PROPOSED MODIFICATIONS TO FRENCHMAN BAY LOCAL DEVELOPMENT PLAN

LOTS 1 & 2 FRENCHMAN BAY ROAD FRENCHMAN BAY

APRIL 2022

PREPARED BY

AYTON PLANNING

ABN: 15 061 140 172

PO Box 5476
Albany WA 6332
Ph 9842 2304

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1. INTRODUCTION

In September 2015, the City of Albany approved a Local Development Plan (LDP) for Lots 1 and 2 Frenchman Bay Road, which are designated as Special Use Site No. 13 under the provisions of the City of Albany's Local Planning Scheme No. 1. The Special Use site provides for the development of Holiday accommodation, Caravan Park, Caretaker's Dwelling and a shop and is identified as an important Local Strategic Tourist site in Council's Local Tourism Planning Strategy.

Following approval of the LDP, a development application was lodged with the Southern Joint Development Assessment Panel in December 2017 and approved in June 2018 for a period of four years. While the approval required substantial works to proceed within two years, the COVID-19 response and recovery initiatives provide for a two year extension of all current development approvals.

The developer subsequently resolved not to proceed with the development and the property has recently been acquired by Frenchman Bay Albany Pty Ltd. The Director is Paul King, who is the founder and Managing Director of Seashells Hospitality Group (SHG), which operates hotels in Scarborough, Fremantle, Yallingup, Mandurah, and Broome. He is also Managing Director of Project Marketing Australasia. (PMA)

Mr King has been an active committee member in more than 20 tourism and business organisations from the north to the south of Western Australia. He served a five-year tenure as Chairman of the Tourism Council for Western Australia from 2010 and was awarded the Sir David Brand medal for Tourism at the 2015 Western Australia Tourism Awards for his contribution to the Western Australian tourism industry.

He continues to champion tourism outcomes for and in Western Australia (WA) and is looking to expand the reach of accommodation offerings in WA in more regional locations that include Albany, Broome and Exmouth.

Mr King recognises the unique attributes of the site and proposes to create a development which reflects the very best of developments he has been investigating in Australia and New Zealand.

While the proposed development will incorporate the key components of the current Local Development Plan, i.e., Holiday Accommodation, a Shop and Caretaker's Dwelling, the modifications will require Council's endorsement. The modifications are required in order to create a commercially viable development. The cost of creating twenty-four 3 to 4 bedroom units is an inflexible model and does not cater for the visitors who may only want single or two bedroom accommodation.

The project will be staged with the development of the Lodge to be the first stage. It is intended to open and operate the Lodge and gauge the level of support for high end tourist accommodation in a location which is somewhat remote form all the amenities associated with the Albany CBD. Apart from Matraya, at Nanarup, this will be a new higher end tourism offering for Albany and the directors and investors wish to tread carefully. Interests associated with Paul King are planning to develop, operate and retain the Lodge which will take time to be designed and branded.

The following report outlines the proposed changes to the LDP with supporting information and justification.

2. BACKGROUND

The current LDP provides for 24 two storey holiday units, a caretaker's dwelling and a reception office, café, kiosk and shop.

Other aspects of the LDP include:

- 20m wide fire setbacks.
- Single storey development setback and a two-story height limit.
- The excision of a portion of the site and incorporation into the adjacent foreshore reserve to accommodate a public footpath.
- Physical processes setback line some 75 metres wide from the HSD to address potential sea level rise over the next 100 years.
- A 65m setback from the Vancouver Spring.
- Effluent disposal to be by way of an advanced secondary treatment system with nutrient removal.
- A potable water supply consisting of a mix of scheme water, rainwater tanks and possibly underground water via an abstraction bore.

3. COASTAL HAZARD ASSESSMENT

Prior to proceeding with the preparation of modifications to the current Local Development Plan, it has been necessary to review the proposal in light of the WAPC State Coastal Planning Policy (SPP 2.6) 2013.

