This stretch of coastline beyond the fore dune is being developed by Lend Lease for residential purposes and sale of lots. The beach access and use is considered a centre piece to the recreational and leisure opportunities the Alkimos development will provide residents and the surrounding community.

Alkimos beach fronting Alkimos development is approximately 2km in length. For most of its length it is backed by a 10m to 20m high foredune with a few blowouts, then vegetated, undeveloped transgressive dunes extending 2km to 3km inland. There is development on the western side of Marmion Avenue which is moving towards the beach area. Pleistocene calcarenite reef continues parallel to shore, lowering the waves to less than 1m, maintaining a moderately steep beach face. The beach is sandy, apart from a section of partly exposed beachrock further toward Shorehaven development and Pipidinny Beach. During times of moderate to high swells there are reef breaks located approximately 1km offshore at Alkimos, including an inner and outer break which generally requires a boat to access.

The beach is not patrolled and is not yet a beach that has a high frequency of visitation for swimming activities; although the outer reefs and Alkimos wreck provide some attraction to surf board riders for surfing and fishing related activities.

Lend Lease has engaged Surf Life Saving Western Australia to conduct an assessment of the Alkimos foreshore to provide advice on:

i. The most suitable location to be designated as a recreational and leisure beach primarily for swimming and wading activities; and within the Alkimos Beach development boundaries.

ii. The best location for a surf lifesaving club and additional outpost facilities based on the risk profile and proposed use by the community.

iii. An assessment of coastal risks present at Alkimos Beach and development of risk management plan and treatments including beach accessibility, proposed access signage, prevention and lifesaving services and awareness and education.

This report contains findings and recommendations specific to current standards, guidelines and good practice regarding risk management pertinent to the characteristics and designed applicative use of the assessed location. The report contains information specific to Alkimos Beach only.

A set of risk treatment options is proposed for the Alkimos beach. The following risk treatments are offered for consideration and are representative of the key recommendations tabled:

1. Beach Access and Ongoing Maintenance (Section 4.2.4)
2. System of Safety Signage (4.2.5)
3. System of Supervision - Lifesaving Service Level Analysis (Section 4.2.6)
4. Existence of Coastal/Beach Emergency Action Plans (Section 4.2.7)
5. Education and Awareness Programs (Section 4.2.8)
6. Public Rescue Equipment (Section 4.2.9)
7. Dune Vegetation Maintenance, Beach Scarping/Tunneling (Section 4.2.10)
8. Emergency Response Beacons, Alarms and Phones (Section 4.2.11)
9. Monitor and Review (Section 4.2.12)

As a consequence of the continuing growth and changing usage patterns it is the view of SLSWA that Lend Lease should periodically review this coastal public safety risk assessment and treatment plan, in particular when a milestone development occurs or is imminent.

1.2 SUMMARY OF PROPOSED KEY RISK TREATMENTS

1.2.1 Beach Access and Ongoing Maintenance

There are currently no defined access paths to Alkimos Beach although the dunes are littered with informal pedestrian and four wheel drive tracks. As development continues, these tracks will be closed off to the public with the introduction of formal roads and pathways into the area.

SLSWA has assessed the mid-point area of the beach fronting the Alkimos development to be the most 'friendly' to a range of beach users (refer Appenidix C). This mid-point is a small bluff at the southernmost aspect of the bay like contour of Alkimos. For the same purposes, SLSWA have recommended this mid-point of Alkimos as the best location for major access points and associated infrastructure, including a Surf Life Saving Club. Formal access paths must be developed for pedestrian use and a wider, gated beach access for emergency vehicles and other approved users.

Please refer to Section 4.2.4 for more information on access infrastructure and ongoing maintenance.

1.2.2 System of Safety Signage

As the site is under development, much of the formalised roadways, carparks, recreational pathways or beach access are not yet under construction. Reasonably, little or no formalised signage was in place at the time of the site visits. Once formalised access ways are developed the appropriate signage needs to be put in place.

Suitable future signage includes:

- Beach and aquatic safety signage
- Location signage
- Marine zoning signage
- Signage relating to location of toilets/disabled access
- Signage relating to location of nearest lifesaving service
- Local government regulation signage
- Environmental and conservation signage
- Dune management signage
- Community information signage including safety, security and crime prevention.

Please refer to section 4.2.5 for more information on systems of safety signage.

1.2.3 Community Surf Lifesaving Facility

SLSWA recommend that a community lifesaving facility is located nearer to the mid-point boundary of Alkimos beach. A number of influences drive this recommendation.

- The elevations at this part of the beach provide for improved outcomes of emergency and lifesaving activity beach access requirements. Entry and exit of plant and equipment on and off the beach and an appropriately sealed access way is likely to be safely provided for with lower elevations.

- The facility and services that can be provided will be more proximally located to where beach users are being channelled, requiring less transportation of equipment and people to activate and manage the beach.
- Transportation of injured persons along the undulating and often bumpy shoreline is less if the lifesaving facility is more proximal to the main beach user area.
- The lifesaving facility and benefit to the community is likely to be enhanced if it is proximal to the public open space and formalised recreational areas.
- Public are more likely to enter at and remain positioned near the midpoint of the beach if the lifesaving facility is also located proximal to the recreational space.
- Despite the developer having limited or no responsibility for the beach area south of the Alkimos Beach development boundary, any lifesaving service will by default have to take responsibility for beach users along this stretch of coastline. The placement of a facility nearer the mid-point of the boundary will enable lifesaving services to better manage beach users that seek to use this stretch.
- The natural bluff provides excellent observation and surveillance to the north and south of the Alkimos beach development.

1.2.4 Lifesaving and Surveillance Outpost

Prior to the development of a community lifesaving facility that may also act as a social and activity hub in the community, SLSWA recommend that at the early stage of development a lifesaving and surveillance outpost is planned, designed and constructed into the development area.

An outpost facility will allow remote surveillance and lifesaving service to be planned and implemented well before the development of a community lifesaving facility. The impetus for this recommendation is to provide a platform that will assist the community stakeholders to determine when greater beach management strategies are required to manage public safety at Alkimos Beach. As access to the beach is provided via through roads, parking and beach access paths, the outpost will also allow lifesaving and response services to be implemented at Alkimos Beach. These may initially commence as a surveillance and response service only which could readily escalate to an on beach prevention and rescue service.

Typically, a lifesaving and surveillance outpost facility should have in summary the following form and function:

1. Have sufficient elevation that provides vision of the shoreline and ocean when streamed from an automated camera or when a trained lifesaver is insitu.
2. Provide for the secure storage of lifesaving, rescue and emergency care equipment:
    i. Jet ski and trailer.
    ii. ATV (All Terrain Vehicle).
    iii. 2 x Rescue Boards.
    iv. 2 x Rescue Tubes.
    v. First aid kit.
    vi. Stretcher and spinal board.
    vii. Oxygen Resuscitation equipment.
    viii. Semi-automated defibrillator.
    ix. Communications equipment (handheld RF radios, tablets).
    x. Beach hazard and warning signs.
    xi. Emergency Response Point.
3. Provide for an area to enable first aid and prolonged pre-hospital care treatments.
4. Have sufficient GPO and electrical access to:
    i. Re-charge equipment.
    ii. Operate tablets and telecommunication devices.
    iii. Operate temperature control equipment.
    iv. Provide adequate illumination of spaces, with illumination relevant to the space required, including external to the facility.

5. Have appropriate telecommunication and data access within the building and to the highest point of the facility.
6. Have appropriate storage cabinets for:
    i. Emergency care equipment and medical supplies.
    ii. Storage of up to 100L of unleaded fuel.
7. Have appropriate access to water for maintenance of equipment, including a drainage space and wash down area.
8. Allow a one direction entry/exit into the storage space for plant and equipment.

Should Lend Lease accept this recommendation SLSWA can provide a more detailed outcome statement on the form and function of a facility of this type.

SLSWA recommend where possible that Lend Lease should give consideration to the development of an outpost facility being part of a staged approach to a larger community lifesaving facility. The recommendation is provided on the basis SLSWA also recommend that the development of an outpost facility should be located in the same area of preferred beach access and a community lifesaving facility.

1.2.5 Education and Awareness Programs

This Section highlights and tables the SLSWA BeachSAFE intiaitive in addressesing education and awareness pertaining to improved coastal aquatic recreation. When consistently implemented it will assist to build the capacity of the community to mitigate these risks.

Education and awareness programs currently delivered within the City of Wanneroo have been identintified so they can be mapped and built upon. Lend Lease should cooperate with The City of Wanneroo and give strong consideration to actively investing in coastal aquatic safety education and awareness programs to improve coastal aquatic risk mitigation at Alkimos beach. This strategy should seek to provide opportunites to undertake safe aquatic activity at any beach location within the City of Wanneroo in addition to Alkimos beach.

Lend Lease should also consider the development of a beach safety information booklet or similar specific to Alkimos beach that can be issued to new residents of Alkimos to enhance their awareness and understanding of behaviours that assit to make beaches a safer and more enjoyable place.

For more information on education and awareness programs please refer to Section 4.2.8.

1.2.6 Monitoring and review

Monitoring and review provides information on the extent to which risk treatment options are meeting their objectives, new hazards and risks being identified in a timely manner and evolving strategies being developed in line with community expectations.

Monitoring and review activity should not be limited to maintenance programs and should actively seek to record and analyse objective data relating to the how, why, what and when Alkimos beach is being used, so that objective decisions and medium to long term planned strategies can be developed by the land manager to assist in managing coastal aquatic and recreational risk at Alkimos beach.

Please refer to Section 4.2.12 for more information on monitoring and review.

1.3 SUMMARY OF KEY RECOMMENDATIONS

Recommendations made in this report look at the broader context of coastal aquatic safety and make assumptions that the risk need to be mitigated no matter where the line of responsibility exists for management of the foreshore reserves. If the owner of the report is not the responsibly body for the considerations, implementation and management of risk treatments, then the recommendations should be shared with the likely owner of the risks and associated treatment options (i.e. City of Wanneroo).

The following recommendations are also made noting that there is currently no formal public beach access to the Alkimos beach development and fronting coastline and that the recommendations can be investigated closer to public access being provided.

1.3.1 RECOMMENDATION 1

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should engage broader input into beach safety issues along the coast through periodic inclusion of other representative groups such as City of Wanneroo Ranger Services, Residential Representative Groups, Volunteer Marine Rescue, Local Surf Life Saving Clubs and Local Police.

1.3.2 RECOMMENDATION 2

The party responsible for implementing and maintaining beach accesses should remove or restrict access to undefined or informal access tracks where appropriate. Access tracks that are no longer in use, unnecessary or that lead people to any high-risk location/s should be considered for closure. If closure cannot be achieved then barriers should be installed to restrict or discourage access.

1.3.3 RECOMMENDATION 3

The party responsible for implementing and maintaining beach accesses and therefore communication of risk (i.e. aquatic safety signage) should implement an inspection regime to assess the installation, adequacy and visibility of in-situ aquatic and recreational safety signage. Records of the inspections and actions should be maintained.

1.3.4 RECOMMENDATION 4

The party responsible for implementing and maintaining aquatic safety signage should ensure the number of individual signs at any one location is maintained to a minimum, wherever possible. A single point of information for warning, regulation and information signage reduces confusion and visual pollution.

1.3.5 RECOMMENDATION 5

The party responsible for implementing and maintaining beach safety signs adopts and maintains Emergency location signage identifiers, as shown in the National Aquatic and Recreational Signage and Style Manual (NARSSM).

These should be incorporated into any new safety signage at Alkimos beach. This should be done in consultation with relevant emergency services agencies. A numbering system will need to be developed and adopted by the party responsible for maintaining beach access tracks and signs. Future municipal/residential developments need to be taken into account to avoid out of sync codes/location identifiers associated with future developments.

1.3.6 RECOMMENDATION 6

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should carefully consider the implementation of electronic surveillance/monitoring solutions such as remote pan, tilt and zoom technology. This system should form part of a lifesaving surveillance and outpost facility.

1.3.7 RECOMMENDATION 7

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should develop, implement and review Emergency Action Plans (EAPs) for Alkimos beach. This activity is to assure a planned and coordinated response to the range of potential and localised coastal aquatic and recreation emergencies that may occur at Alkimos beach.

The EAPs should take into account the difficulties in accessing locations, delay of response and the inherent risks of the locations.

1.3.8 RECOMMENDATION 8

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should, in association with other water safety and emergency response organisations, develop a planned and adequately resourced approach to improving long term awareness and education opportunities as they relate to safer aquatic recreation at Alkimos beach.

1.3.9 RECOMMENDATION 9

That Lend Lease considers contribution toward an awareness program that develops a resident's beach safety booklet/flyer or similar to be distributed or promoted to new home owners in the Alkimos beach development. This booklet should contain beach safety information specific to Alkimos beach in addition to other generalised beach safety information and messages.

1.3.10 RECOMMENDATION 10

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should implement the use of Quick Reader (QR) codes on aquatic and recreational safety signage at Alkimos beach. Users of this technology are taken to coastal aquatic safety information and in languages and translations that are relevant to their culture and language. The use of QR codes should form part of any aquatic awareness and education programs.

1.3.11 RECOMMENDATION 11

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should consider, and where practicable, implement engineered options to minimise the risks associated with dune and beach scarping presenting a risk of tunnelling, sand collapse and falls, or access to rock overhang areas. Beach and dune erosion are important considerations when determining the placement and maintenance of beach access tracks/infrastructure.

1.3.12 RECOMMENDATION 12

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should consider that vegetation species planted in dune revegetation programs should be regularly monitored to ensure that they are not negatively impacting on the provision of safety and emergency services at a location. In particular the monitoring should ensure that plant foliage does not obscure vision of signs and reduce the effectiveness of the messaging.

1.3.13 RECOMMENDATION 13

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should review and continue to enhance aquatic recreation public safety injury data and information collection. This should include the collation and analyses deemed necessary to underpin accurate risk assessment and effective risk treatment plans and actions.

1.3.14 RECOMMENDATION 14

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should investigate and where practical implement activity zoning measures at Alkimos beach. Zoning of incompatible activity will assist to reduce conflict and the incidence of injury by users of this location. This action can assist in directing swimmers into a safer swimming area south of Alkimos beach.

2. Introduction, Scope & Context

Assessed Locations:

1 Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]

2.1 Introduction

In 2012/2013 summer season Western Australia (WA) accounted for 10% of the national coastal rescue statistics drowning toll annually[1]. In 2013 Western Australia had the second highest number of reported drowning's accounting for 20% of the national figure[2].

The vast majority of these fatal drowning's can be attributed to swimming/rip-currents and rock-fishing, with almost all occurring at unpatrolled locations/times, where no expert assistance is immediately available.

Accidental drowning deaths in the coastal aquatic environment can be accounted for through a number of causal factors known as the *drowning chain*.

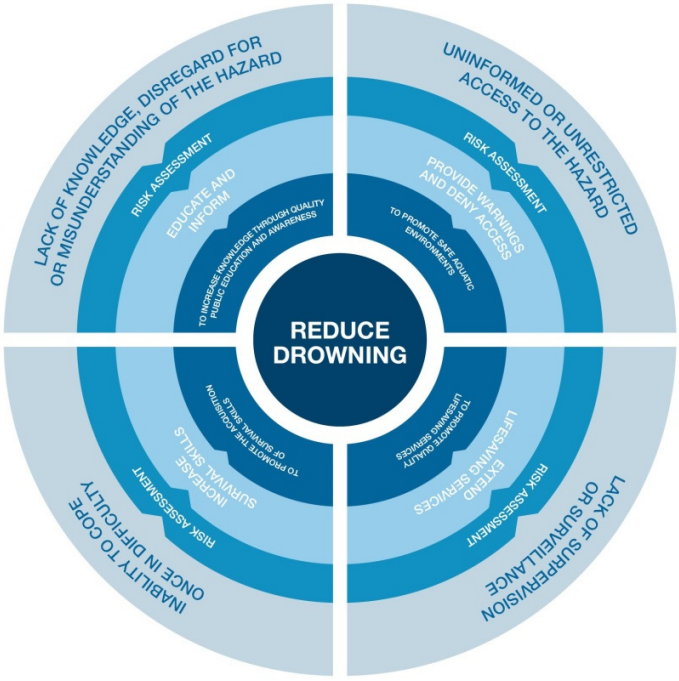

Figure 1: The International Life Saving Federation Drowning Chain (Source: ILSF Drowning Prevention Strategies, 2008)

Causal factors include:

- Lack of knowledge, disregard or misunderstanding of the hazard
- Uninformed or unrestricted access to the hazard
- Lack of supervision or surveillance
- Inability to cope once in difficulty.

Any of the above, either alone or in combination, could lead to a death by drowning. The strategies that have been identified to address the drowning chain include:

- Education and information
- Denial of access
- Improvement of infrastructure and/or provision of warnings

[1] Surf Life Saving Australia. Annual Report 2012/13.
[2] Surf Life Surf Life Saving Australia (2013) National Coastal Safety Report 2013. SLSA: Sydney. Surf Life Saving Australia.

- Provision of supervision
- Acquisition of survival skills.

This document is a coastal public safety risk assessment and treatment plan specific to water safety related issues identified at unpatrolled locations of Alkimos Beach located on the coast of Wanneroo in Western Australia.

This coastal risk assessment and treatment plan has been prepared following an on-site risk assessment undertaken by SLSWA for Lend Lease. The on-site assessments were based upon good practice risk management practices.

Both the on-site risk assessment and compilation of the risk assessment and treatment plan report have received contributions and input by SLSWA personnel including Mr Chris Peck, Ms Rachel Duczynski, Mr Matt du Plessis and Ms Belinda Fleay.

The identified risks are rated against a semi-qualitative assessment matrix and given a numerical value between 1 and 25, with 25 representing the highest risk and 1 the lowest. For the purposes of this risk assessment the Surf Life Saving Enterprise-Wide Risk Management – Risk Ranking Tool was used to assign risk scores and rankings.

The assessment of risks and their potential treatments are detailed in the risk register and risk treatment plan section. Risks and the potential risk treatments are grouped into one table for ease of understanding.

The risk register and risk treatment plan is a tabular summary of risks identified by SLSWA and how to possibly best deal with them. It includes a list of **potential** risk treatments as identified by SLSWA and those risk treatments identified that are already in place.

The Overview of Principal Risk Treatments Section details SLSWA's recommendations for a coordinated system of access control (Section 4.2.4) and safety signage (Section 4.2.5), which reflects current good practice. Although an effective risk treatment, signage should not be the only method used in minimizing the identified risks.

2.2 Scope and Context

The risk assessment is based on available information and conditions as observed on several site visits between July 2013 and February 2014.

This report provides treatment recommendations about how to improve risk and safety management in line with current industry aquatic risk management good practices and international standards and Australian water safety signage standards.

Risk treatments are guiding recommendations only and are representative of SLSWA's opinion in relation to water safety at Alkimos Beach.

Lend Lease in consultation with its key stakeholders should determine which risk treatments are appropriate and can feasibly be implemented at Alkimos Beach.

2.3 Definition of Terms

The following is a summary of the definition of key terms used within this report.

ABSAMP, means the Australian Beach Safety and Management Program.

Emergency Action Plan, means a plan that outlines the procedures to be used in the event of an emergency.

Fringe, means the periods between the summer school holidays and both the spring and autumn school holidays, excluding the actual school holidays and Easter. The fringe season is usually characterised by periods of high level beach activity on weekends and public holidays and medium level beach activity on week days.

Hazard, means a potential to threaten human life, health, property or the environment.

Hazard symbols, means a graphical symbol used together with a safety colour and safety shape to form a safety sign.

Lifesaving Service, means an organised and structured service comprised of volunteer lifesavers and/or paid lifeguards and appropriate rescue and first aid equipment supported by a coordinated backup team.

Off peak, means the winter period generally from May through to August and which traditionally has low levels of beach activity.

Peak, means the spring, summer and autumn school holiday periods, and Easter where not included within the autumn school holiday period. The peak season is usually characterised by a high level of beach activity on all days.

Observation tower, means an elevated platform from which provides a lifesaver or lifeguard with an unobstructed view of an area of water and/or beach from either a seated or standing position.

Recreational waters, means those natural waters used not only swimming, windsurfing, and waterskiing, but also for boating and fishing.

Rescue, means to withdraw, remove, free, save or deliver from a state of exposure to a hazardous or potentially hazardous event.

Rescue watercraft, means a watercraft designed and used for rescue; in this instance the rescue of people.

Rip, (aka rip current) means channelled currents of water flowing away from shore, typically extending from the shoreline, through the surf zone, and past the line of breaking waves.

Risk Register, means a table summarising the identified risks, the location, why it has been identified as a risk, what current treatments are in place to lessen the risk and an overall hazard rating.

Risk Treatment Plan, means a table summarising how to deal with the identified risks, including a list of potential risk treatments, the risk treatments currently and any residual risk.

SLSC, means a surf life saving club from which seasonal volunteer based lifesaving services are provided.

2.4 Report Authors

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3. Assessment Methodology

Assessed Beaches:

1 Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]

3.1 Site Identification

Beach WA 893 commences on the northern side of the sandy foreland initially curving to the north for 1.5km to the lee of the prominent Alkimos wreck, then continues north-northwest for another 6.5km past Pipidinny Beach and the southern side of Yanchep to the beginning of the Yanchep beachrock. The beach totals 8.3km in length with vehicle access at Pipidinny and Yanchep, as well as 4WD tracks backing most of the beach.

The southern end of the survey area is a narrow beach (<15m) backed by high dunes (10-20m) and has a moderately steep beach gradient. This section of beach is exposed to wave action, strong currents and has a narrower bank and sudden drop off into deep water. The northern end of the survey area forms a bay like contour. This section of beach is generally wider than the southern end (>20m) and has a more gentle gradient and lower dune heights (<10m). There are a number of exposed rocks on the beach and in the swash zone at the northern most point of the Alkimos boundary. Here there are also exposed beachrock and cliffs backing the beach.

3.1.1 Swimming

The beaches in the Alkimos area are not easily accessible for swimming due to the early development of the area, and lack of direct beach access. Access is generally via any of a series of 4WD tracks, or from Pipidinny Beach or Yanchep area in the north. There is currently no direct access and supporting infrastructure (paths/stairways, car parks, amenities, ablution facilities). The origin of users is unknown, but is likely to be a combination of local residents and visitors to the area.

The Alkimos beach area is generally considered a suitable beach for swimming under average conditions; however, this can change depending on the prevailing swell, wind direction and strength, tide position, time of the year and ultimately the fitness and capability of each individual beach user. There is a section of rock/reef platform in the swash zone to the north of the boundary; beach users should be discouraged from swimming near this particular area.

3.1.2 Surfing

Surfers are known to visit the area, however not in the same numbers as the more accessible beaches further north (the Spot) and south (Clayton's beach). Access is via a series of 4WD tracks which, in itself, presents hazards due to the poor conditions, range of visibility and gradient of some areas of the track. There are no facilities or infrastructure behind the beach.