A Coastal Hazard Assessment jointly funded by the City of Albany and the proponent, has been completed and is attached in Appendix 'A'. This assessment formed the basis for a more detailed Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) report which has been prepared for the development and is attached in Appendix 'B'.

The assessment has shown that there is a risk of coastal hazard impact over the 100-year planning timeframe. However, these risks are limited to erosion impacts that are tolerable during the 40-year planning timeframe to 2061. The serviceable design lifetime of the proposed development has been reconsidered to fit within this time frame. The Coastal Erosion Hazard Lines plan is attached over leaf. The 2061 Hazard line is coloured yellow and effectively follows the northern boundary of the site.

As the SPP2.6 requires the development of an adaptation strategy that extends to a 100-year planning horizon, the long-term strategy is "managed retreat". This will require on-going monitoring based on a trigger point whereby "managed retreat" will be initiated when the "shoreline retreat" reaches a point 33 metres from the development within the site. This is expected to take place sometime beyond the 40-year planning horizon and likely after the built form needs replacing. Replacement infrastructure/buildings will then be relocated to an area considered safe for the ensuing planning horizon based on an updated coastal hazard assessment.

The development concept has moved to the utilisation of more adaptable built forms, such as the glamping tents and potentially relocatable chalets.

ALL AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY

LEGEND

- Present Day (2021)
- 2041
- 2061
- 2081
- 2101
- 2121

Data from CHRMAP
MP Rogers & Associates
February 2022

301
VCL

300
Reserve 21337
35.72ha

AMPHITHEATRE
RECEPTION
CHALETS
GLAMPING TENTS
Lot 1
POOL
Lot 2
POOL
TENNIS COURT
SHED
LODGE
SPA
MANAGERS RESIDENCE
FRENCHMAN BAY ROAD
8099
Reserve 50239
8.4664ha
WHALING STATION ROAD

N

ORIG A3
SCALE 1:1500
0 10 20 30 40 50

19-17-CR(a)

AYTON PLANNING
POBox 5476, ALBANY WA 6332
Ph 9842 2304

COASTAL EROSION HAZARD LINES

Lots 1 & 2 Frenchman Bay Road
Frenchman Bay, City of Albany

4. FORESHORE RESERVE AND FRENCHMAN BAY HERITAGE TRAIL

The previous development concept incorporated an extension of the foreshore reserve abutting the northern boundary of the site, to accommodate the proposed Frenchman Bay Heritage Trail.

While the trail is an important extension of Albany's trial network and is infrastructure that is complementary to the tourism product, running it through the tourist development is not compatible with the proposed concept.

Another alternative exists for the trail to utilise the cleared track running adjacent to the southern boundary of the site. This will minimise clearing of vegetation and need to relocate the infrastructure if and when coastal erosion occurs. As the 2061 Coastal Erosion Hazard Line coincides approximately with the northern boundary of the site, an extension of the foreshore boundary at this time is not considered practical as the foreshore would be vested in the local authority who would then be responsible for on-going management. Retaining the land in a low fuel state is a critical component for the Bushfire Management Plan and is considered a responsibility most appropriately allocated to the developer.

At such time as coast erosion triggers the "managed retreat" of the development, an extension of the foreshore can be initiated at that time.

5. PROPOSED DEVELOPMENT

Tourism development is acknowledged as one of the most difficult forms of development which is underlined by the difficulty in attracting support from financial institutions. Attempts to develop the site have failed to progress since the caravan park was closed in 2006, and the issue of coastal erosion is a further concern that needs to be addressed.

In order to achieve a successful outcome, the proponent believes it is necessary to break the development into three components consisting of;

- A luxury holiday Lodge consisting of 10-12 bedrooms, a swimming pool, tennis court and maintenance shed located in the western section of Lot 2.
- A signature café/restaurant/bar with associated kiosk/shop and reception office located in the eastern section of the site on Lot 1, where the original café was located.
- 25 one-bedroom Chalets, swimming pool, day spa and 8 glamping tents located on the balance of the property between the Lodge and Café/Restaurant/Bar/Shop.

While it is intended that they will be separate business entities, the three components will form a fully integrated plan. Refer attached Local Development Plan.