The wreck of the Alkimos and the surrounding reefs are known to be more frequented by surfers than the beach; however, a boat is usually required to access these surf breaks. It is highly likely that as the development is opened with roads and access paths a range of recreational beach and aquatic users are more likely to use this area of coastline such as:

- Kite surfers
- Wind surfers
- Ocean paddlers
- Water walkers
- Fitness groups

3.1.3 Fishing

There is first hand and anecdotal evidence that fishing occurs along this area of coastline, however similar access issues as those confronting swimmers and surfers are present. Historically, this area is accessed by beach fisherman when four wheel drive access was frequent and available.

3.1.4 Beach/Track Walking and Recreation

There are no existing formal tracks in the area, however 4WD tracks are abundant.

Figure 2: Overview of Alkimos Beach (Google Earth)

This report systematically progresses through the risk management steps with regard to the location outlined above.

3.2 Site Inspection

Site visits were completed on the following dates:

Location	Date
Alkimos-Pipidinny-Yanchep (S) [Alkimos Beach]	10th July 2013 7th and 8th November 2013 10th and 11th Janaury 2014 18th February 2014

At no time during the inspection was the water entered. The inspection area was limited to the area outlined within the *'Site Identification'* section of the report.

All inspections were performed from the land, along the edges of the water, along the rocks outcrops, headlands, and pertinent access tracks and informal access points.

3.3 Hazard Identification and Risk Assessment

During the site inspection hazards were identified within the area inspected and assessed in terms of their individual risk to public safety (extreme, high, medium, low) using a risk assessment matrix (see Appendix B). The risk assessment matrix considers both the type of harm that could be sustained as a result of an individual hazard and the likelihood of this harm actually occurring. The matrix is not specific to Lend Lease risk tolerances.

International Life Saving (ILS) endorses the Surf Life Saving Australia (SLSA) Aquatic Public Safety Risk Assessment program. The methodology is as follows:

1. Determine the minimum acceptable level of risks and potential injuries through completion of a risk assessment in accordance with recognised guidelines and standards.

2. Provide economically sustainable risk mitigation options

3. Provide recommended staging plans considering the environmental conditions, forecast settlement areas, beach access and usage

4. Review the status of aquatic safety and signage management

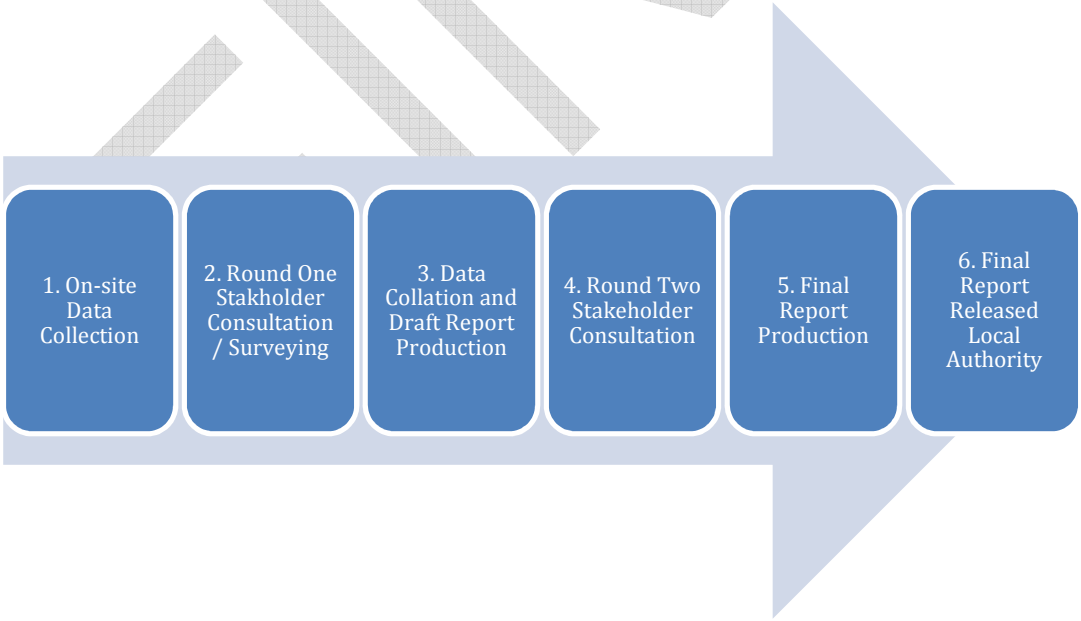
5. Evaluate the level of compliance or noncompliance with relevant regulations and standards

6. The assessment will include reference to:

    a) The Australian Beach Safety and Management Program (ABSAMP)
    b) The Australian Coastal Public Safety Guidelines
    c) Beaches of the Australian Coast-A guide to their nature, characteristics, surf and safety
    d) The National Aquatic and Recreation Signage Style manual
    e) Relevant standards including AS/NZS 2416:2010 Water Safety Signs and Beach Safety Flags (Parts 1, 2, 3) and AS/NZS ISO 31000:2009 Risk Management-Principles and Guidelines; and

7. Consult with relevant community stakeholders including volunteer surf life saving services and other community organisations involved in or impacted by beach safety

The diagram below shows the steps involved for the Project. These steps were repeated for each assessment area.



3.4 Data Analysis

Data relevant to risk assessment has been considered in the production of this report. This includes:

- News and media information
- SLSA Incident Reporting Database
- National Coronial Information System
- Coronial recommendations
- City of Wanneroo future local development
- City of Wanneroo beach usage statistics
- City of Wanneroo community profile data
- On-line local community survey
- Formal and informal interviews with identified stakeholders

All of these areas, factors and associated data have been taken into consideration within the risk register and risk treatment plans.

3.5 Beach Hazard Ratings and Overview

The hazards present at any given beach are very often determined by its geomorphology and the impact of water and weather conditions. Therefore it is important for land managers to understand the risks presented by these hazards. Since the late 1980s, Surf Life Saving Australia and the University of Sydney have partnered to identify the beach hazard ratings of every known beach in Australia.

The ABSAMP (Australian Beach Safety and Management Programme) was developed by Professor Andrew Short from the University of Sydney Coastal Studies Unit in conjunction with Surf Life Saving Australia and the State Associations. The programme has identified coastal hazards that affect bathers and rates the safety of the beach on a scale of one to ten, where one (1) is the least hazardous and ten (10) is the most hazardous.

The beach hazard ratings and definitions are provided in the following Table 1.

Table 1: ABSAMP Beach Hazard Ratings

Hazard Rating	Details
1 - 3	Least Hazardous: Low danger posed by water depth and/or weak currents; however, supervision still required, in particular for children and poor swimmers.
4 - 6	Moderately Hazardous: The level of hazard depends on wave and weather conditions, with the possibility of strong rips and currents posing a moderate risk.
7 - 8	Highly Hazardous: Experience in strong surf, rips and currents required, with beaches in this category considered dangerous.
9 - 10	Extremely Hazardous: Identifies beaches that are considered extremely dangerous due to strong rips and currents, and large breakers.

The beach hazard rating is calculated by determining the beach type and wave height. This can be done under either modal (average) or prevailing (current) conditions. The beach hazard rating is then calculated by using the following table:

Table 2: Beach hazard rating calculation matrices for wave dominate beaches.

Wave Height / Beach Type	< 0.5 (m)	0.5 (m)	1.0 (m)	1.5 (m)	2.0 (m)	2.5 (m)	3.0 (m)	> 3.0 (m)
Dissipative	4	5	6	7	8	9	10	10
Long Shore Bar Trough	4	5	6	7	7	8	9	10
Rhythmic Bar Beach	4	5	6	6	7	8	9	10
Transverse Bar Rip	4	4	5	6	7	8	9	10
Low Tide Terrace	3	3	4	5	6	7	8	10
Reflective	2	3	4	5	6	7	8	10

It should be noted that the beach hazard ratings presented in this report relate to modal beach conditions and as such the hazard rating of a beach may increase when conditions alter *e.g.* with increasing wave height, winds, strong tides and high tide.

Furthermore, a hazard rating is also applied to an average person and therefore depending upon an individual's own skill, understanding and competence in relation to a certain area the hazard may in fact be greater or less.

The ABSAMP hazard ratings for the inspected areas of Alkimos Beach are detailed within the next section of the report.

3.6 ABSAMP Beach Types and Ratings for Alkimos Beach

The ABSAMP Hazard Rating for the assessed beaches is listed in Table 2.6.1. The table provides an ABSAMP rating and descriptive label/name type for each specific beach location.

Table 3: ABSAMP Beach Hazard Ratings – Alkimos

Location Name	ABSAMP no.	ABSAMP Rating	ABSAMP type
Alkimos-Pipidinny-Yanchep (S)	WA 893	4	Reflective plus low tide terrace

3.7 ABSAMP Beach Type Characteristic Overview and Hazards for Alkimos Beach

Alkimos beach characteristics and associated hazards are:

Table 4: Table description of Reflective Beach Type

Beach Type	Details
Reflective Beach (R) plus Low Tide Terrace (LTT)	**Summary – Reflective Beach and Low Tide Terrace** Characteristics: Consists of waves that tend to reflect back off the beach with 0.0m-1.0m breakers. These beaches generally only occur on very low wave beaches and on harbour beaches. Hazards: Normally the safest for bathing, apart from deep water close inshore and when the shore break is higher during periods of high wave conditions. Beach Hazard Hints: Caution as a steep beach and abrupt drop off to deeper water can make access hazardous for the young, elderly or infirm/disabled.
	Reflective Beach **Characteristics:** Reflective sandy beaches lie at the lower end of the wave dominated beach spectrum. They are characterized by relatively steep narrow beaches usually composed of coarser sand. On the WA open coast, sandy beaches require waves to be less than 0.5m to be reflective. For this reason they are normally found at entrance to bays, at the lower energy end of some ocean beaches and in the lee of the many calcarenite reefs and rock platforms. Reflective beaches always have a steep, narrow beach and swash zone. **Hazards:** Reflective beaches usually offer relatively safe swimming conditions due to the low waves and generally protected locations. Changing waves and currents can produce a number of hazards to both swimmers and surfers. These are summarised: • Steep, soft beach face may be a problem for toddlers, the elderly and disabled people, • Relatively strong swash and backwash can knock children and unwary people off their feet, • Swash zone step can cause a sudden drop off from shallow water into deeper water, • Deep water – the absence of a sand bar means deeper water close into shore, which can be a problem for non-swimmers and children,

	• Surging waves and shore break – when waves exceed 0.5m they break increasingly heavily over the step and lower beach face. The can knock unsuspecting people over. If swimming seaward of the break, swimmers may experience problems returning to shore, • Most hazardous when waves exceed 1m and shore break becomes increasingly powerful; and • When fronted by a rock platform or reef, additional hazards are associated with the presence of rock/reef. *Summary:* Reflective beaches present low hazards under low wave conditions, provided users are competent swimmers and experienced at swimming in the surf. Parents/guardians need to monitor children carefully due to the proximity of deep water to the shore. A hazardous shorebreak and strong surging swash is commonly present where waves are greater than 1m in height.

Beach Type	Details
	Low Tide Terrace **Characteristics:** Low Tide Terrace beaches are the lowest energy intermediate beach type and the most common intermediate type in Western Australia. These beaches occur on the open coast where the sand is fine to medium and wave height averages between 0.5m and 1m, and particularly where near shore reefs and headlands lower waves to less than 1m at the shore. Low Tide Terrace beaches are characterised by a moderately steep beach face, which is joined at the low tide level to an attached bar or terrace. The bar usually extends between 20m and 50m seaward and continues along shore, attached to the beach. Mid tide conditions result in water being returned seaward, both by reflection off the beach and via the mini rips, even if no rip channels are present. The rips are usually weak, ephemeral (short-lived) and shallow. **Hazards:** Low Tide Terrace beaches are the least hazardous of the intermediate beaches because of their characteristically low waves and shallow terrace. Changing wave and tide conditions produce a number of hazards to both swimmers and surfers. These are summarised: • High tide: deep water close to shore; behaves like a reflective beach, • Low tide: waves may plunge heavily on the outer edge of the bar, with deep water beyond. Extreme care should be taken if body surfing or body boarding in plunging waves – the consequence is likely to be spinal injuries, • Mid tide: more gently breaking waves and waist deep water; weak mini rips return some water seaward, • Diving: care is required if diving into the surf as the water is usually shallow and can result in head/spinal injuries, • Higher waves: mini rips increase in strength and frequency, and may be variable in location; and • Oblique waves: rips and currents are skewed and may shift along the beach, causing a longshore and seaward drag *Summary:* Low Tide Terrace beaches are most hazardous at mid to high tide when waves exceed 1m and are oblique to shore, e.g. during summer when the winds are stronger.

3.8 Facility Visitation Rates (FVR) for Alkimos Beach

The Facility Visitation Rate (FVR) is a term, which has been developed to provide a quantitative assessment that can be used to determine the most appropriate signage schedule for a facility (venue or location). The FVR is a calculated using data collected during the assessment process and includes site

population use, and frequency of use. As the FVR calculation is used to determine aquatic recreational warning signage requirements the figures used are those of the peak period of beach usage. The following calculation is derived using:

I. Stakeholder observation, consultation and feedback relative to the table values outlined , and;
II. Utilisation of the Facility Visitation Rate (FVR) formula, where:

Facility Visitation Rate = (ABSAMP Rating x Population) + Frequency

The values and calculations are outlined as follows:

Table 5: Facility Visitation Rates – Alkimos

LOCATION NAME	ABSAMP RATING	*	POPULATION	+	FREQUENCY	=	FVR
Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]	4	*	1	+	**1**	=	**5**

Given the assigned FVR score of five (5), shown in the above table, the nearest rating scale and control measures have been applied (between 7 and 10) to this report. An FVR of six (6) or less is deemed to be so low in risk due to lack of population that visits the beach location. The population loading also does not occur with any consistent frequency. There are no control descriptors for ratings that are between zero (0) and six (6).

Listed below is an outline of the most appropriate sign characteristics pertinent to each location:

FVR Score between 7 and 10

This score would generally indicate that *where access cannot be controlled*, entrances to the beach provided by council have signage and spaced no greater than 500 metres apart around the beach perimeter. Additionally the signage should contain the following:

- The name of the facility
- A general warning message
- All Council's Ordinances that apply to the facility should appear on the sign as prohibition pictograms
- All potential hazards identified within the facility that have a risk rating of HIGH should appear on the sign as warning symbols. If no highs then the top hazard should appear
- Any information symbols relevant to the facility

3.9 Communication and consultation

Communicating with stakeholders about risk perception and tolerance is the heart of the risk management process.

During the onsite visits for the assessment from July 2013 to February 2014, consultation with a number of stakeholders was undertaken to ensure the report process was transparent and to gain local knowledge, background and visitor statistics on the areas inspected. Stakeholder interviews were conducted with:

- Chris Peck, Community Safety Manager, SLSWA
- Belinda Fleay, Health Promotion and Research Coordinator, SLSWA
- Matt du Plessis, Lifesaving Operations Coordinator, SLSWA
- Shane Spinks, Manager Community Programs and Services, City of Wanneroo

- Dean Patterson, Community Partnership Manager, Lend Lease

The process of communicating risk estimates from the assessment process to decision-makers and ultimately to the public, sometimes referred to as risk education, is only one part of the communication process.

However, in getting those affected by risk to accept risk mitigation measures, and in providing decision-makers and communities with the information they need to tolerate and deal with risks, there needs to be two-way communications that includes those affected by risk, the public, into the decision-making process.

There is a great opportunity to have this wealth of knowledge actively participate in the implementation of many of the potential risk treatment options. In particular it would be strongly recommended that the recommendations of this report are discussed on a regular basis at the Alkimos resident's group meetings.

RECOMMENDATION 1

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should engage broader input into beach safety issues along the coast through periodic inclusion of other representative groups such as City of Wanneroo Ranger Services, Residential Representative Groups, Volunteer Marine Rescue, Local Surf Life Saving Clubs and Local Police.

4. Risk Assessment Findings

Assessed Locations:

1 Alkimos-Pipidinny-Yanchep (S) (Alkimos beach)

4.1 Action Planning Priority (Gross Risk)

It must be noted that the below calculation of action planning priority index reflects the current status of the beach. Being a Greenfield site with no formal access tracks, facilities or amenities and very little housing nearby the number of beach users is minimal. This will result in a 'very low' priority index for the region. Given the proposed residential development and the associated development in the coastal region over the next 6 years, dependant on market conditions, visitation rates and conflicting activities on the beach will increase. For this reason consideration needs to be given to potential numbers and incorporate this in planning of the coastal zone at Alkimos.

4.1.1 Action Planning Priority Index

The action planning priority index can be viewed as the gross risk score for a beach. The index seeks to identify the risks associated with the broader coastal environment under assessment, rather than specific hazards and risks present at a particular location or site. The majority of information detailed in this section of the report will be identified through pre existing data (where available), with new data sourced where gaps are present or the data is not reliable.

The information is based on modal data for peak visitation during the busiest season(s). Appendix D of this report is site/hazard specific and will give greater detail for local control measures best suited to local requirements, including factors such as; weather, seasonal adjustments, times, activities etc.

The action planning priority index uses the following risk identification information (RII) - (where available):

1. Australian Beach Safety & Aquatic Management Program Rating (ABSAMP Rating)
2. Local Population Rating (LPR)
3. Human/Activity Interaction Rating (HAIR)
4. Access Rating (AR)

4.1.1.1 Australian Beach Safety & Aquatic Management Program Rating (ABSAMP Rating)

The University of Sydney Coastal Studies Unit developed ABSAMP (Australian Beach Safety and Management Program) in conjunction with Surf Life Saving Australia and the State Associations. The program has identified coastal hazards that affect bathers and rates the safety of the beach on a scale of one to ten, where one (1) is the least hazardous and ten (10) is the most hazardous (see appendix A for ABSAMP beach type characteristic overview). The scales are tabled below:

Location Name	ABSAMP no.	ABSAMP Rating	ABSAMP type
Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]	WA 893	**4**	Reflective plus low tide terrace

4.1.1.2 Local Population Rating

The Local Population Rating (LPR) expands on the information obtained from the Facility Visitation Rating (RII part 2). This additional population rating identifies the population of residents and/or non residents located within 2km's of a coastal location under assessment. The highest figure (resident or non resident) will be recorded.

Population Rating	Qualifying Description (all staying/living within 2km of beach)
1	< 50 residents and/or < 20 non residents (domestic or overseas tourists)
2	50 - 250 residents and/or 21 - 100 non residents (domestic or overseas tourists)
3	250 - 1000 residents and/or 100 – 500 non residents (domestic or overseas tourists)
4	1000 – 2500 residents and/or 500 – 1000 non residents (domestic or overseas tourists)
5	2500 + residents and/or 1000 non residents (domestic or overseas tourists)

Location	LPR Total
Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]	**1**

4.1.1.3 Human/Activity Interaction Rating

The Human/Activity Interaction Rating (HAIR) identifies any conflicts present at the coastal environment between the number of people and activities taking place. Activities include both those in the water and those on the beach. A conflict may include a passive activity such as picnicking and ball games.

Population (in-water)		Conflicting activities		Population (on beach)		Conflicting activities	
100+	5	Persistent and dangerous	5	1000+	5	Persistent and dangerous	5
75-100	4	Persistent	4	750-1000	4	Persistent	4
50-75	3	Regular	3	500-750	3	Regular	3
25-50	2	Isolated conflicts	2	250-500	2	Isolated conflicts	2
1-25	**1**	No conflicts reported	**1**	1-250	**1**	No conflicts reported	**1**

Location	Population (in water)	Conflict	Population (on beach)	Conflict	HAIR Total
Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]	**1**	**1**	**1**	**1**	**4**

4.1.1.4 Access Rating

Beaches or coastal environments that have increased accessibility (i.e. near major roads, cities, public transport, car parks, boat ramps, maintained access paths etc) increase the likelihood of users at that beach. This directly increases the level of risk of drowning and or injury and should be assessed as part of a wider risk assessment.

Access Rating	Qualifying Description
1	No identifiable access via road or track, no facilities, car parking or obvious access points
2	Access via un-maintained track with no facilities and/or via water access
3	Access via any form of track or walkway (either maintained or un-maintained) AND any provision of facilities or services including (but not limited to) public transport, shower, public toilet, payphone, kiosk, significant roadway, parking
4	Access via maintained tracks with clearly identified parking area AND/OR provision of basic facilities (i.e. public toilets, public shower/ wash down area) AND/OR within 10km of moderate sized town or city (population greater than 5,000)
5	Clearly evident, marked or signposted and maintained access points AND/OR within 10km of major town or city (population greater than 25,000) AND / OR car parking for 50 or more vehicles/boat trailers. Public transport provided within 250m of a beach access point

Location	Access Rating
Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]	**2**

4.1.1.5 Action Planning Priority Score

The action planning priority score provides an indicator for the overall level of risk of the location. The scores range from 0 to 60. These scores can be used to prioritise the order in which risk treatments described in Section 4.2 of this report are implemented.

Location	AMSAMP X 2 (Out of 20)	Population Support X 2 (Out of 10)	Human Activity/ Interaction (Out of 20)	Access X 2 (Out of 10)	Total Score (Out of 60)
Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]	**8**	**4**	**4**	**4**	**20**

Scores of 40 or higher indicate a high overall level of risk. Where limited resources prohibit the implementation of all risk treatments recommended in this report, those beaches that have received a high action planning priority score should be treated first, then beaches with a medium score.

Priority	Priority location	Priority Action & Total Score	Comments
1	Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]	16	The lower frequency and population use and low conflicting activities keep this beach and mitigation options in the very low range. As the frequency, population loading and conflicting activity increase so will the priority of action.

Key to Action Planning Priority	High 40+	Medium 31-40	Low 21-30	Very Low 0-20

4.2 Overview of Principal Risk Treatments

4.2.1 Overview of Principal Risk Treatments

There are ranges of risk treatment options that can be considered in the context of coastal risk management. The selection of the most appropriate option involves balancing the financial, social and environmental impacts of implementing each against the benefits derived from each. These may include any combination of the following

- Spread (share) risk – insurance
- Engineer (structural and technological) risk treatment – include modified practices
- Regulatory and institutional – change through revised regulations and planning
- Avoid – isolate the risk, move people away
- Research to better understand
- Educate and inform stakeholders

4.2.2 Hierarchy of risk treatments (controls)

In determining the most appropriate and cost effective option, it is important to consider the hierarchy of risk treatments (controls). The hierarchy is a sequence of options which offer a number of ways to approach the hazard control process.