5.1 Stage One

The proponent wishes to proceed with Stage One which will comprise:

- A luxury holiday Lodge with 10-12 bedrooms. (to be designed but examples of this form of development are provided overleaf). The building will be a mix of single storey and two storey components.
- A swimming pool and tennis court.
- A storage/maintenance shed.

Examples of the Lodge development include the Saffire Lodge in Tasmania, however, the scale is more in line with lodges such as Blanket Bay, Mt Gold, Te Arai Lodge, Wharekaukau in New Zealand. (Refer Appendix 'C' which provides information relating to these examples)

Blanket Bay Lodge, New Zealand

Mt Gold Lodge, New Zealand

Helena Bay, New Zealand

The Lodge will be located within existing Lot 2 with access via a battle-axe leg onto Frenchman Bay Road. A fire service accessway around the perimeter of the lot will connect up with accessways associated with the development of the Café/Restaurant/Bar/Shop and Chalets.

The Lodge will be setback from the Vancouver Spring setback, the 2061 Coastal Erosion Hazard Line Setback and the setback required by the fire management plan. The two-storey component of the Lodge will be set behind the Single Storey Setback Line as identified in the current Local Development Plan.

Market research has yet to confirm whether the proposed tennis court is a desirable addition to the facilities offered by the Lodge. In addition to its use as a tennis court, there is the potential for it to be used for wedding marquees and functions associated with the Lodge. If required, the preferred location is located within the Vancouver Spring setback on the understanding that it is a benign use that will have no detrimental impact on the Spring's catchment. The location is convenient to the lodge and given the overall setbacks and constraints of the site, utilisation of the area will enable the balance of the site to be more effectively used.

A maintenance shed is required for back of house storage as well as machinery and equipment associated with clearing, landscaping, construction and on-going maintenance of the site. The shed will be 10 metres by 24 metres with 4.2 metre high walls and pitched roof with a ridge line at 7.0 metres. It will be screened with existing vegetation and supplemented as necessary by additional screen planting. The location of the shed straddles the Vancouver Spring setback, but will not incorporate a caretaker's accommodation and associated effluent disposal as previously suggested. The shed will be placed on a concrete slab and designed to ensure no contaminants will be emitted into the environment. Further detail will be provided at the Development Application stage of development.

A site for Caretaker's Accommodation will be located in the south eastern corner of the site, adjacent to one of the two entry points to the development.

As it is not economically viable to connect the development to Scheme sewer, effluent disposal will be contained within the site based on the requirements of the Government Sewerage Policy. A secondary treatment system with nutrient removal, as approved for the previous development will be used. The Lodge will accommodate between 20 to 24 people. A Site and Soil Evaluation has been carried out by Bio Diverse Solutions and is attached in Appendix 'D'. The evaluation confirms that the site is suitable for on-site effluent disposal and is compliant with the Government Sewerage Policy. The effluent irrigation area for the Lodge is proposed to be located along the landscaped entrance driveway.

Given that the property is not connected to a reticulated water supply, the provision of a potable water supply will be by way of filtered bore water and rainwater tanks. Two tanks of between 175,000 – 220,000 litres are proposed utilising water from the rooves of the Lodge and shed. The tanks can be appropriately located and screened and the Lodge tank(s) could be placed underground. The existing tank located within the driveway along the southern boundary will supplement the rain water tanks and will provide water for bushfire fighting. This has a 200,000-litre capacity utilising bore water. The Lodge swimming pool will also be available for bushfire fighting purposes. As connection to scheme water is not available at this time, a scheme variation is requested.

As the lodge will accommodate between 10 to 12 bedrooms, 12 carparking bays have been provided together with 3 bays for staff and visitors. An additional two car bays are provided in association with the care takers dwelling. The proposed provision of car bays is considered more than adequate, as it is anticipated that up to 25%-30% of guests will arrive by air.

A waste storage and bin area for the Lodge is located at the entrance of the driveway onto Frenchman Bay Road. This site will be accessible to waste collection vehicles and will be separated from effluent disposal areas.