- Hard controls deal with the tangible such as
    - Eliminate the hazard which in a coastal context is often difficult to achieve
    - Isolate the hazard which in a coastal context can be difficult due to the dynamic nature of environmental and weather conditions.
    - Use engineering controls such as design of access paths, installation of appropriate signage, and revegetation

- Use administrative controls such as supervision, emergency action plans, other documented policies, practices and procedures

- Soft controls deal with human behaviour such as:
  - Awareness and education
  - Community and individual capacity building: and
  - Use of effective leadership, management, trust, ethics, integrity, and building relationships

Outlined below are principal risk treatment solutions that expand upon those listed within the summary of proposed key risk treatments in Section 1.2 of this report. The solutions outlined endeavour to provide specific and detailed information relative to Alkimos beach; however, due to the diverse nature of location characteristics, recommendations are at times generic in nature and may extend to risk mitigation at other City of Wanneroo beaches.

Lend Lease, as the land manager, should endeavour to adopt the most appropriate treatments specific to their organisations capabilities, and in consultation with all relevant stakeholders.

4.2.3 Haddon's Matrix Applied to the Alkimos

William Haddon Jr developed a conceptual model, The Haddon Matrix, over 40 years ago. The matrix applies basic principles of public health management to the problem of traffic safety (Runyan, 1998). The framework can be applied to any source of injury.

The Table below provides an overview of countermeasures for coastal aquatic hazards, as assessed using Haddon's Matrix.

Table 6: An overview of countermeasures, as assessed using Haddon's Matrix

	Host (Beach user)	Agent/Vehicle (Water, waves, rocks)	Physical Environment (Beach, rock platform)	Social Environment (Community norms, policies, rules)
Primary: Pre-Event **(Prior to the beach user entering the water)**	Education to choose appropriate locations and conditions Signage Weather warning systems Systems of supervision Dune vegetation maintenance; management of beach scarping and tunnelling	Activity Zoning Maintain access points	Restrict access Install safer access Maintenance programs Remove hazards	Regulate usage at times of heightened risk Cultural resistance to swimming at patrolled locations
Secondary: Event **(Once the beach user has entered the water)**	Provision of survival skills - education Swimming skill development Systems of supervision	Appropriate clothing/equipment Activity Zoning	Emergency Response Beacons / Alarms / Phones	Use of PFDs while engaging in other aquatic activity (especially if inexperienced)
Tertiary: Post Event **(Once the beach user is in difficulty and requires assistance)**	Education to teach others how to assist or advise the patient CPR and first aid Basic rescue techniques Systems of supervision	Public Rescue Equipment	Emergency markers Install better access for emergency services Emergency alarm/alert devices/systems	Improve response of emergency services Prompt/timely notification of an emergency

4.2.4 Beach Access and Ongoing Maintenance

The provision of access to the coast is a major contributor to the creation of risk in that access methods will guide people to the area and to any hazards that may be present. Access treatment, or otherwise, is a major contributor to managing coastal risk.

Currently there are no formal access tracks in place in the Alkimos coastal zone, however there were a number of informal 4WD tracks observed during site visits (Figure 3). A full detail of access tracks observed at Alkimos beach can be seen in Appendix F.

SLSWA has assessed the mid-point of Alkimos beach (proximal to the area 31°37'22.23"S, 115°39'53.39"E) to be the most suitable location for a recreational and leisure beach which is within the

Alkimos Beach development. In order to direct swimmers and beach users to the safest areas the southern boundary is recommended as the site for the primary access points and associated infrastructure.

This area is optimal as it has:

- Less exposure to submerged rocks and reef along the shoreline and in the surf zone,
- Greater beach width,
- A more gentle gradient in to the water with an extended bank,
- Lower dune elevation; and
- A natural bluff feature providing good visibility north and south.

These characteristics will create a more positive experience for swimmers and beach users and make entry and exit of the water easier and safer. The lower elevation of the dunes in this section will potentially allow for the construction of a multi-use access path for pedestrians, disabled and emergency service and other approved vehicles.

With the existence of public access infrastructure (defined and open access), and amenities comes the necessity to maintain existing infrastructure/capital works and further develop infrastructure to match that of the growing and changing community/stakeholders' needs. A key outcome of the implementation of access tracks and safety signage is the need for a periodic inspection, maintenance and replacement program.

Access tracks will require periodic inspection and maintenance. Common issues include sand drift, overgrown vegetation, degraded footings and damaged fencing. Continual upkeep of defined access paths and associated barriers, including the grading of access paths and sweeping of stairs/steps will ensure continued usage of formal tracks and prevent the creation of additional hazards.

Once defined access tracks have been developed any informal tracks should be closed off. Fences along the base of dunes on the beach side would help prevent future use of these tracks, stop the creation of new tracks and also help protect the dunes from further erosion. Revegetation of the dunes in these areas is also advised to deter use of the informal tracks and improve the stability of the dunes.

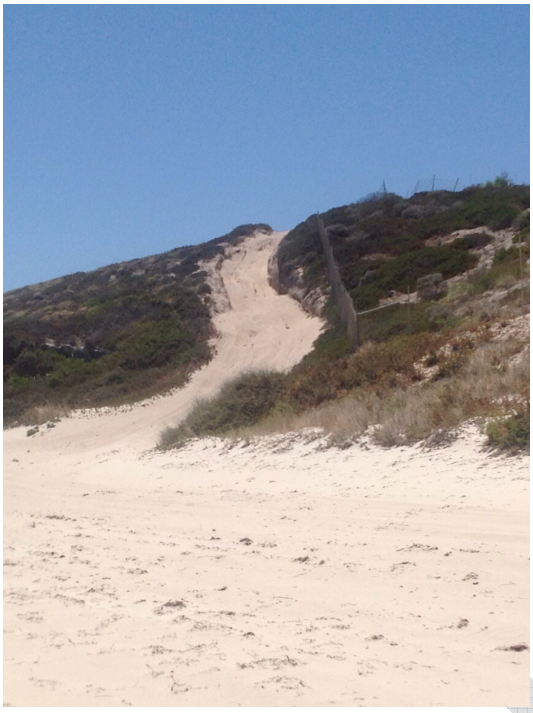


Figure 3: Example of an informal access track observed at Alkimos Beach

RECOMMENDATION 2
The party responsible for implementing and maintaining beach accesses should remove or restrict access to undefined or informal access tracks where appropriate. Access tracks that are no longer in use, unnecessary or that lead people to any high-risk location/s should be considered for closure. If closure cannot be achieved then barriers should be installed to restrict or discourage access.

4.2.5 System of Safety Signage

A coordinated approach to signage, with strategically placed signs which are clearly visible, is a very important part of and the first stage toward more effective coastal aquatic risk management.

Due to the undeveloped nature of the Alkimos site there are currently no formal tracks in place to access the beach, understandably there is no signage either. As the Alkimos coastal zone is developed SLSWA advise Lend Lease to install informative and hazard signage at all access points, on entry roads and at individual hazards (refer to Appendix E). Emergency markers are also recommended at each access track to aid emergency services in the case of an incident. Once paths, roads and other infrastructure is in place SLSWA can undertake a signage audit to advise on types of signage and the exact GPS locations of these.

Examples of suitable future signs include:

- Beach and aquatic safety signage
- Location signage
- Marine zoning signage
- Signage relating to location of toilets/disabled access
- Signage relating to location of nearest lifesaving service
- Local government regulation signage
- Environmental and conservation signage

- Dune management signage
- Community information signage including safety, security and crime prevention.

RECOMMENDATION 3
The party responsible for implementing and maintaining beach accesses and therefore communication of risk (i.e. aquatic safety signage) should implement an inspection regime to assess the installation, adequacy and visibility of in-situ aquatic and recreational safety signage. Records of the inspections and actions should be maintained.

RECOMMENDATION 4
The party responsible for implementing and maintaining aquatic safety signage should ensure the number of individual signs at any one location is maintained to a minimum, wherever possible. A single point of information for warning, regulation and information signage reduces confusion and visual pollution.

RECOMMENDATION 5
The party responsible for implementing and maintaining beach safety signs adopts and maintains Emergency location signage identifiers, as shown in the National Aquatic and Recreational Signage and Style Manual (NARSSM).

These should be incorporated into any new safety signage at Alkimos beach. This should be done in consultation with relevant emergency services agencies. A numbering system will need to be developed and adopted by the party responsible for maintaining beach access tracks and signs. Future municipal/residential developments need to be taken into account to avoid out of sync codes/location identifiers associated with future developments.

Below are examples of the types of signage and hazard symbols to be installed at Alkimos Beach.

<u>Recommended Signage Types</u>
Provided below are examples of the types of signs recommended within each of the coastal aquatic locations.

Level 3: Defined Access
Type B: 3 or 4 Hazard Symbols

Level 3 Open Access/Car Park
Type C: 3 or 4 Hazard Symbols

Level 1: Road Sign

Level 4: Individual Hazard and Regulation Signs

Recommended Hazard Symbols

In reference to the hazard symbol pictorials they are listed in summary below. The alpha numerical code relates to how they are coded within *A/NZS 2416:2012 Water Safety Signs and Beach Safety Flags – Part 1 – Specifications for water safety signs used in public areas* and the *National Aquatic and Recreational Signage Style Manual, Third Edition*.

Swimming Not Advised (AWS,1)

Unstable Cliffs (WSW010)

Submerged Objects (WSW007)

Warning (WS,15)

Unstable Cliffs / Falling Rocks (WSW011)

Shallow Water (WSW006)

Slippery Area (WS,11)

High Surf, Large Waves (WSW023)

Slippery Stairs (WS,37)

Outfall (WSW013)

Strong Currents (WSW015)

Deep shelving beach (WSW024)

Access and Signage Schedule – Access Specific Risk Treatments

The following signage schedules include existing and proposed risk treatments that are specific to accesses. These include, but are not limited to:

- **Closure (Elimination)** – involving revegetation of eroded ground and preventative measures (such as fencing and the removal of existing signage) that would prevent a reasonable person from concluding that access is provided.
- **Formalisation** – involving provision of access control measures (such as fencing and signage) that would allow a reasonable person to conclude that access is provided the desired location.
- **Maintenance** – existing signage & formal access tracks requiring maintenance to ensure they continue to provide the desired controlling of access, and ensure they do not become a hazard themselves.
- **Routine Maintenance** – Monitoring of implemented signage and formalised access to ensure a satisfactory condition is maintained.
- **Signage** – as described in "System of Safety Signage". This may also involve the removal of non-standard signage that could cause confusion or detract from the desired purpose of standard aquatic and recreational signage.

Access and Signage Schedule – Recommendations for all signs

All signage should incorporate the following information:

- **General Information** – for example, the location and direction of the nearest patrolled location,

- **Regulations** – As required by Wanneroo ordinances,
- **Facility Manager** – If desired, the signs can incorporate the Wanneroo logo.

Emergency Location Indicators/Markers

Numbering of access tracks aids location of the incident in the case of an emergency. The City of Wanneroo must be contacted before any system of numbering is implemented to avoid out of sync codes or location identifiers associated with current or future development.

Emergency Vehicle Access to the Location

There are a number of vehicle access tracks to the location, few have relevant signs or control mechanisms such as a lockable barrier.

Those tracks that are used for emergency vehicles should be identified by appropriate signage at the nearest contact with the roadway. These signs should have an emergency location indicator/marker in accordance with the recommendations contained within this report and numbering scheme approved by the relevant emergency service providers.

Distance to closest Lifesaving Service Patrolled Area

The following signage should be used to direct the coastal users to permanent lifesaving services such as that provided by the four volunteer surf lifesaving clubs.

Where multiple signs are positioned at a location they will compete for the attention of visitors. More signs at a location not only create visual pollution, but may reduce the likelihood of any messages being understood. For this reason *A/NZS 2416:2010 Water Safety Signs and beach Safety Flags – Part 3 – Guidance for use*, provides options for the consolidation of signage onto a single multiple symbol sign. The use of such signs, in conjunction with the removal of any unnecessary signage, can reduce the overall number of signs used at a location and therefore reduce visual pollution. Most importantly, however, consolidation of signage may increase the likelihood of the messages on the signs being sighted by visitors and also may increase comprehension.

The recommended signage is, in the opinion of SLSWA, in compliance with both the Australian and International standards for Water Safety Signs and Beach Safety Flags and also mirrors the style guidance in the National Aquatic Recreational Signage Style Manual.

For more specific information on proposed signage at Alkimos Beach refer to Appendix E

4.2.6 System of Supervision – Lifesaving Service Level Analysis

The direct or indirect supervision of aquatic coastal locations is often required to manage the risk of the location. The elevation in risk can be due to prevailing water conditions, the proximity to large populations of people, attendance at the beach/coastal area due to its proximity or attractiveness, seasonal fluctuations, the low capability and experience of beach users or due to the mix of activities in the same location.

The management of preventative and rescue services at coastal aquatic and recreational areas should distinguish between those areas that will receive a lifesaving service and those areas that will not receive such a service.

Levels of supervision that may be considered for Alkimos beach include:

- Beach access and point of hazard signage,
- Beach Camera streams/CCTV/ and other technologies
- Paid Lifeguard Roving Patrols,
- Paid Lifeguard in-situ services,
- Volunteer Lifesaving roving patrols; and
- Volunteer Lifesaving in-situ services;

The advice of subject matter experts and key stakeholder community consultation outcomes will guide the land manager on the most appropriate location for establishing a lifesaving service at Alkimos beach. The advice should include the decision for which areas will be denoted as **guarded** (direct supervision) and which will be **unguarded** (indirect or no supervision).

A lifeguarded beach or designated safer bathing (swimming) area is one at which a trained lifesaver and/or lifeguard is stationed during prescribed times, with associated facility, plant and equipment and is designated by the erection of a pair of red and yellow flags. A mobile lifesaver/lifeguard or lifeguard vehicle that periodically visits or checks a location may be effective as a proactive prevention strategy.

Data gathering and education initiatives should not be considered as providing a guarded swimming location by either the land manager or the population served. The objective data collected; however, serves as a very important analysis and review tool to allow the land manager to make objective decisions around the cost benefits of implementing direct or in-direct supervision strategies.

Signage compliant with ***AS/NZS 2416:2010 Water Safety Signs and Beach Safety Flags*** is required at accessible beach locations. Signage is the first and most basic form of supervision.

Signage is known to increase the awareness of bathers at the location of the guarded/unguarded sites and the hazards present at each location, so that they may make an informed choice as to where to swim. This can be achieved through advertising in local media, and public awareness through residential, tourism and accommodation promotions.

The provision of supervision is difficult to establish, or may not be provided, for some or all of the following reasons:

- The provision of a service may encourage attendance at an unsuitable location, such as when the beach topography and morphology create a highly hazardous location,
- Difficulty resourcing lifeguards and/or lifesavers,

- Determined to be too cost prohibitive and therefore not provided by the responsible land manager; and
- The patronage of the location is low and the assessed risk level is minimal.

There is a range of aquatic supervisory services that should be considered - as one size does NOT fit all.

These include:

- **Full time Comprehensive Lifesaving Service** with appropriate levels of trained personnel, fixed and portable facilities, equipment, craft, vehicles and links to central command and emergency services.
- **Seasonal Lifesaving Service** with appropriate levels of trained personnel, portable facilities, equipment, craft, vehicles and links to central command and emergency services.
- **Seasonal Lifesaving Outpost Service with trained personnel**, portable facilities, some equipment and craft, and links to a command centre.
- **A flexible demand based service** with trained personnel which allocate resources to where they are most needed.
- **Beach Camera/CCTV recorded surveillance**;
- **Other technologies** which may include any combination of periodic monitoring, emergency response points/alerting and communication devices and on-line or other community surveys; and
- **No Service**, with the provision of safety signs and controlled access only.

VOLUNTEER LIFESAVING SERVICES

The City of Wanneroo currently provides resources to implement a comprehensive lifeguard service at two (2) ocean beaches (Quinn's beach and Yanchep Lagoon). Surf Life Saving Clubs (SLSCs) provide a voluntary highly skilled rescue service on weekends and public holidays through the patrol season. Neither of the beaches is patrolled 365 days a year.

These services collect data for days they are actively patrolling, which is logged into SLSA Surfguard database. Since Surf Life Saving Clubs offer voluntary services over wider period of time than current contracted lifesaving services, the statistics collected by these clubs can been used to quantify beach usage levels outside of the peak summer season. Even though the statistics collected by the Surf Life Saving Clubs pertain only to weekends and public holidays, it would be reasonable to expect that these figures could be used as a guide for mid-week usage, particularly during the school holiday periods.

Voluntary services provide an invaluable service to the community, and where possible should be used in conjunction with paid lifesaving services (Lifeguards) who are able to provide services throughout the week.

Currently no direct volunteer lifesaving services are provided at Alkimos Beach. There are provisions for an outpost facility, and/or a Surf Life Saving Club to be installed at Alkimos Beach. There is a Surf Life Saving Club nominated in the Alkimos-Eglington District Structure Plan that will be funded by the Developer Contributions Plan.

Table 7 below shows the current volunteer lifesaving service dates and times.

Table 8 below shows the current City of Wanneroo lifeguard service dates and times.

Table 7: Surf Life Saving Club patrol times

Location	Start Date	End Date	Days	Times
Quinns-Mindarie	3-Nov	30-Nov	Sun/PH (Exc Christmas)	0900 - 1500
	7-Dec	31-Mar	Sat	1000 - 1300
	7-Dec	31-Mar	Sun/PH	0900 - 1400
	1-Apr	21-Apr	Sun/PH	1000 - 1400
Yanchep	3-Nov	30-Mar	Sun	0800 - 1200

Table 8: SLSWA/City of Wanneroo lifeguards patrol times

Location	Start Date	End Date	Days	Times
Quinns	2-Dec	30-Mar	Mon – Fri (Inc Christmas)	0800 - 1300
Yanchep	2-Dec	30-Apr	Mon – Sat /PH	0900 - 1600
	2-Dec	28-Apr	Sun	1200 – 1600
	18- Apr	21-Apr	Fri – Mon (Easter)	0900 - 1600

The land manager will be the responsible agency to meet the cost of developing and implementing a lifesaving service and this will require significant initial and ongoing financial commitment. There a number of challenges with the Alkimos beach site regarding the placement and storage of lifesaving assets and equipment to operate the service. The inclusion of appropriate infrastructure will also require significant planning, development and financial contribution to adequately support the delivery of a direct surveillance service at Alkimos beach.

In the opinion of SLSWA there is not yet sufficient data or infrastructure to support the implementation of a lifesaving service to provide direct supervision of beach users at Alkimos beach.

SLSWA believe the immediate and ongoing cost to support a direct surveillance service currently outweighs the benefit of investment. SLSWA believe that any investment in coastal safety for Alkimos beach would be better directed to supporting the outcomes of recommendations for long term awareness and education programs and beach camera surveillance.

<u>BEACH CAMERA</u>

Cameras through open and closed circuit television (CCTV) can aid supervision through remote periodic monitoring of screens. There are limitations as the effectiveness of this method as it is often only as good as the person watching the monitor, as well as the appropriateness of the response procedures and practices in place to respond to an alert initiated by the person watching the screen/s.

Camera streams can be effective for incident investigation and review. Beach cameras can also be used to stream a video feed to the public who can then virtually assess beach conditions prior to attending the site and make appropriate decisions regarding their attendance.

In the short term and in the opinion of SLSWA the implementation of a camera stream will assist the Land Manager to collect additional objective evidence on beach usage and activity, population loading and the frequency of the loading at Alkimos beach. This information can be analysed and used to assist in the development and planning for future risk mitigation strategies and infrastructure requirements at Alkimos

beach. Collection of objective data with this technology is cost effective, flexible, frequent and sensitive to seasonal fluctuations.

RECOMMENDATION 6
The party responsible for implementing and maintaining coastal aquatic beach safety strategies should carefully consider the implementation of electronic surveillance/monitoring solutions such as remote pan, tilt and zoom technology. This system should form part of a lifesaving surveillance and outpost facility.

LIFEGUARD SERVICE

The nature of the volunteer lifesaving service means that it is most difficult to provide a lifesaving service on days and times when volunteers may be working or studying. As a consequence it is vital that lifeguards be employed to provide a lifesaving service during these times and at locations where beach conditions and attendances dictate.

City of Wanneroo currently provides a paid lifeguard service at the following locations during peak summertime and school holiday periods:

1. Quinns Beach; and
2. Yanchep Lagoon

No paid lifeguard service is currently in place at Alkimos Beach, however with development of a surveillance and outpost facility, paid services are the most logical step prior.

Lifesaving Service Assessment:
The following table identifies the peak season (Summer, Autumn and Spring School Holiday periods, as defined in Section 1.3) calculated Lifesaving Service Level Scores for Alkimos Beach using the ABSAMP Beach Hazard Ratings; Visitation Levels; Frequency of Use; Residency of Visitors; Incident History; and Remoteness of Location to determine best practice lifesaving service levels, and for which the information was available.

Table 9: Lifesaving Service Level scores – Alkimos Beach

Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]: LIFESAVING SERVICE LEVEL CALCULATOR

Dates	ABSAMP Rating	Visitation Rating	Frequency Rating	Residency Rating	Incident History Rating		Remoteness Rating	Total LSSL Score
					New	Existing		
Summer – 2014/2015	4	1	1	1	0	0	4	11

NOTES TO Table 9:

Note 1: When Visitations and Frequencies are low yet rating is high consideration should be given to some form of surveillance patrols or IT solutions to overcome variations of population/visitation numbers.

Note 2*: The option to have one lifeguard on a beach is only permissible under specific circumstances, these being:

- The ABSAMP beach hazard rating is **less than 4,** *or*
- Access to other rescue services is **less than 5 minutes**, direct communication with services is in place, and a Rescue Water Craft is in place.

Otherwise the minimum number of lifeguards at a given location would be **two**.

Detailed analysis of lifesaving service level scores for Fringe and Off-Peak seasons have not been assessed in this report as this was outside of the scope of this assessment. SLSWA is able to provide this service; alternatively your lifesaving service provider can assist you with determining these levels.

LIFESAVING SERVICE LEVEL DESCRIPTORS

The following lifesaving service level descriptors provide the recommended lifesaving service level for the scores/rating as calculated in Table 9 above. The scores are not absolute and are to be used as a guide in determining the actual levels.

Table 10: Lifesaving Service Level scores

Rating	Lifesaving Service Level Description
</= 10	Warning Signage to Aquatic & Recreational Signage Style Guide standard
11-14	Emergency Beacons and/or Camera Surveillance or Swimming Enclosure (where applicable)
	Routine monitoring/surveillance patrols (land, sea, air) to also be considered
15-19	Lifesaving service = 1 x Lifeguard personnel during period assessed (refer to note 2)
20-25	Lifesaving service = 2 x Lifeguard personnel during period assessed
26-30	Lifesaving service = 3 x Lifeguard personnel during period assessed
31 and >	Lifesaving service= more than 3 Lifeguard personnel during period assessed

Where the number of people in the patrolled area is over 1,000, the lifesaving service provider should increase the number of lifesaving personnel in line with the following table.

Table 11: Impact of beach attendance on lifesaving service levels

No. of People on Beach	No. of additional lifeguards
1,000 - 5,000	2
5,000 - 10,000	4
> 10,000	6

Crowds can become in themselves hazardous as a result of difficulties of surveillance and heightened crowd interaction

ACTIVITY ZONING

Activity zoning provides a beach management tool to isolate or separate activities that may be incompatible with the other activities or to isolate hazards or activities that are required to be contained to a particular area. Zoning of activities can be considered in lieu of direct lifesaving services establishing daily beach management plans and zones; however, compliance to the zoning may be much harder to enforce if persons of authority are not in-situ.

However, despite a direct lifesaving service not being in place the seasonal, temporary or permanent use of zoning should not be discounted by the land manager and stakeholders to assist in risk mitigation at Alkimos Beach.

There are two ways that zoning should be applied:

a. Confining a particular aquatic activity to a specific location; and
b. The segregation of activities that are a risk to other aquatic users.

The activities that are most commonly zoned include:

- Swimming,
- Surf boards (stand, stand up),

- Wind craft,
- Paddle craft,
- Fishing,
- Powercraft (including personal water craft [PWC] and water-skiing),

Primary zones for water-based recreation should include:

- Kite surfing
- Sailboarding
- Surfing
- Sub-aqua
- Fishing and/or spear fishing
- Water-skiing
- PWC

Consultation with the local community is essential before putting any zoning in place.

RECOMMENDATION 14

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should investigate and where practical implement activity zoning measures at Alkimos beach. Zoning of incompatible activity will assist to reduce conflict and the incidence of injury by users of this location. This action can assist in directing swimmers into a safer swimming area south of Alkimos beach.

4.2.7 Existence of Coastal/Beach Emergency Action Plans

While SLSWA and the Surf Life Saving Clubs have well-developed Emergency Action Plans for Quinns and Yanchep beaches, these plans do not extent to or have not been tested at Alkimos beach.

Any development of an EAP and associated procedures should give consideration to the following areas in the context of potential coastal aquatic and recreational hazards and incidents that are may occur at Alkimos beach:

- The identification and response to emergencies,
- The nature and types of emergencies,
- Protocols in responding to each emergency,
- The competency and proficiency of responders,
- The type of plant and equipment required for each identified emergency,
- Emergency access to beach locations,
- Planned and scheduled training/practice opportunities; and
- Monitoring and review opportunities.

RECOMMENDATION 7

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should develop, implement and review Emergency Action Plans (EAPs) for Alkimos beach. This activity is to assure a planned and coordinated response to the range of potential and localised coastal aquatic and recreation emergencies that may occur at Alkimos beach.

The EAPs should take into account the difficulties in accessing locations, delay of response and the inherent risks of the locations.

4.2.8 Education and Awareness Programs

The City of Wanneroo has a substantial base of residents that are new arrivals to Australia, many of which have selected to live in a suburb promising a beach lifestyle. The same can be expected in Lend Lease's Alkimos development. The City of Wanneroos jurisdiction therefore offers a unique occurrence where many people are frequently accessing the coast and have poor water safety skills and beach safety awareness.

SLSWA recommend that Lend Lease and the City of Wanneroo engage services for the provision of water safety and education programming in consultation and cooperation with education institutions and learning centres within the local catchment. SLSWA recommends the development of a plan that sustainably leads to the delivery of programs with students from grades K – 10 and that serve to improve and build resilience to drowning.

SLSWA recommend the program needs to be delivered annually with some of the presentations completed by a facilitator external to that educational institution. The external facilitator must have suitable knowledge and experience in water safety and have access to resources that support the delivery of these programs.

SLSWA recommend the key outcome of this program must be to increase;

1. Awareness of key coastal aquatic safety messages and information portals, (i.e. BeachSAFE, Twitter, RecFish West)
2. Awareness of coastal aquatic recreational risks and hazards at Alkimos beach,
3. Awareness of safety signage and the meaning of specific hazard symbols in a coastal setting,
4. Awareness of locations at Alkimos beach and that lead to knowledge of the appropriate areas to undertake aquatic recreation; and
5. Awareness of the need to build individual capability to recreate in a coastal aquatic setting through participation in:
    a. Learn to swim programs,
    b. Swimming fitness programs, and
    c. Surf activity and survival programs.

The development of a resident's beach safety booklet/flyer or smart device app with information specific to Alkimos beach is another awareness and education strategy worthy of consideration. Strategies of this type could be provided and promoted to home owners in the area and assist in raising the awareness and improving education in the wider community on the potential hazards at their local beach.

Items covered in the handbook or flyer may include:

- Beach access
- Hazards and warnings
- "Friendly" part of the beach for swimming
- Map showing beach zoning (for fishing, swimming, surfing, dog beach)
- Parking and other facilities
- Emergency Information
- Lifesaving services

Surf Life Saving Western Australia have investigated various education and awareness programs that are currently, or have been previously, in place to educate and inform beach users coming from both within and outside the City of Wanneroo boundaries, during the assessment and consultation phases of the project.

These include:

- School Education – Life Skills for Life at Mercy College (2012),
- Community Education (2012)
    - CPR Course – Irene McCormack Catholic College, Woodvale Senior High School, Mindarie Quinns Super Clinic
    - Senior First Aid – Woodvale Senior High School, Brightwater Care Group
    - Basic First Aid – Seacrest Homes, Bethanie
    - Remote First Aid – Irene McCormack Catholic College
- Edith Cowan University – Campus Surf Awareness Programs (Surf Educators Australia)

Existing programs should be regularly monitored and reviewed to confirm their effectiveness and ensure they are delivering the desired results.

A number of existing programs have been developed or are offered by various agencies, including Surf Life Saving WA that can assist the land manager to increase beach safety awareness and lifesaving skills. These programs which are imbedded in the SLSWA **BeachSAFE Initiative** include:

- **SurfBabies and SurfKids:** A six week program aimed at children from 2-7 years of age and their parents to increase awareness, confidence and safety at the beach.
- **Surf's Up:** A holiday program for participants between the ages of 7 & 10 years. Over a three day period, participants learn about and enjoy the beach environment with fun games on the beach and in the water, under the supervision of qualified Surf Lifesavers and trainers.
- **Beach Activities**: A way to educate students on the important aspects of sun and beach safety, while increasing their skills and fitness in the water and on the beach. Important safety information is integrated into activities such as board riding, surf negotiation, swimming and beach games.
- **Life Skills for Life:** The program is an interactive two hour program designed to teach school children resuscitation and basic first aid.
- The **SunSmart SurfSmart Presentation:** An interactive PowerPoint presentation covering important topics of sun and beach safety. This includes dangers at the beach, warning signs and meanings, surf environments, identification of lifesavers, wave types, rips, sea creatures, sun protection and safety at the beach.
- The **On the Same Wave:** This program is a beach safety and awareness program aimed at people from multicultural backgrounds. The program can be tailored to suit each groups needs and includes any combination of the SunSmart SurfSmart Presentation, Beach Activities and Life Skills for Life programs using multilingual and culturally appropriate resources.
- The **Nippers Program**: Children aged 5 to 13 years participate in beach activities where they learn about beach safety, surf sports and the beach environment.
- **Indigenous Sports Program:** Aimed at educating indigenous students in rural communities by increasing their knowledge of beach safety and Basic first aid skills, through the SunSmart SurfSmart Presentation and the Life Skills for Life program.
- The **SLSWA School Cadets**: Aims to engage secondary school aged children to participate in personal development and leadership, and aims to foster qualities of community responsibility and service in the way of coastal aquatic safety.

- The **Ocean Paddling – Be Safe Project**: Aims to provide a safety framework and guidelines aimed at the recreational paddler in how to safely participate in recreational paddling activities at the WA coast.
- The **Kite Boarding – Be Safe Project:** Aims to provide a safety framework and guidelines aimed at the recreational kite boarder in how to safely participate in recreational kite boarding activities at the WA coast.
- **Community Surf Rescue Certificate:** Provides participants with the skills and knowledge of basic prevention/rescue and surf awareness in order to be able to participate in aquatic activity and supervise others; and
- The **BeachSAFE website and app**: Information portals that target at all beach users. People can find their nearest patrolled beach and check the associated hazards and recommended activities appropriate for that beach at any time. Other information is provided which allows beach users to make an informed decision about whether or not to recreate at the beach including; weather, UV index, patrol timetable, activities, beach hazard rating and beach facilities such as car parks and café's.

Table 12: Example template of education and awareness program

Program	Target audience	Location	Delivery (Who)
School based safety programs	Lifesavers/Lifeguards attending local LGA primary schools	All locations	SLSWA/Land Manager
Indigenous safety awareness program	Visit by local lifesavers/lifeguards to indigenous communities to provide beach safety information	All locations	SLSWA/Land Manager
Car park tickets	Use car parking ticketing to deliver key safety messages, e.g. ***always swim between the red and yellow flags***	All locations	City of Wanneroo
QR Codes	Use of QR codes on signage and other infrastructure to link to location based beach safety information		SLSWA
Media/Promotion	Use local media and promotional opportunities to deliver safety messages during the peak summer season, i.e. local newspapers, local radio, community publications and billboards Multi Media – Internet Social Media	All locations	Locally significant cultural events SLSWA/Land Manager
Nipper programs	Encourage local children to join local SLSCs and take part in Nipper activities.	All locations	SLSWA and SLSCs
Surf survival program	Promote SLSAs surf survival program at local SLSCs and surf shops no tomb stoning message	All locations	SLSWA and SLSCs
Beach and ocean safety warnings	Media (e.g. Radio and TV), Internet, digital road signage, BeachSAFE, Digital information screens Edith Cowan University, SLSWA/CoW Lifeguards on local TV news doing beach reports – also promotes safety, conditions and the profile/capabilities of lifeguards and lifesavers	All locations	SLSWA and Land Manager

QR Codes

There are many opportunities at present to make use of technology in innovative ways for education and awareness programs. One such opportunity is the use of smart phones to provide location based safety messaging. One method of delivering this would be to implement a system of Quick Response (QR) Codes. These codes can be included on signage and linked to specific beach safety information relating to the beach. The codes can be scanned by smart phones with freely available QR scanning applications installed, such as QR Reader on the iPhone. Below is an actual example of a QR code. This system would be relatively easy and cost effective to implement and would create opportunities for the media to increase public awareness of beach safety related issues. The Shire of Augusta-Margaret River has successfully retro fitted QR Codes to existing signage at beach access points.

Figure 4: An example of a QR Code linked to beach safety information

RECOMMENDATION 8

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should, in association with other water safety and emergency response organisations, develop a planned and adequately resourced approach to improving long term awareness and education opportunities as they relate to safer aquatic recreation at Alkimos beach.

RECOMMENDATION 9

That Lend Lease considers contribution toward an awareness program that develops a resident's beach safety booklet/flyer or similar to be distributed or promoted to new home owners in the Alkimos beach development. This booklet should contain beach safety information specific to Alkimos beach in addition to other generalised beach safety information and messages.

RECOMMENDATION 10

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should implement the use of Quick Reader (QR) codes on aquatic and recreational safety signage at Alkimos beach. Users of this technology are taken to coastal aquatic safety information and in languages and translations that are relevant to their culture and language. The use of QR codes should form part of any aquatic awareness and education programs.

4.2.9 Public Rescue Equipment (PRE)

Public rescue equipment in coastal areas must be appropriate for the features and conditions of the coastline and water. The equipment should be easy to use by members of the public with minimal hesitation and without putting the safety of the rescuer at risk. Not only the type of PRE that is important, but also that it is positioned in the correct location and that maintenance and checking procedures are addressed and in place.

Primary considerations for the adoption of PRE at a coastal location include:

- PRE that requires the rescuer to enter the water to reach a casualty should not be used, for example a personal flotation device with line attached,
- PRE should have inherent buoyancy to support an adult casualty whilst in water,
- PRE device should be retrievable once deployed and then reusable,
- The traditional large life ring is less effective when a rescuer is required to throw rather than lower the equipment to a casualty,
- Line should float and have a breaking strain of no less than 0.5 tonne,
- The line should be no longer than 25m plus any additional drop to the water,
- PRE should be of a weight that is not overly affected by wind conditions and should not present a danger to the casualty,
- Minimum instructions should be presented in order, to reduce confusion and deployment time,
- PRE is not a suitable control measure for some types of shallow shelving beaches,
- The need for strategies to reduce the occurrence of vandalism,
    - Displacing and enforcing by-laws,
    - Electronic warning systems,
    - Awareness and education; and
    - Repositioning/removal of PRE.

Most rescue equipment that is available is for two types of rescue – reach rescue and throw rescue. This is because there is an element of danger associated with any rescue. Other rescue equipment is intended for use by trained lifeguards/lifesavers.

There is limited research, literature or guidelines available in Australia on the use of PRE. The Royal National Lifeboat Institute (RNLI) in the UK has published ***A guide to coastal public rescue equipment*** (2007). The New South Wales Department of Primary Industries commissioned a report titled a *Research Review of Rock Fishing in New South Wales* (2012). This report was named NSW Water Safety Research Project of the Year at the NSW Water Safety Awards in 2012. Page 47 of this report discusses tertiary prevention strategies (post event). This report also notes "Australia currently lacks a rigorous methodology or guideline for the installation of public rescue equipment". Action item 1.16 of the report makes the recommendation to "develop, including necessary field testing, and implement a guideline for the use of public rescue equipment to ensure adequate methodology for the citing, installation, and maintenance of public rescue equipment".

Rescue tubes are not recommended for public use for the following reasons:

1. Rescue tubes are a piece of lifesaving equipment requiring training for safe and proper use,
2. Lifeguards and lifesavers are trained to use rescue tubes in conjunction with swim fins; and
3. Rescue tubes require a rescuer to enter the water to perform a rescue and retrieve the victim by swimming back to shore.

The instalment of public rescue equipment is not recommended at this stage of development due to the lack of visitors to Alkimos beach. As development of the region continues with the creation

of paths, roads and other infrastructure leading to an increase in visitation rates to Alkimos the use of public rescue equipment should be reviewed.

4.2.10 Dune Vegetation Maintenance, Beach Scarping and Tunnelling

People like to have fun on the beach and often dig holes, sculpture the sand or climb amongst the dunes. It is safe as long as people do not excavate or build structures that can collapse and bury them.

- Slopes of dry sand are extremely unstable because there is no attraction between the grains,
- Wet sand dries out quickly,
- Vibrations (from wind, waves or footsteps) can make sand slopes collapse, even when wet; and
- A tunnel or hole in sand can cave in at any time, without warning, when anyone tunnels or digs deep holes.

Dune and beach scarping has been identified as a hazard at Alkimos beach fore dune, with the potential risk of tunnelling, sand collapse and fall injury.

Options to reduce the risk of tunnelling, sand collapse and falls in relation to erosion issues are limited. Some options may include:

- Individual hazard and/or temporary signage,
- Access restriction barriers (permanent or temporary); and
- Periodic monitoring of specific locations where this has been identified as a potential risk.

RECOMMENDATION 11

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should consider, and where practicable, implement engineered options to minimise the risks associated with dune and beach scarping presenting a risk of tunnelling, sand collapse and falls, or access to rock overhang areas. Beach and dune erosion are important considerations when determining the placement and maintenance of beach access tracks/infrastructure.

RECOMMENDATION 12

The party responsible for implementing and maintaining coastal aquatic beach safety strategies should consider that vegetation species planted in dune revegetation programs should be regularly monitored to ensure that they are not negatively impacting on the provision of safety and emergency services at a location. In particular the monitoring should ensure that plant foliage does not obscure vision of signs and reduce the effectiveness of the messaging.

4.2.11 Emergency Response Beacons, Alarms and Phones

Emergency response beacons are a mobile or fixed unit capable of providing emergency communications to high-risk unguarded localities where there is a history of fatal drowning or other coastal death. The time taken to raise the alarm and achieve an emergency service response in such locations is a contributing factor to the chance of survival. These types of units (pictured below in Figure 5) are capable of communicating over two-way radio network, GSM or fixed line network.

Public education and information as to the location of the lifesaving service, including typical response times, should be provided near/on the ERP, along with other emergency service information.

A suitable Standard Operating Procedure (SOP) and Emergency Action Plan must be developed if this mitigation strategy is adopted.

Simple and effective use of these technologies allows emergency reporting and voice information to be received by emergency communication centres using a range of technology. Field evaluation has proved the community recognises these devices, as they are common on motorways, public transport and access areas throughout the world today.

Any program initiated and supported by the land manager will need to monitor and review any malicious activations and vandalism of the device before determining this strategy as permanent.

SLSWA recommends the emergency alert system is directed to '000' call and dispatch centres or to the WA Water Police communications centre to enable a consistent and reliable responses to known emergencies; and one that is coordinated by a central agency with responsibility for marine search and rescue activity. From this point a relevant and appropriate decision can be made to tasks the best placed agency to respond to the identified emergency. Consultation with WA Police agencies to determine the acceptance of this service has not been completed for compiling this report.

Figure 5: An example of a mobile Emergency Reporting Point in place at a beach(s)

At this stage SLSWA does not recommend the installation of an Emergency Respone Beacon. When the facility visitation rates and priority action score for Alkimos beach increase the instalment of an Emergency Response Beacon should be reviewed.

4.2.12 Monitor and review

Monitoring and review activity are an important part of risk mitigation to ensure that risk treatment options are meeting their objectives, new hazards and risks are identified and addressed in a timely manner and evolving strategies are in line with community expectations.

The land manager should ensure there is a process of regular review of the effectiveness of any risk treatments implemented. This should include a process for the collection of data regarding any incidents affecting public safety.

RECOMMENDATION 13
The party responsible for implementing and maintaining coastal aquatic beach safety strategies should review and continue to enhance aquatic recreation public safety injury data and information collection.

This should include the collation and analyses deemed necessary to underpin accurate risk assessment and effective risk treatment plans and actions.

5. Actions Register

Assessed Locations

1 Alkimos-Pipidinny-Yanchep (S) (Alkimos beach)

5.1 Implementation Priorities

This section provides an example only of the charting and recording of actions taken in implementing a consistent risk mitigation program at Alkimos beach. The actual implementation and records taken against actions is left to the land manager to confirm.

Priority 1

- Acceptance or otherwise of report recommendations to be completed by Lend Lease officers.
- Control measure implementation charts, to be completed and responsibilities assigned.
- Works programmes to be developed or re-affirmed from recommended control measure implementation charts, and in conjunction with relevant internal (or where appropriate) external stakeholder groups.
- High priority works to be commenced as soon as is practical.
- Communication with relevant stakeholders be maintained or increased.
- Risk monitoring practices and procedures is implemented with records retained.
- Enhanced data collection and collation procedures are implemented.
- Monitoring and review activity completed periodically and results documented.

Priority 2

Education and awareness

- Education and awareness program be identified, developed and implemented (development may be commenced earlier)

Risk Assessment Update

- An updated risk assessment to be conducted and information collected to be collated with the inclusion of relevant and up to date data collected and collated in the intervening period.

The following chart is provided as **one example** of how the land manager could log and manage its coastal aquatic risk management program at Alkimos beach.

Table 13: Control Measure Implementation

Hazard Description (Location)		Recommended Additional Controls/Treatment Plans	Refer to section	Priority			Person responsible for implementing control measures	Complete by date	Details of action taken (date completed)	Review date
Ref				H	M	L				
	Alkimos	**Emergency Marker Sign:** Land Manager to identify each formal beach access track and provide each one with a unique identifier that can be posted onto access warning signs.								
	Alkimos	**Restrict access:** Informal access points are to have barriers put in place to restrict in direct access to the beach via these locations. Dune revegetation is also recommended in these areas.								
	Alkimos	**Education Program:** SLSWA recommend that Lend Lease and the City of Wanneroo engage services for the provision of water safety and education programming in consultation and cooperation with education institutions and learning centres within the local catchment. SLSWA recommends the development of a plan that sustainably leads to the delivery of programs with students from grades K – 10 and that serve to improve and build resilience to drowning.								

	Alkimos	**Residents Booklet/ Education:** SLSWA recommend the development of a beach safety booklet/flyer/tool containing coastal safety information specific to Alkimos Beach to be distributed to new home owners in the area.								
	Alkimos	**Maintained access tracks:** Maintain growth of foliage from trees along formalised access tracks, especially so they do not obscure hazard warning signage. Maintain access track surface so they are evenly graded and relatively free from any significant changes in levels or rocks or boulders protruding up from the ground.								
	Alkimos	**Emergency Action Plans:** The land manager with the advice of a water safety emergency response organisation to develop an emergency action plan that specifically addresses the need to respond to emergencies that are likely to occur at Alkimos beach.								
	Alkimos	**Beach camera stream:** In consultation with the City of Wanneroo, Lend Lease to explore the installation and maintenance of a beach camera that can be periodically monitored to collect data for beach conditions, use and activity.								

Alkimos	**Activity Zoning:** Lend Lease through its formalised policy framework actively work to separate incompatible activity though the use of activity zones (i.e. fishing, surfing, swimming, kite boarding)								
	Access and Signage: • Access paths to be clearly defined. • Appropriate safety signage be installed • Inappropriate, damaged or vandalised signs to be replaced/removed								

6. Documentation and Reference Material

The following documentation was provided by Lend Lease to assist in compilation of this interim report:

- City of Wanneroo. Coastal Management Plan – Part 1 (July 2012)
- City of Wanneroo Local Laws. Local Government Act 1995. Dog Act 1976. City of Wanneroo Animal Local Law 1999.
- Identification of subdivision, timing of release and expected population.
- Lend Lease Communities (Alkimos) Pty. Ltd. Alkimos Coastal Setback Assessment.
- Alkimos Marina – Comments for local structure plan.
- South Alkimos Local Structure Plan.
- Alkimos District Structure Plan (Excerpt.)
- Draft Perth Coastal Planning Strategy. December 2008.
- South Alkimos – Key GPS Locations.

Other documentation and reference points include:

- SLSA Australian Coastal Public Safety Guidelines (2007) 1st Edition
- Australian Beach Safety and Management Program. SLSA and Dr. Andrew Short (University of NSW). Beaches of the Western Australia Coast: Eucla to Roebuck Bay (2005). University of Sydney Publications. SLSA Coastal Aquatic Risk Assessment Process
- AS/NZS 2416.1:2010 Water safety signs and beach safety flags - Specifications for water safety signs used in workplaces and public areas (ISO 20712-1:2008, MOD)
- AS/NZS 2416.3:2010 Water safety signs and beach safety flags - Guidance for use
- National Aquatic and Recreation Signage Style Guide; Third Edition (July 2006)
- AS/NZS 2416.3:2010 Water safety signs and beach safety flags - Guidance for use
- ISO 7010: 2011. Graphical symbols – Safety colours and safety signs – Registered safety signs
- Beach Safety and the Law: Australian Evidence. Wilkes. J (Ed). (2008)
- Google Earth: Datum reference points and images
- SLSA Australian Coastal Public Safety Guidelines (2007) 1st Edition
- SLSA - 33rd Edition Public Safety and Aquatic Rescue
- SLSA Surfguard Database
- Australian Beach Safety and Management Program. SLSA and Dr. Andrew Short (University of NSW). Beaches of the Western Australia Coast: Eucla to Roebuck Bay (2005). University of Sydney Publications. SLSA Coastal Aquatic Risk Assessment Process
- National Coastal Safety Report 2012 (SLSA)
- National Aquatic and Recreation Signage Style Guide; Third Edition (July 2006)
- A Guide to Coastal Public Rescue Equipment. Version 1. 2007. Royal National Lifeboat Institute.
- BeachSAFE Initiative. Version 1. 2013. Surf Life Saving Western Australia.
- WA Coastal Safety Report 2013. Surf Life Saving Western Australia.
- Surf Life Saving Australia (2013) National Coastal Safety Report 2013. SLSA: Sydney.
- www.coastsafe.org.au
- www.ripcurrents.com.au
- www.beachsafe.org.au
- www.bom.gov.au

7. Appendices

APPENDIX A: Facility Visitation Rating (FVR) Reference Tables

Table 1 - Typical Development and Natural Hazards Rating for Reserves

Rating	Development	Natural Hazards
1	Virginal bush, cleared land, no infrastructure	No hazardous features
2	Cleared land, static infrastructure e.g. grass area with tables and chairs, toilet block, lookout	Sloping ground; no natural water; walking track around reserve
3	Cleared land with mobile infrastructure e.g. grassed area with play equipment, cycleway, market, leash free dog areas	Reserve contains natural waterway that runs during wet weather, drops less than 1 metre
4	Council owned infrastructure with no artificial lighting e.g. golf course, football field, recreational ground, caravan park	Creeks, ponds and ledges between 1 metre and 3 metres
5	Extensively developed infrastructure with artificial lighting e.g. sporting complex, artificially lit courts	Contains rivers, dams and cliffs greater than 3 metres

Table 2- a typical population use within a facility provided by Council. It is important that Council's table reflects as accurately as possible its actual situation.

Rating	Population Use
1	Less than 5 people at a time
2	5 to 50 people at a time
3	50 to 100 people at a time
4	100 to 500 people at a time
5	Greater than 500 people at a time

Table 3 - Suggested Frequency of use rating for a Facility

Rating	Frequency of Use
1	An annual activity or event in held at the facility
2	An activity event takes place in the facility on a monthly basis
3	An activity event takes place in the facility on a weekly basis
4	An activity event takes place in the facility on a daily basis
5	The facility is in continuous use for the majority of the day

APPENDIX B: Enterprise Wide Risk Ranking Tool

Australian for life.

ENTERPRISE-WIDE RISK MANAGEMENT – RISK RANKING TOOL

IMPACT TABLE

DESCRIPTOR	PEOPLE (Social) Due to SLSA Culpability or Negligence	PROPERTY & FINANCIAL Property loss; Increased expenses; lost revenue	ENVIRONMENTAL (Environment) e.g. Dune and Back beach; Creeks; Lagoons; Bushland; Air; Vegetation; Wildlife	REPUTATION (Governance) Social; Ethical; Heritage; Cultural; Leadership
Extreme	Death or total permanent disability	> $1 million; Massive financial loss	Catastrophic event (e.g. habitat destruction) with national significance (e.g. endangered species) attracting national media attention	Wholesale resignation of Board Members and Senior Management Major State or National media coverage 1,000 + complaints Financial loss or fraud > $100,000
High	Critical injury resulting in long-term partial disability	> $100,000 - $1 Million; Major financial loss	Major event (e.g. creek contamination, chemical spill, > 20lt oil spill) with regional impact (e.g. lake, lagoon, creek) requiring external emergency agency clean up support	External Agency Inquiry with adverse finding Significant regional media coverage 50 – 1,000 complaints Financial loss or fraud > $50,000 <- $100,000
Medium	Very serious injury, e.g. broken arm, leg, wrist, etc which could result in hospitalisation and/or greater than 7 days off work	> $10,000 - $100,000; High financial rate	Major event (e.g. 10 - 20lt oil spill) with localised impact (e.g. street, precinct)	External Agency request for clarification Regional & suburban media coverage 20 – 50 complaints Financial loss or fraud > $5,000 < $50,000
Minor	Minor injury, e.g. strain, sprain, gash, etc resulting in between 1-7 days off work	> $1,000 - $10,000; Minor financial loss	Minor event (e.g. < 10lt oil spill) with localised impact (e.g. street, precinct)	Suburban media coverage 10 – 20 complaints Financial loss or fraud > $1,000 < $5,000
Insignificant	Minor injury, e.g. cuts, abrasions, etc requiring first-aid and/or resulting in less than 1 day off work	< $1,000; Low financial loss	Negligible event (e.g. noise pollution) with localised impact (e.g. street, precinct)	Media enquiry / Letter to the Editor 0 – 10 complaints Financial loss or fraud < $1,000

LIKELIHOOD TABLE

DESCRIPTOR	DESCRIPTION
Almost Certain	• Will probably occur more than once • 100% chance of occurrence • Common or Frequent Occurrence • Is expected to occur in most circumstances
Likely	• High probability that will occur at least once • 1 in 10 chance of occurrence (10%) • Likely to occur or "has happened to us a number of times in the past" • Might occur in a 2-3 year timeframe
Possible	• Reasonable likelihood that could occur more than once • 1 in 100 chance of occurrence (1%) • Could occur or "I've heard of it happening elsewhere" • Might occur in a 5 year timeframe
Unlikely	• May occur once or less • 1 in 1000 chance of occurrence (0.1%) • Not likely to occur • Might occur in a 10 year timeframe
Rare	• May occur in exceptional circumstances • Practically impossible • 1 in 10,000 chance of occurrence (0.01%) • Could happen but probably never will

RISK SCORE MATRIX*

LIKELIHOOD \ IMPACT	1. INSIGNIFICANT	2. MINOR	3. MEDIUM	4. HIGH	5. EXTREME
5. ALMOST CERTAIN	M5	H10	H15	E20	E25
4. LIKELY	L4	M8	H12	E16	E20
3. POSSIBLE	L3	M6	H9	H12	E15
2. UNLIKELY	L2	L4	M6	H8	H10
1. RARE	L1	L2	L3	M4	M5

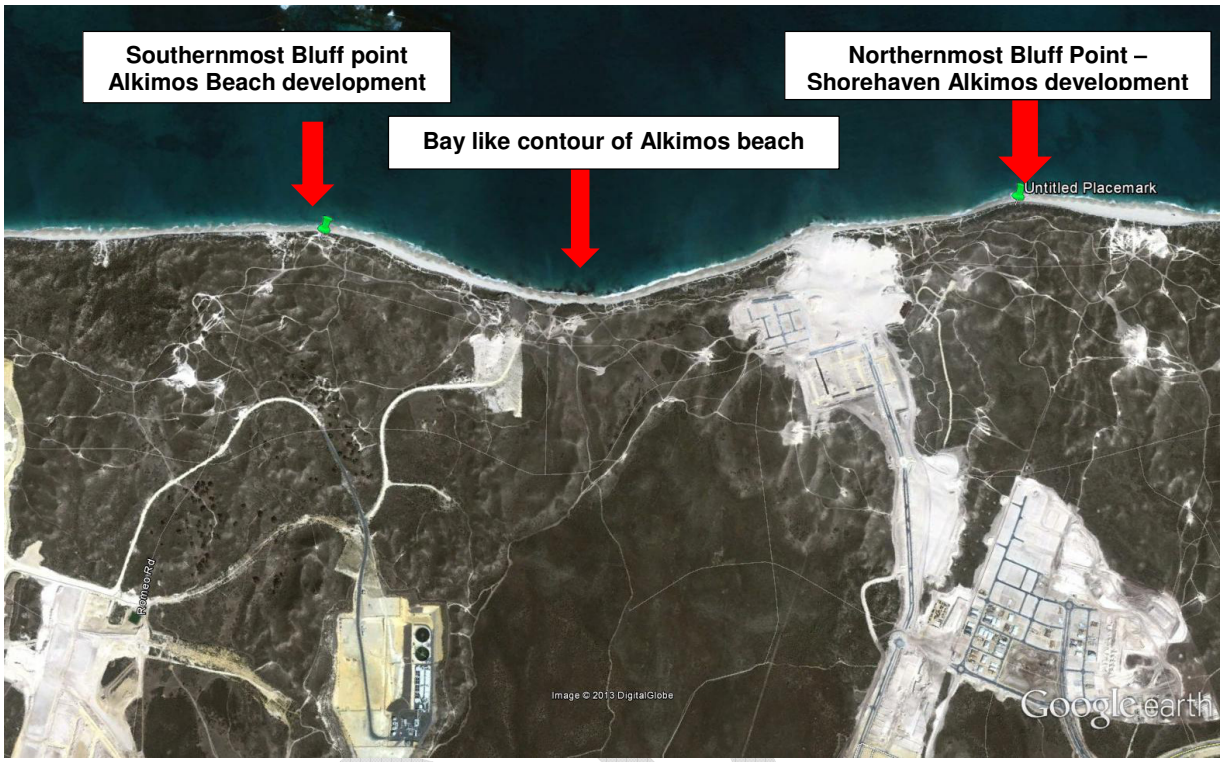
RISK LEVEL	ACTION YOU SHOULD TAKE
EXTREME – (E15-25)	Consider discontinuing - Immediate correction required
HIGH - (H8 –H15)	Immediate corrective action required
MODERATE – (M4 - M8)	Attention needed - correction required
LOW – (L1 – L4)	Perhaps acceptable as is

* Risk Score Matrix consistent with ISO 31000: Risk Management

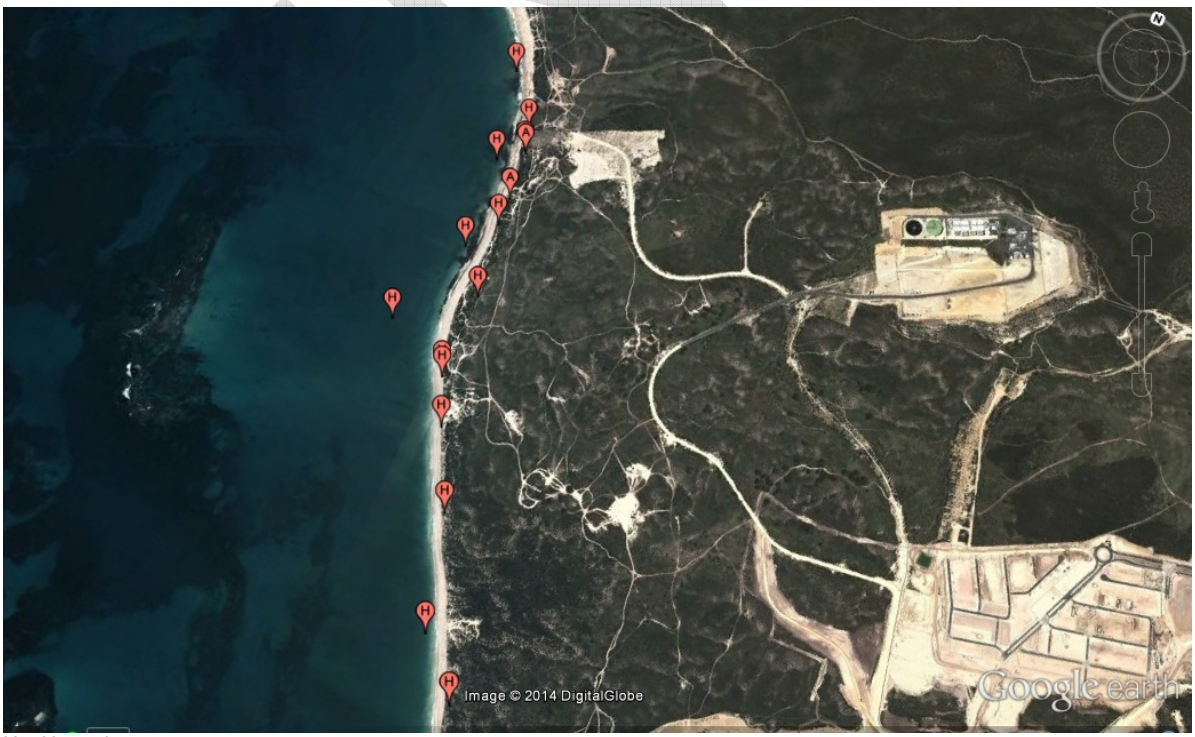
Appendix C: Alkimos Beach Assessment Area

C1: Image of Alkimos beach (Google Earth)

C2: Google Earth Image of North and South Bluff Points



C3: Hazard and access data overlayed on a Google Earth Image



H = Hazard
A = Access

C4: Graphical Observations

View north from the southernmost bluff showing the desired location for a designated swimming beach.

View south from the southern bluff showing narrower beach and steep dunes with signs of erosion.

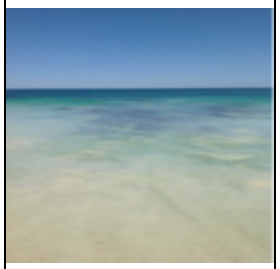
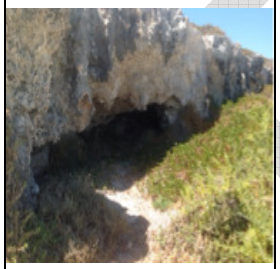
Reef platform located in the surf zone at the northern end of Alkimos Beach.

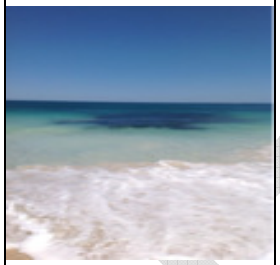
Limestone cliffs backing the beach at the northern end of Alkimos.

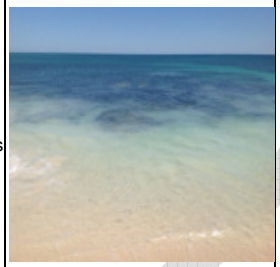
Appendix D: Risk Register* and Risk Treatment Plan**

Assessed Beaches:
1 Alkimos-Pipidinny-Yanchep (S) (Alkimos beach)

D1 Risk Register and Risk Treatment Plan – Alkimos-Pipidinny-Yanchep (S) [Alkimos Beach]

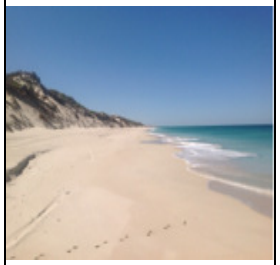
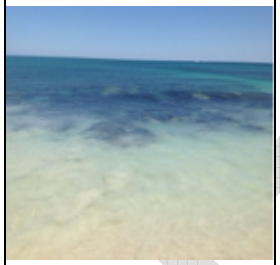
Ref	Hazard Description (location)	Photo	Risk(s)	Risk Matrix's			Risk Groups	Existing Controls/Treatment Plans	Recommended Additional Controls/Treatment Plans	Action Priority & Residual Risk Level
				C	L	Risk Level				
1	Submerged Reef		Dislocation Slips, trips, falls Head Injury Major injuries / Hospitalisation Cuts and abrasions Spinal injury Minor First Aid	Extreme	Possible	Extreme	Swimmers Elderly Disabled Children	Nil	Access restrictions Activity Zoning Beach safety signage Discourage usage by swimmers	**High**
2	Cave		Rock fall/collapse	Extreme	Unlikely	High	Beach user Poor vehicle access	Nil	Fence Beach safety signage	**Medium**

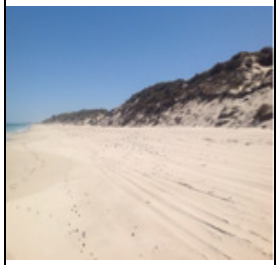
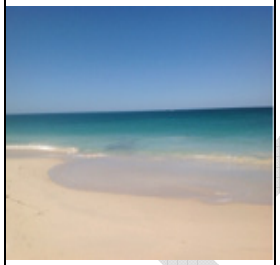
Ref	Hazard Description (location)	Photo	Risk(s)	Risk Matrix's			Risk Groups	Existing Controls/Treatment Plans	Recommended Additional Controls/Treatment	Action Priority & Residual
3	Rocks		Cuts and abrasions Head Injury Slips, trips, falls	Minor	Possible	Medium	Beach user	None	Access restrictions Beach safety signage Controlled Access	**Low**
4	Rock Shelves / Reefs		Cuts and abrasions Minor First Aid Dislocation Head Injury Slips, trips, falls Major injuries / Hospitalisation Spinal injury	Extreme	Possible	Extreme	Swimmers Disabled Elderly Children	None	Access restrictions Activity Zoning Beach safety signage	**High**

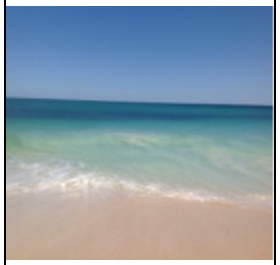
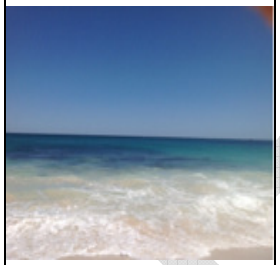
Ref	Hazard Description (location)	Photo	Risk(s)	Risk Matrix's			Risk Groups	Existing Controls/Treatment Plans	Recommended Additional Controls/Treatment	Action Priority & Residual
5	Cliff		Head Injury Rock fall/collapse	Extreme	Unlikely	High	Beach user	Nil	Fence	**Medium**
6	Rockshelves/reefs		Cuts and abrasions Minor First Aid Major injuries / Hospitalisation Head Injury Broken Bones Slips, trips, falls Spinal injury Dislocation	Extreme	Possible	Extreme	Swimmers Disabled Children Elderly	Nil	Access restrictions Beach safety signage Activity Zoning	**High**

Ref	Hazard Description (location)	Photo	Risk(s)	Risk Matrix's			Risk Groups	Existing Controls/Treatment Plans	Recommended Additional Controls/Treatment	Action Priority & Residual
7	Snakes	No picture	Poisonous bite Minor injuries / First Aid	Medium	Possible	High	Beach user Walkers	Nil	Access restrictions Fence Beach safety signage	**Low**
8	Dune drop off		Sand collapse Environmental damage	Medium	Possible	High	4WD/ATV Operator Beach user	Nil	Create formal access paths Dunal Restoration Fence	**Medium**

Ref	Hazard Description (location)	Photo	Risk(s)	Risk Matrix's			Risk Groups	Existing Controls/Treatment Plans	Recommended Additional Controls/Treatment	Action Priority & Residual
9	Unstable and / or Eroded Dunes		Environmental damage Sand collapse	Minor	Possible	Medium	4WD/ATV Operator Beach user	Nil	Create formal access paths Fence Dunal Restoration	**Low**
10	Pollution / Litter		Cuts and abrasions	Minor	Unlikely	Low	Beach user Walkers	Nil	Beach Cleaning / Grooming	**Low**

Ref	Hazard Description (location)	Photo	Risk(s)	Risk Matrix's			Risk Groups	Existing Controls/Treatment Plans	Recommended Additional Controls/Treatment	Action Priority & Residual
11	Dune drop off		Environmental damage Sand collapse	Medium	Possible	High	4WD/ATV Operator Beach user	Nil	Dunal Restoration Fence Create formal access paths	**Medium**
12	Submerged rocks		Cuts and abrasions Minor First Aid Major injuries / Hospitalisation Head Injury Broken Bones Slips, trips, falls Spinal injury Dislocation	Extreme	Possible	Extreme	Swimmers Disabled Children Elderly	Nil	Access restrictions Beach safety signage Activity Zoning	**High**

Ref	Hazard Description (location)	Photo	Risk(s)	Risk Matrix's			Risk Groups	Existing Controls/Treatment Plans	Recommended Additional Controls/Treatment	Action Priority & Residual
13	Dune drop off		Sand collapse Environmental damage	Medium	Possible	High	Beach user	Nil	Dunal Restoration Fence Create formal access paths	**Medium**
14	Drop off in water		Non-Fatal Drowning Drowning Death	Extreme	Possible	Extreme	Elderly Disabled Children Weak swimmers	Nil	Access restrictions Activity Zoning Beach safety signage	**High**

Ref	Hazard Description (location)	Photo	Risk(s)	Risk Matrix's			Risk Groups	Existing Controls/Treatment Plans	Recommended Additional Controls/Treatment	Action Priority & Residual
15	Rips		Non-Fatal Drowning Drowning Death	High	Possible	High	Elderly Physically Unfit Disabled Beach user Weak swimmers	Nil	Controlled Access Beach safety signage Escape a Rip sign	**High**
16	Submerged Reef		Cuts and abrasions Broken Bones Slips, trips, falls Minor First Aid Head Injury Major injuries / Hospitalisation Spinal injury Dislocation	Extreme	Possible	Extreme	Disabled Swimmers Elderly Children	Nil	Beach safety signage Access restrictions Activity Zoning Discourage usage	**High**

Appendix E: Proposed Signage

Assessed Locations:
1 Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]

Example Only  	**Location Identification:**	
	Beach Name:	Alkimos Beach
	Site Reference:	N/A
	Sign Type:	**Level 1 - Road Sign**
	GPS Location:	
	Location Description and Siting:	Road signs may be used to direct swimmers to certain areas (e.g. patrolled beaches) or can be warning signs (e.g. 'no lifesaving service'). Road signs are dispayed along local roads leading to the beach.

Hazards and Warnings:

No Lifesaving Service

AS/NZ: ZZW3

Information:

Regulations:

General Notes on location:

Reference:

1. AS/NZS: 2416.1. 2010. Water safety signs and beach safety flags. Specifications for water safety signs used in workplaces and public areas (ISO 20712-1: 2008 MOD)
    a. Where available use symbols in diamond enclosure from this standard.
2. AS/NZS: 2416.3. 2010. Water safety signs and beach safety flags. Guidance for use
    a. Where available use symbols in diamond enclosure from this standard.
3. National Aquatic and Recreational Style Guide Manual (Version 3. July 2006).
    a. Use this manual to guide the development of the sign style.

Example Only	**Location Identification:**	
	**Beach Name:**	Alkimos Beach
	Site Reference:	<Street Name>. In case of emergency dial '000'
	Sign Type:	**Level 2 - Carpark Sign**
	GPS Location:	
	Location Description and Siting:	Designed to attract attention and to display important. Contains location name and emergency marker, hazards, lifesaving service/safety information and regulations.

Hazards and Warnings:

					
No Lifesaving Service NARSSM WS 15	Deep Water AS/NZS: 2416.1 WSW005	Submerged Rocks AS/NZS: 2416.1 WSW007	Dumping waves AS/NZS: 2416.1 WSW023	Unstable cliff AS/NZS: 2416.1 WSW011	Snakes AS/NZ: 2416.1 WSW013

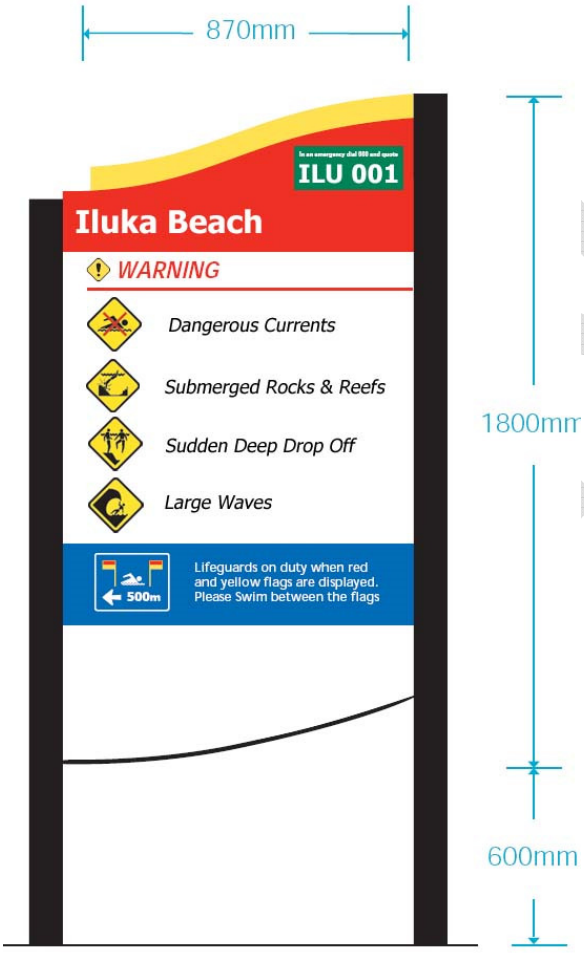
Information:

	Yanchep Lagoon (Yanchep SLSC) is patrolled only when red and yellow flags are displayed. *??km North. Refer www.beachsafe.org.au or www.wanneroo.wa.gov.au. *Approximate assessment		Keep children under supervision at all times.
NARRSSM IS, 1		AS/NZS: 2416.1 WSM002	

Regulations:

					
No Animals ISO 7010 PO21	No Horses NARSSM RS 17	No Vehicles NARSSM RS 03	No Motorbikes/Quad bikes NARSSM RS 04	No Littering NARSSM RS, 10	No camping NARSSM RS 43

Reference:
1. AS/NZS: 2416.1. 2010. Water safety signs and beach safety flags. Specifications for water safety signs used in workplaces and public areas (ISO 20712-1: 2008 MOD) a. Where available use symbols in diamond enclosure from this standard. 2. ISO 7010: 2011. Graphical symbols – Safety colours and safety signs – Registered safety signs 3. National Aquatic and Recreational Style Guide Manual (Version 3. July 2006). b. Use this manual to guide the development of the sign style.
<<INSERT GIS GRAPHIC>>



Example of Level 3 Open Access/Car Park signage for Alkimos Beach

Example Only	**Location Identification:**	
	**Beach Name:**	Alkimos Beach
	Site Reference:	<Street Name>. In case of emergency dial '000'
	Sign Type:	**Level 3 - Access Sign: Type A (defined access)**
	GPS Location:	
	Location Description and Siting:	For use where access to the beach is controlled via a narrow pathway. Sign includes location identification, hazards and warnings, information, regulations and facility manager.

Hazards and Warnings:

					
No Lifesaving Service NARSSM WS 15	Deep Water AS/NZS: 2416.1 WSW005	Submerged Rocks AS/NZS: 2416.1 WSW007	Dumping waves AS/NZS: 2416.1 WSW023	Unstable cliff AS/NZS: 2416.1 WSW011	Snakes AS/NZ: 2416.1 WSW013

Information:

	Quinns Beach (Quinns Mindarie SLSC) is patrolled only when red and yellow flags are displayed. ??km South. Refer www.beachsafe.org.au or www.wanneroo.wa.gov.au. *Approximate assessment	 AS/NZS: 2416.1 WSM002	Keep children under supervision at all times.
NARRSSM IS, 1			

Regulations:

					
No Animals ISO 7010 PO21	No Horses NARSSM RS 17	No Vehicles NARSSM RS 03	No Motorbikes/Quad bikes NARSSM RS 04	No Littering NARSSM RS, 10	No camping NARSSM RS 43

Reference:

1. AS/NZS: 2416.1. 2010. Water safety signs and beach safety flags. Specifications for water safety signs used in workplaces and public areas (ISO 20712-1: 2008 MOD)
    a. Where available use symbols in diamond enclosure from this standard.
2. ISO 7010: 2011. Graphical symbols – Safety colours and safety signs – Registered safety signs
3. National Aquatic and Recreational Style Guide Manual (Version 3. July 2006). (NARSSM)
    c. Use this manual to guide the development of the sign style.

<<INSERT GIS GRAPHIC>>

Example of Level 3: Defined Access signage for Alkimos Beach

Example Only  	**Location Identification:**	
	Beach Name:	Alkimos Beach
	Site Reference:	N/A
	Sign Type:	**Level 4 - Individual Hazard Sign**
	GPS Location:	
	Location Description and Siting:	Used where a hazard is localised and identified at a level of risk that warrants sign posting. Also used for displaying regulations at known trouble spots and to indicate regulation boundaries (e.g. dogs permitted past this point)
Hazards and Warnings:  Unstable rock AS/NZS: 2416.1 WSW011		
Information:		
Regulations:		
General Notes on location: Reference: 1. AS/NZS: 2416.1. 2010. Water safety signs and beach safety flags. Specifications for water safety signs used in workplaces and public areas (ISO 20712-1: 2008 MOD) a. Where available use symbols in diamond enclosure from this standard. 2. AS/NZS: 2416.3. 2010. Water safety signs and beach safety flags. Guidance for use a. Where available use symbols in diamond enclosure from this standard. 3. National Aquatic and Recreational Style Guide Manual (Version 3. July 2006). a. Use this manual to guide the development of the sign style.		
<<INSERT GIS GRAPHIC>>		

Appendix F: Access Schedule

Assessed Beaches:

1 Alkimos-Pipidinny-Yanchep (S) [Alkimos beach]

Note: GPS Datum is WGS 84. Additionally, the GPS device used was an iPad 3 with a margin error of ±5.0 metres.

F1: Access and Signage Schedule – Alkimos-Pipidinny-Yanchep (S) [Alkimos Beach]

Access Reference	Photo	Access Location Description	GPS Position	Current Access Risk Treatment	Proposed Risk Treatment for Access	Type	Hazards
1			31.615351,115.663666	None	Fence Controlled Access Create formal access paths	Informal 4WD track	Dune drop off Unstable and / or Eroded Dunes
2			31.616686,115.663811	None	Create formal access paths Controlled Access	Informal 4WD track	Dune drop off Unstable and / or Eroded Dunes

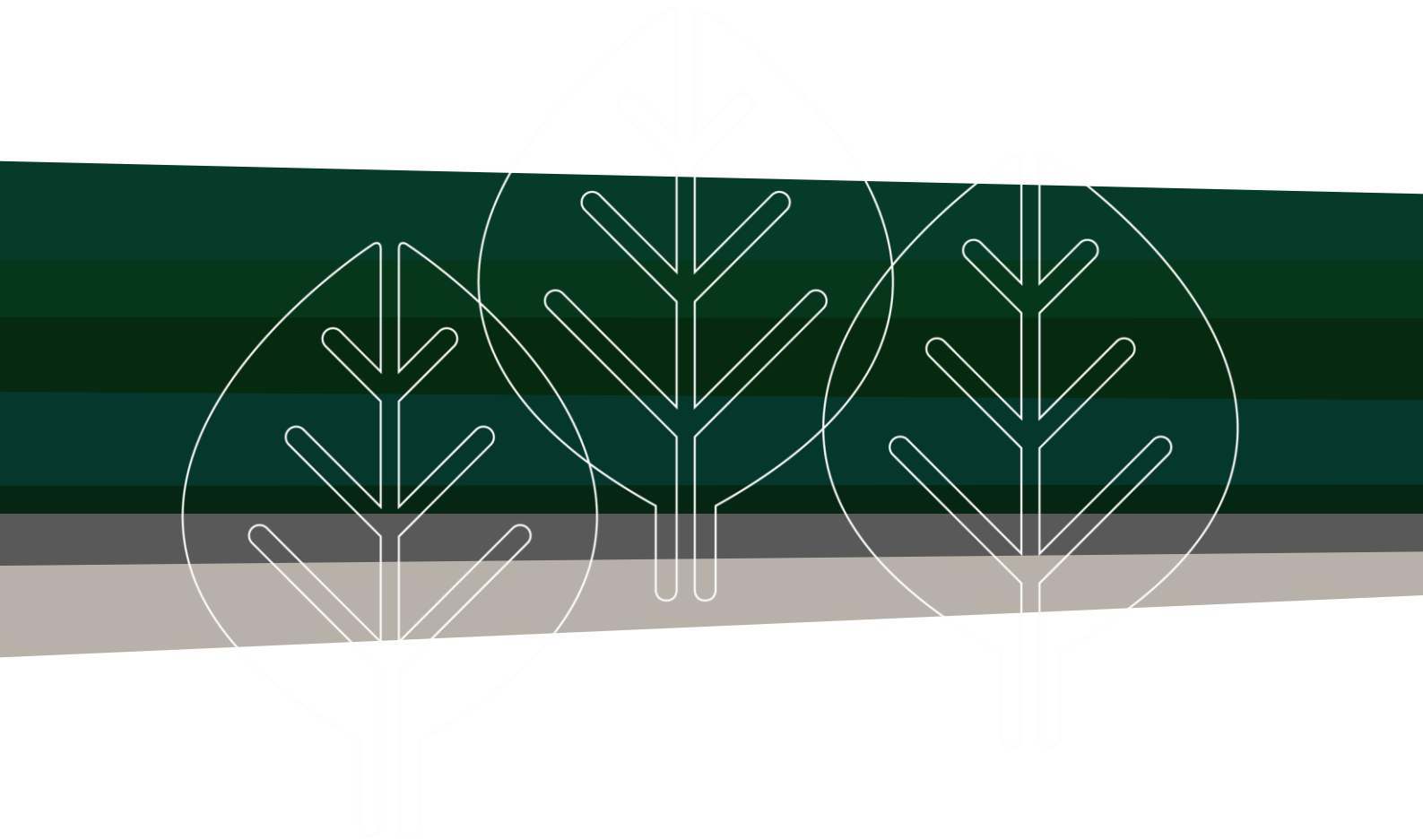
RPS

APPENDIX 6

Tranen Foreshore Revegetation Plan

revegetating
rehabilitating
restoring

tranen
revegetation systems



P521E Alkimos Beach
Foreshore Management Plan (FMP)
Revegetation Plan

Lend Lease Communities

P521E-01-Rev4

November 2015

Disclaimer

This report has been prepared by Tranen Revegetation Systems solely for the benefit and use of the client.

Tranen Revegetation Systems shall assume no liability or responsibility to any third party arising out of use of or reliance upon this document by any third party.

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Document Version Control				
Rev	**Date**	**Description**	**Author**	**Review**
0	13/10/14	Initial document	DG	JL, RW
1	3/2/15	Revised following client review	DG	
2	5/8/15	Revised to include access road and path	DG	
3	24/8/15	Updated to show revised access path alignment	DG	
4	16/11/15	Updated Appendix 3, Foreshore Concept Plan	PJG	

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1 INTRODUCTION AND BACKGROUND

In October 2014 Tranen Revegetation Systems was commissioned by Lend Lease Communities (Alkimos) Pty Ltd (Lend Lease) to prepare a revegetation plan for the foreshore reserve at Alkimos Beach. The foreshore area totals approximately 41.93 hectares (ha) in area. Two Foreshore Management Plans (FMP) have been prepared for the site to separately address Commonwealth and State requirements. The Commonwealth FMP (RPS, 2014) has already been approved by the Department of the Environment in April 2014. The State FMP (RPS, 2015) is currently being finalised for submission. The FMP's are both strategic documents, and this revegetation plan has been developed to provide the specific details of how the revegetation requirements of both FMP's will be concurrently achieved. Should there be changes to the final issue of the State FMP, this revegetation plan will be updated to incorporate the changes.

1.1 Background

The Alkimos Beach residential project is being developed by Lend Lease in partnership with LandCorp. Alkimos Beach (formerly known as "South Alkimos") is an approved master planned residential development located approximately 40 kilometres (km) north-west of Perth's Central Business District within the City of Wanneroo (see Appendix 1).

The Foreshore Management Plan (FMP) study area is centred on the foreshore reserve bounded by the "Urban" zoned portion of the Alkimos Beach to the east and the Indian Ocean to the west. The foreshore reserve continues to the north and south of the area (see Appendix 2).

Lend Lease has developed a Foreshore Concept Plan in response to regional and local demand for beach access as well as providing important infrastructure such as fire and emergency access paths. Key elements of the Foreshore Concept Plan are summarised below and provided in Appendix 3:

- The majority of the foreshore reserve is retained for conservation and rehabilitation (including black cockatoo habitat rehabilitation areas), with the only other activities proposed within the foreshore being for low level (local) beach access and maintenance/safety. Rehabilitation works will be focused on priority areas including the road and path batters, dune blow out and four wheel drive paths.
- Fenced 'southern' pedestrian pathway (3.0 m wide, compacted limestone) providing residents with walkable access (and emergency vehicle access) to the beach. Coastal fencing to the CoW specification will be provided either side of the path. Lockable bollards will positioned at the entry points of the path to prevent public vehicle access.
- A dual use path (3.0 m wide, red asphalt) providing a continuous north-south linkage along the perimeter of the foreshore reserve, connecting into adjacent foreshore areas to the north and south (Eden Beach). This path will be fenced adjacent to the foreshore reserve. The path also provides a shared maintenance/emergency vehicle access role in the northern portions of the site where there is no nearby public road frontage. The final location of this dual use path is subject to engineering review.
- A fenced emergency vehicle maintenance and access track (compacted crushed limestone, 3 m wide with 5 m wide passing nodes at regular intervals)

traversing only the widest portion of the foreshore area in a north-south direction. This track will be restricted to emergency/ maintenance vehicles, but also serve as a pedestrian access path. The final location of this emergency vehicle maintenance and access track is subject to engineering review.

- Fenced public vehicle access asphalt road (6.0 m wide with a 2.4 m wide concrete pedestrian path to one side), located centrally in the foreshore reserve and providing convenient visitor access to the car park. The road has been designed to accommodate informal 'overflow' car parking on the edge of the road if required. Coastal fencing to the CoW specification will be provided either side of the road / pedestrian path. Key services such as street lighting, power, communications and water will follow the road alignment.
- Pedestrian and surf life saving vehicle access on a 3.0 m wide emulsion stabilised limestone path which will be ramped to the beach from the car park to allow surf life saving / emergency vehicles access to the beach. Lockable bollards will prevent public vehicle access, but allow access for maintenance and/or surf life saving vehicles from the interim facility for mobile beach patrols. Coastal fencing to the CoW specification will be provided either side of the pedestrian path.
- A small site adjacent to the car park has been allocated for an interim facility for mobile beach patrols for SLSWA at Alkimos Regional Beach. The interim (and relocatable) facility comprises a modular structure capable of storage for surf life saving but also hosting a variety of flexible community functions such as a community meeting space, fundraising events, etc.
- A single car parking area, accessed via the public vehicle access road, (located behind the modelled 50 year coastal processes line) and providing approximately 30 standard bays which includes ACROD and a single bus parking bays.
- An approximate 400 m dog walking beach (to be registered with the CoW), running southward from the access path.

The foreshore is planned to operate as a low intensity, passive recreational area providing local beach access for current and future residents. This is a direct response to both the conservation values of the area and the wider coastal context, where higher intensity coastal development and access is planned to be provided further north at the future Coastal Village site.

1.2 Approvals and Conditions

The requirement to prepare and implement an approved FMP is established by the following statutory mechanisms:

- Ministerial Statement No. 722 on Metropolitan Region Scheme Amendment No.1029/33;
- South Alkimos LSP 72; and
- Condition 11 of the Environment Protection and Biodiversity Act 1999 (EPBC Act) Commonwealth approval required an FMP.

The FMP (RPS, 2015) responds to the Ministerial Statement No. 722 and Clause 6.6 of Part 1 of the South Alkimos LSP No. 72, and provides the state level requirements for revegetation through:

1. Describing the existing foreshore environment.
2. Setting clear boundaries of the areas to be protected and managed.

3. Outlining the management of access to the beach, construction and revegetation.
4. Allocating construction and management responsibilities including routine monitoring of the environmental values, maintenance and contingencies.

Condition 11 of the Commonwealth approval requires a FMP (for the same area of foreshore reserve) to be prepared to the satisfaction of the Commonwealth Minister for the Environment. Specifically, the key management actions required by the Commonwealth are concerned with the revegetation to at least 1 ha, and management of Carnaby's Black-Cockatoo habitat within the foreshore reserve area against identified threats such as weeds, feral pests, bushfires, erosion and foreshore access.

1.3 Documentation

This report is based on the following information provided by Lend Lease:

- Foreshore Management Plan (Commonwealth) Alkimos Beach, prepared by RPS (Document No: L1234701 Rev 3, March 2014);
- Foreshore Management Plan (State) Alkimos Beach, prepared by RPS (Document No: L12036 R Rev 2, August 2015; and
- Approval, Urban Development – Lot 1003, 80L Romeo Road and 2611 Marmion Avenue, Alkimos, WA (EPBC 2011/5902) - Department of Sustainability, Environment, Water, Population and Communities.

1.4 Objectives

The primary objective of this revegetation plan is to convert the revegetation components in the strategy of the FMP into an actionable management plan that:

- delineates the areas where the works will take place within the site;
- provides specific details of what those works will be; and
- outlines the indicative project implementation schedule for these works.

2 SITE DESCRIPTION

2.1 Site Location and Size

Alkimos Beach is an approved master planned residential development located approximately 40 km north-west of Perth's Central Business District within the City of Wanneroo.

The Commonwealth approved the Alkimos Beach project area is 224 ha, located adjacent to 1.7 km of coastal foreshore and 41.93 ha of coastal foreshore reserve which is designated Regional Open Space (ROS). Appendix 2 shows the Local Structure Plan for the Alkimos Beach project area and delineates these areas.

2.2 Land Form and Soils

Topography of the site varies from 45 m above sea level (AHD) in the east of the site to less than 5 m AHD to the west in the foreshore reserve. The landscape is undulating, dominated by consolidated Quindalup dune formations with swales between dune phases.

The dominant soil type on the LSP site is Quindalup (Q3) which is classified as loose, calcareous sand with some organic matter in the first 10 cm and incipient cementation at depth (RPS, 2011).

2.3 Vegetation Assessment

A vegetation and flora survey was undertaken by Bennett in 2004 for ATA Environmental and the following vegetation associations were identified within the foreshore reserve:

MsLm	*Melaleuca systena* and *Lomandra maritima* Low Open Heath
MsOaLm	*Melaleuca systena, Olearia axillaris, Lomandra maritima* Low Open Heath
SgSc	*Spyridium globulosum, Scaevola crassifolia* shrubland
SgMsLm	*Spyridium globulosum, Melaleuca systena, Lomandra maritima* Low Open Heath
AIMs	*Allocasuarina lehmanniana, Melaleuca systena* Closed Heath
Alloc	*Allocasuarina lehmanniana* Closed Heath
C	Cleared
Soak	Karli Spring Wetland

The majority of the ROS is in very good to excellent condition (see Appendix 4). The exception are a few vehicle tracks created by off-road vehicles in the north and south-east parts of the site. There is also one relatively small blowout in the middle of the ROS adjacent to the beach.

2.4 Site Stability

The degraded sections of the site are relatively stable, due to the undulation of the dunes. The relatively tall dunes provide some protection from the prevailing south-westerly and easterly winds to the lower lying inland sections, where most of the vehicle tracks / disturbance is located. The exception is the small blowout near the beach in the middle of the ROS which is exposed to westerly winds. As this site is degraded it is considered the most appropriate location for the placement of the planned carpark and recreation node.

2.5 Fauna

Calyptorhynchus latirostris (Carnaby's Black-Cockatoo (CBC)), is listed as "Schedule 1" fauna under the *Wildlife Conservation Act 1950* and "Endangered" under the EPBC Act. It is likely to fly regularly over the area due to the good quality foraging habitat that exists nearby. There is very limited foraging habitat (e.g. *Banksia sessilis*) available for the cockatoo on the Alkimos LSP site which may occasionally be used by the cockatoo for foraging; however, the site does not contain a significant food resource for this species compared to other areas in Alkimos–Eglinton and surrounds.

The federal approval conditions require details of supplementary planting and weed control equivalent to at least 1 ha of Carnaby's Black-Cockatoo foraging habitat on the project area (to be spread between ROS and POS) (DSEWPaC, 2012). As detailed in the FMP the EPBC referral identified a very limited range of Carnaby's Black-Cockatoo habitat in the foreshore. A core aim is to complement the existing tuart trees (*Eucalyptus gomphocephala*) in the FMP study area in accordance with the EPBC Act referral and subsequent conditions. The key Carnaby's Black-Cockatoo foraging habitat species likely to be used in the revegetation program include:

- *Acacia saligna*;
- *Allocasuarina lehmanniana*; and
- *Eucalyptus gomphocephala*.

2.6 Conservation Value

The Alkimos LSP site includes the majority of the foreshore reserve along its western margin. This area is part of Bush Forever site 397 which forms part of a semi-contiguous north–south vegetated coastal strip. The recommendations pertinent to the FMP study area in the EPA report, Alkimos–Eglinton Metropolitan Region Scheme Amendment No. 1029/33 (EPA, 2005) centred on increasing the size of the foreshore reserve around Karli Spring to include additional areas of consolidated Quindalup Dunes to protect Aboriginal Heritage values and approximately 2.8 ha area of *Allocasuarina lehmanniana* (dune sheoak). The dune sheoaks may be used as foraging habitat by Carnaby's Black-Cockatoo and other bird species (RPS, 2014).

The LSP site also abuts the east–west conservation linkage associated with the Alkimos Waste Water Treatment Plant buffer on the northern margin. This area is not a Bush Forever site, however it is zoned for "Parks and Recreation" and "Public Purposes" (Conservation) in the MRS.

2.7 Existing Uses

The majority of the site is undisturbed and currently has no special purpose. Vehicle tracks in the north and south-east have been created by unauthorised recreational 4WD vehicles that are primarily used as access routes to areas of easier beach access.

Karli spring in the south of the ROS has Aboriginal Heritage values.

3 FMP MANAGEMENT MEASURES

The following approved measures extracted from the Commonwealth and State FMPs (RPS, 2014) have been used to guide the revegetation strategy for each of the areas as detailed in the next section.

3.1 Carnaby's Black-Cockatoo Species to be Used

A range of native plant species will be used in this revegetation program for the foreshore area. Various overstorey and understorey species will be planted in order to provide diversity to the vegetation structure and fauna habitat. The EPBC Act referral identified a very limited range of Carnaby's Black-Cockatoo habitat in the foreshore. A core aim is to complement the existing tuart trees (*Eucalyptus gomphocephala*) in the FMP study area in accordance with the referral and subsequent conditions.

The key Carnaby's Black-Cockatoo foraging habitat species that grow naturally in the local coastal dune environment, and will be used in the revegetation program include:

- *Acacia saligna*
- *Allocasuarina lehmanniana*
- *Eucalyptus gomphocephala.*

3.2 Revegetation Methodology

3.2.1 Site Protection – Prior to Revegetation

In order to avoid accidental clearing from construction activities and prevent unauthorised access, a temporary fence will be positioned around the retained Carnaby's Black-Cockatoo habitat and revegetation area (1 ha). All construction activities will be restricted to the subdivision areas and will avoid this foreshore area.

To assist in preventing unauthorised access and trampling of revegetation efforts, additional signage may be installed. This signage aims to inform the resident / visitors to Alkimos Beach of the revegetation works and importance of the area.

3.2.2 Revegetation Site Preparation

To maximise the potential for revegetation success, the area(s) that are subject to revegetation will be prepared in the following manner:

- weed spraying commenced, rubbish and debris will be removed and disposed of appropriately if required; and
- brushing and / or mulching if required may be used to assist stabilising soil in erosion prone locations as required.

3.2.3 Revegetation Method

Planting and seeding are the key methods to be employed in the revegetation areas within the foreshore reserve. Species selection is the key to reaching a successful outcome for the project. Species must be carefully selected based on the surrounding 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.

Species selected will take into account existing and identified use of the area. Revegetation species will be subdivided into four categories:

1. Beach grasses and herbaceous species adopted for the most exposed locations.
2. Semi-stable dune colonisers adapted to partially protected areas.
3. Plants of protected dunal situations.
4. Plants of protected well stabilised and vegetated areas.

Tuart trees – the identified Carnaby's Black-Cockatoo habitat species to be retained in the foreshore – are located in Category 3 and 4 areas.

3.2.4 Scheduling

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

Planting will be carried out in winter; around June–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 mostly be planted at a density of 2 plants / m^2 (as a minimum, species dependent) for rehabilitation.

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

3.2.5 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.

4 REVEGETATION STRATEGY

As the majority of the site is in very good to excellent condition, the focus of the revegetation efforts is protection of the existing vegetation by closing former access tracks, stabilisation of blowouts, and creation / protection of CBC foraging habitat.

The overall site is to be broken up into separate parcels each with its own management strategy as delineated in Appendix 5. The requirement is for "supplementary planting and weed control equivalent to at least 1 ha of Carnaby's Black-Cockatoo foraging habitat on the project area". Table 1 details the treatment methods and area sizes for each of the zones delineated in Appendix 5, and shows that supplementary planting and weed control will be undertaken on over 1.9 ha of CBC foraging habitat within the project area.

Table 1 Revegetation Zones and CBC Foraging Area Calculations

Zone Name	Area (m^2)	CBC Species Revegetation Zone	CBC Revegetation Area (m^2)
Dune Blowout	1,631	N	-
North 1	690	Y	690
North 2	688	Y	688
South Track Closures	2,246	Y	2,246
Northern Access Rd and Carpark Batters	5,854	Y	5,854
Carpark Beach Access Batters	3,339	N	-
Southern Access Track	10,175	Y	10,175
Total	**24,623**		**19,653**

Descriptions of the revegetation zones and their proposed treatment strategies are provided in the remainder of this section. The specific techniques and methodologies that will be employed to satisfy the objectives are detailed further in later sections.

At some time in the future, additional pedestrian and vehicle access tracks will be constructed as per the Foreshore Concept Plan. These areas will be the subject of future detailed engineering designs, and therefore are not included in this plan. Areas disturbed as part of these works that are not required for permanent infrastructure will be rehabilitated using the same concepts and techniques, to ensure consistency across the foreshore reserve.

4.1 Dune Blowout

Figure 1 Dune Blowout

The Dune Blowout is a degraded section of the foredune covering 1,631 m^2 that was originally created by vehicles but has expanded in size due to the strong prevailing winds. It is called the Dune Blowout as the originally proposed primary public access and carpark is to be located to the immediate north-east of this dune. This is a priority area for rehabilitation to prevent future degradation by vehicles, as well as the potential for foot traffic once the carpark is constructed. The majority of the blowout faces west, and sand has accumulated on the top / east facing parts of the dune.

In order for rehabilitation efforts to be successful in this area the site first needs to be stabilised with physical measures to prevent further erosion, and complemented with a high density of native planting to provide long term stabilisation. Physical barriers will also be required to prevent further vehicle access to the area. Foredunes do not naturally support CBC foraging or habitat species, and therefore species selection will not include those species, only those that are found in the foredune areas and are capable of providing long-term stabilisation.

Stabilisation works will involve the placement of open weave coir netting on disturbed areas, fixed in place with steel U-pins. The only entry to the site is from the beach and once works are finished the access will be closed by fencing, with revegetation in progress signage attached. Seedling planting will be undertaken at 3 plants / m^2, which is a higher rate than required, as well as direct seeded at 3 kg / ha, to provide rapid establishment of stabilising ground cover in this highly erodible area.

Several introduced plant species occur in the vicinity of the blowout (e.g. *Cakile maritima* (Sea Rocket), *Ammophila arenaria* (Marram Grass), and *Tetragonia decumbens* (Sea Spinach). These species are all common dune species in the area and some are naturalised. The intent is to keep these weed species in place and to not target them for control in the initial stages, as they are providing a stabilisation function to the dune. Once the infill planted vegetation has established then these species may be controlled if they are inhibiting further development of the desired native species.

4.2 North 1 and North 2

Figure 2 North 1

Figure 3 North 2

The areas designated North 1 (690 m^2) and North 2 (688 m^2) are very similar in condition that connect to the Conservation POS. They are both areas that have been disturbed by frequent vehicle access. Wind erosion has expanded the area of disturbance, providing avenues for opportunistic weed species to establish.

As can been seen in Figure 2 , the tracks are amongst established *Eucalyptus gomphocephala*, a key CBC foraging and habitat species in the area. This species will be planted in the lower lying sections of these areas where there is shelter from the winds. The other approved CBC species *Acacia saligna* and *Allocasuarina lehmanniana* are more suited to, and will be planted in, the less sheltered parts. CBC species will not be the only species planted in these zones. Other coastal species that typically grow in conjunction with these species will also be planted.

The aim for this area is to have a least 2 plants / m^2 established in these sections, with 1 CBC species / 10 m^2. Completely degraded areas will be planted at the full target density, and the partially disturbed areas will be planted at half this density. Direct seeding will also be conducted at a rate of 3 kg / ha using seed stored in the Alkimos Beach seed bank. The tracks have been compacted by repeated vehicle use. Prior to planting these sites will be ripped to break this compaction which will promote greater water infiltration rates, and make it easier for plant roots to establish. Brush will also be placed on the tracks to both stabilise the site, and make it more difficult for vehicles to continue to access the area.

Part of North 1 requires a 3 m wide vehicle access track to be established (see Appendix 5). This track will be formalised sometime in the future. Revegetation works will commence before the track is constructed so this area will be delineated and left unplanted. To prevent vehicles from accessing the adjacent rehabilitation areas and

potentially causing damage, tracks feeding off this main track will be blocked off using limestone boulders, and later fencing to physically restrict access.

4.3 South Track Closures

Figure 4 South Tracks

The south tracks are a series of interconnected tracks in the south-east of the ROS. One of the central tracks will be formalised as a vehicle access track for emergency access and maintenance. The remainder serve no future purpose, and therefore will be closed off and rehabilitated. The tracks to be closed off cover an area of 2,246 m^2.

The tracks are mostly located in the valleys and lower lying sections between dunes and are relatively sheltered from the winds. This makes them suitable for revegetation using CBC species. *Allocasuarina lehmanniana* and *Acacia saligna* are the two CBC species that will be planted in this zone, along with other native, non-CBC species.

Seedling planting will be at the rate of 2 plants / m^2, with 1 CBC species / 10 m^2. Direct seeding will also be conducted at a rate of 3 kg / ha using seed stored in the Alkimos Beach seed bank. Prior to planting a weed control program will be undertaken with the tracks and disturbed edges to be targeted. As the tracks have been compacted by repeated vehicle use they will be ripped prior to planting to optimise plant establishment and survival rates.

All of the tracks will be physically blocked to prevent vehicles from continuing to access the site and potentially damaging the revegetation efforts. Tracks will be blocked off at each end using large limestone boulders to physically restrict access. The track that

will eventually be formalised as a vehicle track will not be blocked, so that there is at least one access for vehicles (emergency, maintenance, or otherwise) through the area until such time as it is formally constructed.

4.4 Northern Access Road and Carpark

An access road and carpark are to be constructed to provide formalised public access to the beach. As no existing tracks currently provide this access, a new route will be created. The undulating topography requires disturbance of some secondary dunes through cut and fill. All of the road batters totalling 5,854 m^2 will be stabilised and revegetated post-construction. Initial works are likely to commence late 2015, so revegetation of this area will be undertaken in 2016.

Revegetation in this area will incorporate both CBC and general dune species. *Allocasuarina lehmanniana* and *Acacia saligna* are the two CBC species that will be planted in this zone, along with other native, non-CBC species.

The batters will be mulched once construction is complete, to stabilise the site until winter 2016 when it can be planted. Seedling planting will be at the rate of 2 plants / m^2, with 1 CBC species / 10 m^2. Direct seeding will also be conducted at a rate of 3 kg / ha using seed stored in the Alkimos Beach seed bank. Prior to planting a weed control program will be undertaken.

4.5 Carpark Beach Access Path

Access to the beach will be formalised from the new carpark, and due to the topography the dunes will need to be cut through to provide accessibility to all users. However, due to the proximity to the coast and exposure to high winds, it will require more extensive stabilisation measures than the road batters, and it is unlikely that CBC species will establish successfully in this zone. Therefore it will be managed differently to the northern access road and carpark, but stabilisation and planting works will be conducted concurrently. The total disturbance and revegetation area is 3,339 m^2.

Species to be used in the area will be foredune and secondary dune species that are more tolerant of mobile sands. Seedling planting will be undertaken at 3 plants / m^2, which is a higher rate than required, as well as direct seeded at 3 kg / ha, to provide rapid establishment of stabilising ground cover in this highly erodible area.

Stabilisation works will involve the placement of brush material in an overlapping and interlocked formation generally perpendicular to the prevailing winds. This has proven to be a successful stabilisation technique in similar situations on nearby developments in the Alkimos area (see Figure 5), promoting more rapid plant cover than other stabilisation techniques such as mulching.

Figure 5 Successful Foredune Stabilisation Using Brushing at Nearby Alkimos Location

4.6 Southern Access Track

In the south of the ROS, another new track will be created providing access for pedestrians, and emergency vehicles to the beach. No such access presently exists, so it will be created by cutting through existing dunes and vegetation. Cut and fill batters will be rehabilitated post-construction, requiring 10,175 m2 of revegetation. Construction is expected late-2015, so revegetation will take place in winter 2016.

Revegetation in this area will incorporate both CBC and general dune species. *Allocasuarina lehmanniana* and *Acacia saligna* are the two CBC species that will be planted in this zone, along with other native, non-CBC species.

The batters will be mulched once construction is complete, to stabilise the site until winter 2016 when it can be planted. Seedling planting will be at the rate of 2 plants / m^2, with 1 CBC species / 10 m^2. Direct seeding will also be conducted at a rate of 3 kg / ha using seed stored in the Alkimos Beach seed bank. Prior to planting a weed control program will be undertaken.

5 IMPLEMENTATION METHODOLOGY

5.1 Scheduling

Preparatory works have commenced in advance of revegetation, including fencing and track closures (see Appendix 7). The existing tracks to be closed, and Dune Blowout will be revegetated in winter 2015. The northern access road and carpark, and southern access track will be constructed late-2015, and revegetation of these areas will take place in winter 2016. Post-construction activities such as mulching will be undertaken as soon as possible following the completion of civil works. As per the approved FMP the site will then be monitored and maintained for a further five years to ensure that the revegetation objectives are achieved in the longer term.

5.2 Weed Management

Weed management is an important component for the establishment of native vegetation. However, in some locations (i.e. Dune Blowout) 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; and
- are familiar with the most appropriate control measures, timing, herbicides, and application rates for the target species.

5.3 Surface Stabilisation

Surface stabilisation measures will be undertaken in all areas, except the southern track closures to prevent further movement, and protect against further vehicle damage. In North 1 and North 2 this will be achieved through the use of brush wood. In the Dune Blowout, access is restricted and it is not possible to get brush material to the site, so coir netting will be used instead. All road and access track batters will be stabilised with mulch.

Brush materials will be sourced from suitable dieback-free locations external to the site. In Tranen's experience the best material for brushing in dune environments is Spearwood (*Kunzea glabrescens*). Brush material will be placed in an interlocking formation and placed roughly parallel to the contours and perpendicular to the prevailing wind direction.

5.4 Surface Preparation

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

5.5 Species Selection and Plant Allocations

All species have been selected based on observations made during Tranen site assessments and seed collection activities throughout the Alkimos Beach development and the greater Alkimos area. Appendix 6 contains the detailed breakdown of species and plant numbers allocated to each area. Numbers are indicative only, as supply may not be possible at the time of order or delivery. Should desired quantities of species not be available, substitutions may occur within the included species lists. Should species not included in the list be available as suitable substitutes, these will be proposed for approval to the relevant authorities prior to inclusion.

5.6 Alkimos Beach Local Provenance Seed Bank

A seed bank has been established for Alkimos Beach, and there are significant quantities of local provenance seed available of a wide range of species for use in the revegetation program. Where possible seedlings will be propagated from the seed bank. Where seed is not available of desired species, seed and seedlings will be sourced from the nearest available provenance. Some species are grown from cuttings and where possible these will also be sourced from on site.

5.7 Seedling Propagation

Due to the site conditions, the recommended pot for all seedlings is a 50 mm x 50 mm x 125 mm forestry tube with root trainers. These pots produce seedlings of good root ball size and transfer well from pot to final environment, maximising survival rates. Should plants of this size not be available for any reason at the time of planting, the next closest available tubestock size will be used.

Plant orders will be ideally placed in winter the year before planting to ensure sufficient seedlings are available (subject to seed availability and species propagation timing). Seedlings will be grown by nurseries that are accredited by the Nursery Industry Accreditation Scheme of Australia (NIASA) which will guarantee the quality of supplied material.

Seedlings will be supplied true to industry standards:

- Soil in containers at the time of delivery will be free of weeds, insects and disease (e.g. dieback);
- All plants will be true to species name, well-formed and hardened off nursery stock;
- The root system will be fibrous and firmly established but not root bound and with no large roots growing out of the container; and
- Leaves to be of normal size, colour and texture for the specified species.

5.8 Seedling Planting

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.

A 10 g native fertiliser tablet (low in P) will be buried adjacent to each seedling (except in the base of the swale) to promote faster root and foliage development in the stages following initial transplant. Tranen research has shown this to have a significant impact on plant development and survival rates.

5.9 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.

5.10 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 will also be initiated to provide longer term protection to seedlings. This will include a combination of warren destruction, rabbit haemorrhagic disease virus (RHDV) release, and Pindone baiting. Baiting and 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 vehicle access tracks. These tracks are to be blocked at both ends to prevent future vehicle access in these areas. They will be blocked by pushing up soil and placing large objects such as limestone boulders or large logs in front of the mounds. Some tracks will be left open to allow vehicles access through the area, to discourage vehicles from creating new accesses.

The FMP states that “a temporary fence will be positioned around the retained Carnaby’s Black-Cockatoo habitat and revegetation area (1 ha). All construction activities will be restricted to the subdivision areas and will avoid this foreshore area”. The habitat areas within the ROS are separated from other areas and once tracks have been blocked off those areas will not be accessible. It is therefore not considered necessary for a temporary fence to be placed around the revegetation areas as they will already be suitably protected.

6 POST-INSTALLATION MANAGEMENT

To ensure longer-term project success, the site will be monitored and maintained for five years following initial seedling installation, to ensure the completion targets are met and will continue to be met in the future. At the end of the maintenance period, assuming all targets have been achieved, the site will be handed to the City of Wanneroo for ongoing management.

6.1 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 five 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 (RPS, 2014)

Year After Planting	Year 1	Year 2	Responsibility for Five Years Post-Commencement of Works
Survival of planted seedlings	90%	90%	Lend Lease
Minimum plant diversity (% of original number of planted species in project area that have survived)	70%	70%	Lend Lease
Plant coverage (% area of visual ground cover measured by a botanist/ revegetation consultant)	25%	50%	Lend Lease
Weeds coverage	10% cover	10% cover	Lend Lease

6.2 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 five-year period after installation. A monitoring report will be submitted to Lend Lease 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 × 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; and
- 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.

6.3 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; and / or
- undertake fence, sign and pathway maintenance as required.

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

Table 3 Revegetation and Weed Management Contingency Measures (RPS, 2014)

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

7 REFERENCES

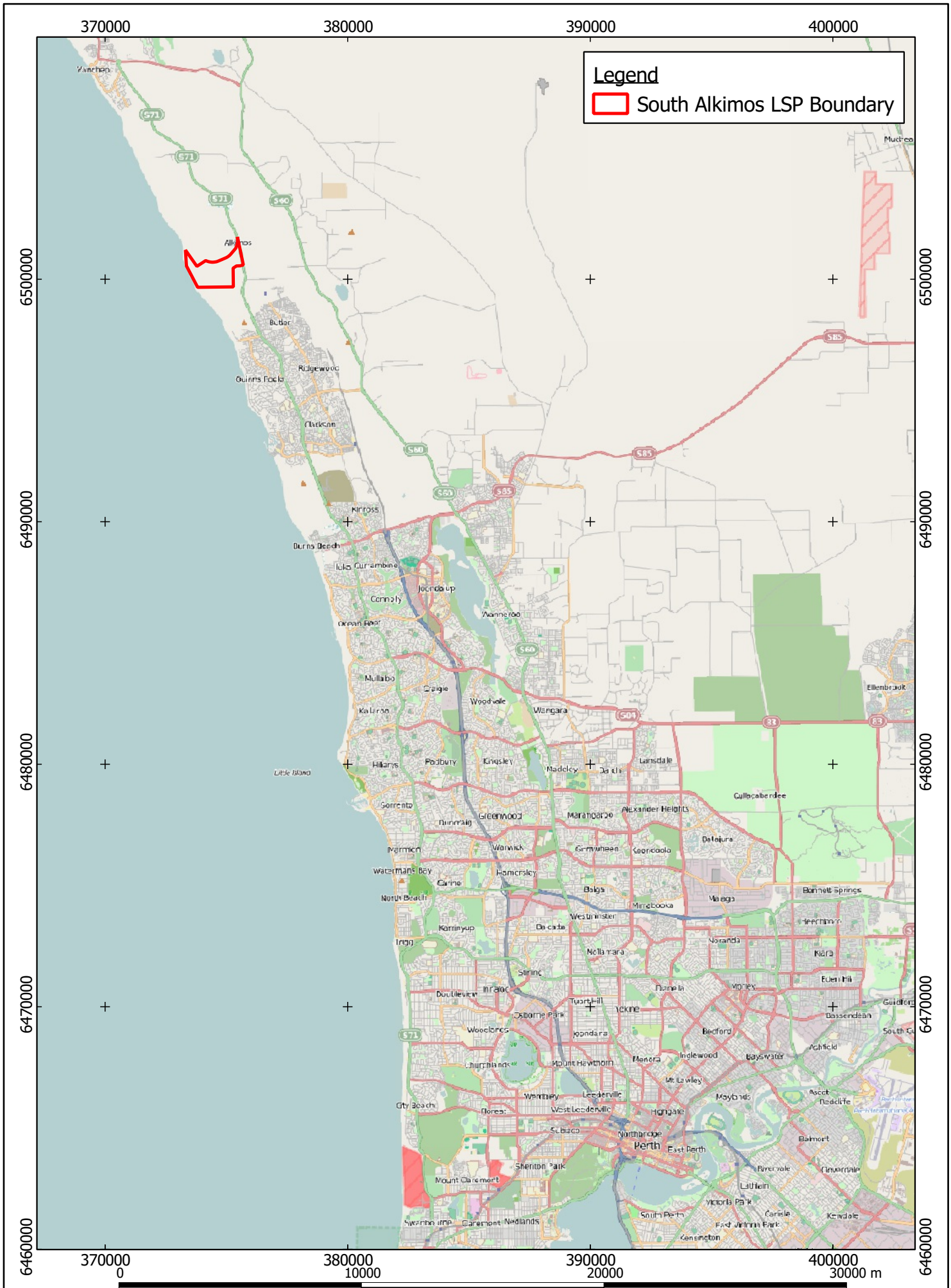
DSEWPaC, 2013. Variation to Conditions Attached to Approval, Urban Development – Lot 1004, 80L Romeo Road and 2611 Marmion Avenue, Alkimos, WA (EPBC 2011/5902). Department of Sustainability, Environment, Water, Population, and Communities. 13 June 2013.

RPS, 2011. Local Environmental Impact Assessment and Management Strategy – Part Lot 1004 Alkimos, South Alkimos Local Structure Plan. Prepared by RPS. Report No: L10354 Rev 1. June 2011.

RPS, 2014. Foreshore Management Plan (Commonwealth) – Alkimos Beach. Prepared by RPS. Report No: L12347 01 Rev 3. March 2013.

RPS, 2015. Foreshore Management Plan (State) - Alkimos Beach. Prepared by RPS. Report No: L12036 R Rev 2, August 2015.

Appendix 1 Site Location



tranen revegetation systems

Project: South Alkimos
Project Number: P521
Client: Lend Lease

Drawing: Site Location Map
Drawing Number: P521-02
Revision: 0

Date: 21/8/12
Drawn By: DG

Appendix 2 Local Structure Plan

Legend

Structure Plan Area

Reserves
- Public Use - (PS) Primary School
- Regional Parks & Recreation (Foreshore Reserve)
- Conservation POS
- Active POS

Zones
- Residential
- Commercial
- Mixed Use
- Private Clubs/Recreation

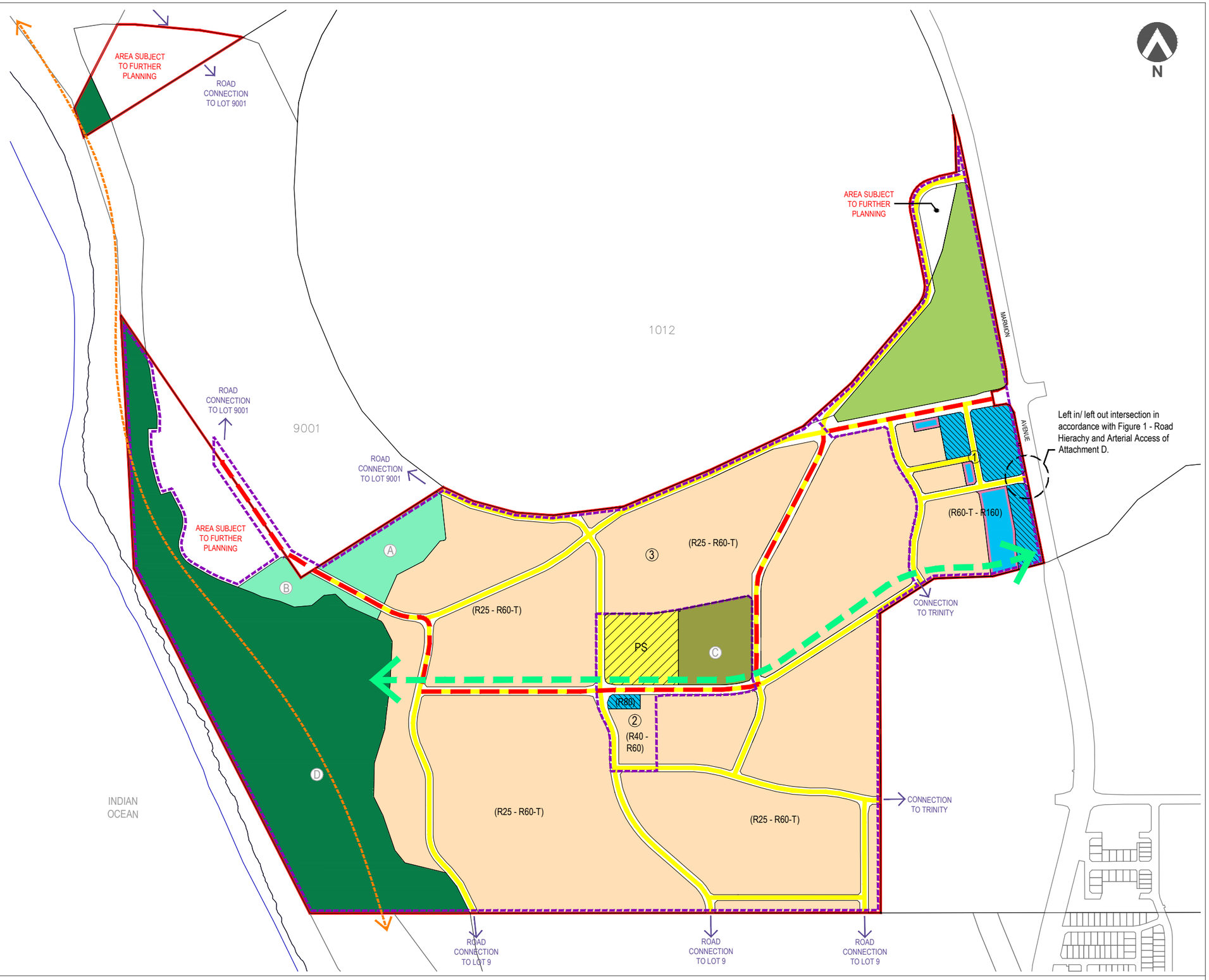
Other
- Indicative STS Route
- Neighbourhood Connector
- Precinct Boundary
- Social / Pedestrian / Cycle Linkage
- Indicative Foreshore Pedestrian and Cycle Link (as per Alkimos-Eglinton District Structure Plan)

Precincts
- (1) Gateway
- (2) Central Village
- (3) Residential
- (A) Strategic Public Open Space - Refer to Table 3 of Part 1 - Statutory Section

NOTES:

1. Areas identified as being of National Environmental Significance under the Environmental Protection and Biodiversity Conservation Act 1999 may be subject to assessment by the Federal Department of Sustainability, Environment, Water, Population and Communities, in accordance with this Act. The outcome of any such assessment may require either a modification to the LSP or minor variations from the LSP at the subdivision and/or development stage.

2. The clearing of habitat such as Lomandra hermaphrodita and Maritima that includes the taking of individual Graceful Sun Moths requires the permission of the Minister for Environment, or their delegate, pursuant to the Wildlife Conservation Act 1950. Evidence is to be provided to the WAPC at the time of subdivision that the licence (if required) has been issued by the Department of Environment and Conservation.



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LOCAL STRUCTURE PLAN No.72 (AMENDMENT No.04)
Alkimos Beach, South Alkimos
City of Wanneroo

SIZE A3
1:10,000 (0 metres 100 200 300 400 500)

REF NO.	DRAW NO.	REV.
DLL ALK	**RD1 008**	**M**

Appendix 3 Foreshore Concept Plan (From FMP)

38 Station Street, Subiaco | T +61 8 92111111 | F +61 8 92111122 | www.rpsgroup.com.au

LEGEND

- Foreshore Management Plan Boundary (Alkimos Beach Area 1, 33.7ha)
- Indicative Fenced Dual Use Pathway & Emergency Vehicle Access (Red asphalt, 3.0m wide)
- Fenced Vehicle Access Road (Asphalt, 6.0m wide with 2.4m wide pedestrian path to one side)
- Fenced Pedestrian and Emergency Vehicle Access Road (emulsion stabilised limestone, 3.0m wide)
- Surf Lifesaving WA (SLSWA) Interim Facility for Mobile Beach Patrols at Alkimos Regional Beach
- Vegetation Rehabilitation Areas
- Hardstand for Interim Surf Lifesaving WA (SLSWA) Facilities
- Pedestrian Lookouts
- Car Parking Area
- Replacement Car Park Outside 100 year Coastal Process Line
- 50 Year Coastal Process Line
- 100 Year Coastal Process Line
- Karli Spring

N

STAGE 2
(SUBJECT TO SEPARATE FMP)

'SUBJECT TO SEPARATE PLANNING PROCESS'

ALKIMOS BEACH

RPS

Job Number: L12036
Doc Number: 025 - Figures L12036
Date: 27.10.15
Scale: 1: NTS @ A3
Created by: MR
Source: Concept Plan - DLL ALK RD1 177G (RD 2015).

Figure 3

Foreshore Concept Plan

Appendix 4 Vegetation Condition

Condition	Area m2
Very Good to Excellent	329138
Degraded to Good	1837
Completely Degraded	6731

tranen revegetation systems

Project: Alkimos Beach
Project Number: P521D
Client: Lend Lease Communities

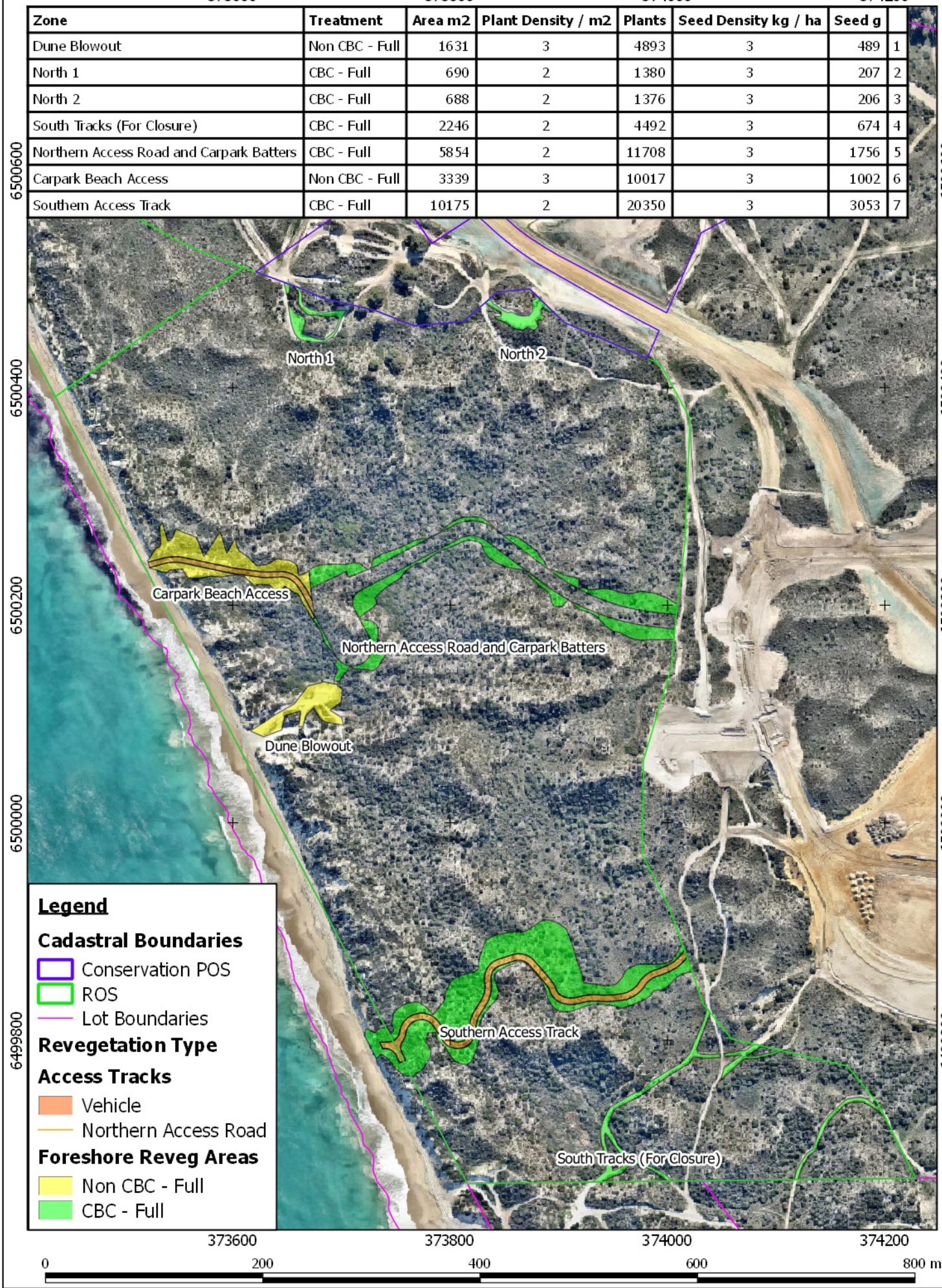
Drawing: FMP Vegetation Condition
Drawing Number: P521D-01
Revision: 0

Date: 23/10/14
Drawn By: DG

N

Appendix 5 Rehabilitation Zones

Zone	Treatment	Area m2	Plant Density / m2	Plants	Seed Density kg / ha	Seed g	
Dune Blowout	Non CBC - Full	1631	3	4893	3	489	1
North 1	CBC - Full	690	2	1380	3	207	2
North 2	CBC - Full	688	2	1376	3	206	3
South Tracks (For Closure)	CBC - Full	2246	2	4492	3	674	4
Northern Access Road and Carpark Batters	CBC - Full	5854	2	11708	3	1756	5
Carpark Beach Access	Non CBC - Full	3339	3	10017	3	1002	6
Southern Access Track	CBC - Full	10175	2	20350	3	3053	7



tranen revegetation systems

Project: Alkimos Beach
Project Number: P521F
Client: Lend Lease Communities

Drawing: FMP Revegetation Zones
Drawing Number: P521F-06
Revision: 3

Date: 24/08/15
Drawn By: DG

N

Appendix 6 Species List and Allocations

tranen revegetation systems

Alkimos Beach FMP
Seed and Tubestock Allocations

Location Name			Dune Blowout		North 1 Full Density		North 2 Full Density		South Track Closures		Northern Access Road and Carpark Batters		Carpark Beach Access Path		Southern Access Track Batters		Overall Total	
Area (m2)			1,631		690		688		2,246		5,854		3,339		10,175		**24,623**	
Treatment			**Seedlings**	**Seed (kg)**	**Seedlings**	**Seed (kg)**	**Seedlings**	**Seed (kg)**	**Seedlings**	**Seed (kg)**	**Seedlings**	**Seed (kg)**	**Seedlings**	**Seed (kg)**	**Seedlings**	**Seed (kg)**	**Seedlings**	**Seed (kg)**
Density (plants/m2 or kg/ha)			3.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0	3.0	3.0	2.0	3.0		
Total			**4,893**	**0.489**	**1,380**	**0.207**	**1,376**	**0.206**	**4,492**	**0.674**	**11,708**	**1.756**	**10,017**	**1.002**	**20,350**	**3.053**	**54,216**	**7.387**
Species		**Seed Bank Stock On Hand (kg)**																
Acacia cyclops	Large shrub	**1.310**			33	0.008	33	0.008	107	0.045	279	0.117			485	0.204	**937**	**0.382**
Acacia lasiocarpa	Shrub	**1.651**			66	0.010	66	0.010	214	0.020	557	0.162			969	0.300	**1,872**	**0.502**
Acacia saligna*	Large shrub	3.303			23	0.008	23	0.008	113	0.045	295	0.117			512	0.300	**966**	**0.478**
Acacia truncata	Shrub	**0.459**			66	0.010	62	0.010	214	0.020	557	0.052			969	0.091	**1,868**	**0.183**
Acanthocarpus preissii	Shrub	**0.998**			66	0.010	66	0.010	214	0.020	557	0.052			969	0.091	**1,872**	**0.183**
Allocasuarina lehmanniana*	Large shrub	0.350			23	0.008	23	0.008	113	0.045	295	0.117			512	0.100	**966**	**0.278**
Atriplex isatidea	Shrub	**0.570**	450	0.050									921	0.115			**1,371**	**0.165**
Calothamnus quadrifidus	Shrub	**0.286**			66	0.010	66	0.010	214	0.020	557	0.052			969	0.091	**1,872**	**0.183**
Carpobrotus virescens	Groundcover	**0.733**	450	0.050	44	0.012	44	0.012	142	0.037	370	0.097	921	0.113	643	0.200	**2,614**	**0.521**
Conostylis candicans	Groundcover	**0.000**			44		44		142		370				643		**1,243**	**0.000**
Eremophila glabra	Groundcover	**0.185**			44	0.012	44	0.012	142	0.037	370				643		**1,243**	**0.061**
Eucalyptus gomphocephala*	Tree	1.315			23		23										**46**	**0.000**
Ficinia nodosa	Groundcover	**0.735**	450	0.030	44	0.012	44	0.011	142	0.037	370	0.097	921	0.098	643	0.200	**2,614**	**0.485**
Gompholobium tomentosum	Shrub	**0.199**			66	0.010	66	0.010	214	0.020	557	0.052			969	0.091	**1,872**	**0.183**
Hardenbergia comptoniana	Groundcover	**2.573**			44	0.012	44	0.012	142	0.037	370	0.208			643	0.300	**1,243**	**0.569**
Hemiandra pungens	Groundcover	**0.098**	250	0.021	44		44		142		370		921	0.043	643		**2,414**	**0.064**
Kennedia prostrata	Groundcover	**0.011**			44		44		142	0.011	370				643		**1,243**	**0.011**
Lepidosperma gladiatum	Groundcover	**0.000**	390		44		44		142		370		354		643		**1,987**	**0.000**
Leucophyta brownii	Groundcover	**0.608**	400	0.050	44	0.012	44	0.012	142	0.037	370	0.097	921	0.102	643	0.168	**2,564**	**0.478**
Melaleuca cardiophylla	Large shrub	**0.266**			30	0.008	30	0.008	106	0.045	276	0.052			480	0.050	**922**	**0.163**
Melaleuca huegelii	Large shrub	**1.623**			30	0.008	30	0.008	107	0.045	279	0.117			485	0.204	**931**	**0.382**
Melaleuca systena	Shrub	**0.303**			66	0.010	66	0.010	213	0.020	555	0.052			965	0.091	**1,865**	**0.183**
Olearia axillaris	Shrub	**0.000**	450		66		66		213		555		921		965		**3,236**	**0.000**
Phyllanthus calycinus	Shrub	**0.501**			66	0.010	66	0.010	213	0.020	555	0.052			965	0.091	**1,865**	**0.183**
Pithocarpa cordata	Shrub	**0.000**			66		66		213		555				965		**1,865**	**0.000**
Rhagodia baccata	Shrub	**1.268**	450	0.079	66	0.010	66	0.010	213	0.025	555	0.156	921	0.283	965	0.250	**3,236**	**0.813**
Scaevola crassifolia	Shrub	**0.724**	450	0.080	66	0.010	66	0.010	213	0.021	555	0.055	921	0.213	965	0.181	**3,236**	**0.570**
Scaevola nitida	Shrub	**0.041**			66	0.009	66	0.009	213	0.022	555				965		**1,865**	**0.040**
Spinifex longifolius	Groundcover	**10.850**	338										708				**1,046**	**0.000**
Spyridium globulosum	Large shrub	**0.305**	255	0.050	30	0.008	30	0.008	107	0.045	284	0.052	708	0.035	489	0.050	**1,903**	**0.248**
Threlkeldia diffusa	Groundcover	**0.079**	560	0.079									879				**1,439**	**0.079**
TOTAL			**4,893**	**0.489**	**1,380**	**0.207**	**1,376**	**0.206**	**4,492**	**0.674**	**11,708**	**1.756**	**10,017**	**1.002**	**20,350**	**3.053**	**54,216**	**7.387**

*CBC species

Appendix 7 Implementation Schedule

tranen revegetation systems

Alkimos Beach FMP
Implementation Schedule

Year	2015				2016				2017				2018				2019				2020				2021			
Season	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
Activity																												
Installation 2015 - Dune Blowout, North 1, North 2, Southern Track Closures																												
Seedling propagation																												
Weed control																												
Brush installation																												
Ripping																												
Tubestock planting																												
Track closures																												
Rabbit control																												
Installation Northern Access Road and Carpark Batters, Carpark Beach Access Path, Southern Access Track Batters																												
Construction																												
Mulching																												
Seedling propagation																												
Weed control																												
Tubestock planting																												
Completion of installation program																												
Maintenance																												
Monitoring																												
Weed control																												
Seedling propagation																												
Tubestock planting																												
Rabbit control																												
Completion of maintenance period																												

RPS

APPENDIX 7

Surf Life Saving WA Letter of Support

SURF LIFE SAVING
WESTERN AUSTRALIA

19 October 2015

Mark Dickson,
Manager of City Growth
City of Wanneroo,
Locked Bag 1,
WANNEROO WA 6946

RE: Interim Facility and Beach Access – Alkimos Beach Project

Dear Mr Dickson

Surf Life Saving Western Australia (SLSWA) has been working in partnership with the City and the Alkimos Beach project through its BeachSAFE program to build the capacity of the community and work towards improving individual safety at beaches within the City of Wanneroo.

BeachSAFE is for SLSWA a cornerstone initiative in achieving the above outcome. SLSWA want to be able to deliver its BeachSAFE aligned programs as soon as access to Alkimos beach is available. SLSWA's Community programs area has developed and scheduled a 2015/2016 summer program that can be delivered as soon a beach access is available.

While the programs will be delivered upon beach opening the logistical requirements and challenges to deliver a consistent program from Alkimos beach can be substantially mitigated if the beach access location was to have an interim level of infrastructure approved and installed. An interim level of infrastructure would broaden the programs that can be delivered and also allow SLSWA to maintain a presence of critical lifesaving equipment at this location for the delivery of lifesaving services that may be planned and scheduled and also allow reduce response times to identified emergencies that SLSWA services may be requested to provide a lifesaving response.

SLSWA acknowledge that into the future a purpose designed and built Surf Life Saving facility will be integrated into the Local Structure and Foreshore Management Plans for Alkimos beach. However, as this facility is not likely to commence construction until at least the 2019, SLSWA are very much in favour of supporting the development of interim infrastructure.

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With the delivery of SLSWA BeachSAFE community programs and lifesaving/response services, sustainable and easy access onto the beach is also an important consideration. This is to enable the transfer of gear/equipment that is used to deliver the programs and services to be taken on/off the beach by associated plant. This beach accessibility consideration should be considered supplementary to any pedestrian access that is provided to the public. SLSWA support the construction of a graded beach access path that is of a stabilised material and sufficiently wide to enable sustainable access. It would also be an advantage for any stabilised access path to reach as far as possible to the base of the dune. SLSWA on the 9th February 2015 wrote to the City regarding support for appropriate beach access points and this letter is attached for reference.

The location of the beach access, car park and interim facility is in area that is consistent with the findings of SLSWA's coastal aquatic risk assessment report. The beach access leads immediately into an area that is largely free of any significant in water hazards. Beach safety and hazard warning signage as recommended in the report should be in place at the time the access is open for use by the public.

Please contact me at your convenience should you wish to discuss further the points outlined in this communication.

Yours sincerely

Chris Peck
General Manager| Lifesaving and Training

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SURF LIFE SAVING
WESTERN AUSTRALIA

09 February 2015

Mark Dickson,
Manager of City Growth
City of Wanneroo,
Locked Bag 1,
WANNEROO WA 6946

RE: Beach Access Development – Alkimos Beach Project

Dear Mr Dickson

Based on discussion between SLSWA, the Alkimos Beach Project and the City, SLSWA make the following recommendation regarding the design and development of beach access into Alkimos beach foreshore reserve.

SLSWA recommend that beach access is designed so that access tracks into the beach foreshore reserve fronting Alkimos beach development have sufficient space/width to allow the safe passage of plant and equipment into the foreshore reserve. Ideally, beach access that separates plant and equipment and pedestrians will be installed so that adequate risk mitigation is undertaken to avoid the potential conflict of pedestrians and plant and equipment using the same access track.

SLSWA state there will be a need for at least one access track to allow plant and equipment to safely transition through and into the foreshore reserve for matters of lifesaving and medical emergencies, surf lifesaving operations (prevention and rescue services, education and awareness programs, health and fitness programs).

While there will be many solution available to meet the above recommendation SLSWA has attached a graphic of beach access at Quinns Beach that the City has installed to manage safe and universal beach access. This is an ideal solution; however, SLSWA will not provide comment on the actual design and construction as this is best left to those with the environmental and technical skills and experience to determine the best design outcome.

Should you wish to discuss the recommendation further I can be contacted at your convenience.

Yours sincerely

Chris Peck
Community Safety Manager

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Attachment 1 – Quinns Beach Universal Access

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