5.2 Stage Two.

Stage Two will be developed predominantly within Lot 1 and a portion of Lot 2. It will include the development of a café/restaurant/bar, together with a kiosk/shop in the north east corner of the site. The balance of the area will accommodate 25 single bedroom chalets, 8 glamping tents, a day spa and swimming pool. This Stage will only proceed once Stage I has been developed and the local tourism market and financial viability has been further researched. It is also dependent on two other critical factors:

- The provision of an on-site refuge or community refuge in order to meet Bushfire Management Guidelines. The current BEEP provides for ''on-site refuge" for 200 people within the current (2018) approval for the café/caretaker's building. This may limit the size of the proposed café/restaurant/bar and shop to approximately 100 people which is unlikely to be commercially viable.
- It is not a practical proposition to use rainwater tanks supplemented by bore water for either the commercial development or the chalets and glamping tents. The provision of scheme water is therefore required.

Subject to these two matters being satisfactorily resolved, the LDP provides an indicative plan for Stage 2 which is outlined below.

5.2.1 Proposed Commercial Uses (Café/Restaurant/Bar/Shop)

This area provides the opportunity to develop a quirky, relaxed informal Café/Restaurant/Bar/Shop to serve local craft beers and wines along with farm to plate food. It will be situated at the eastern end of Lot 1 with a sheltered northern aspect overlooking King George Sound. It will have access to the existing stairway down to the beach and picnic area and the public carparking area to the east.

Provision for lawns and an alfresco area in front of the commercial area along with an amphitheatre, which may sit across the proponent's land and Council's reserve, utilises the slope of the land and will provide the opportunity for a variety of events to be accommodated at the site.

A mixed commercial enterprise is in high demand from local residents and will provide a service for both the local community as well as for visitors from within and outside the region.

5.2.2 Chalet and Glamping Tents

The third component of the development proposes the development of 25 luxury one-bedroom Chalets together with 8 Glamping Tents, a Day Spa and a Swimming Pool.

The Chalets will be located behind the 2061 Coastal Erosion Hazard Line, the bushfire setback requirement and Single Storey Development Setback.

The luxury Chalets will be single storey and in order to reduce the impact of traffic, access will be via 'golf buggies' utilising the laneways which will also incorporate the required access for bushfire management purposes. Examples of the Chalet designs are based on the New Zealand South Island "Crib" which is a word for a cabin or simple shelter. The Roys Peak Crib development in Wanaka, Central Otago, illustrates a contemporary more upmarket design which provides an illustration of what is proposed for the Frenchman Bay site. Refer to examples of the Chalets below. The scale of these Chalets will enable them to be well integrated into the site and allow existing vegetation to be retained where possible while also being in conformity with bushfire guidelines.

The eight Glamping Tents will be located adjacent to the northern boundary where they will enjoy an exclusive location and view on the edge of the ridgeline overlooking King George Sound.

A Day Spa and Swimming Pool, are also proposed within this precinct.

Visitor car parking will be located on the periphery of the site adjacent to the eastern boundary and access to the Chalets and amenities, as noted above, will be via 'golf buggies'.

A financial model for operation and development has yet to be prepared and is unlikely to be considered until the Lodge is approved to commence construction and open for operation. In short, the Chalets are more of a medium-term proposition and will most likely to be in a different ownership structure.

5.2.3 Car Parking

An indicative car parking layout for Stage 2 is outlined in the LDP and is based on the following:

- One car bay per one bedroom chalet and glamping tent. Total for 25 chalets, 8 glamping tents and 3 staff – 36 bays. As the City of Albany's scheme requires 2 bays per unit a variation is requested
- Car parking for the café/restaurant/bar which will accommodate 100 people is based on one bay per four people plus staff – 28 bays. Space exists to provide additional bays on site and within the Frenchman Bay Road reserve, particularly around the public convenience area. This would allow for the number of people using the commercial facilities to be expanded, including special events associated with the amphitheatre. Indicative parking bays are shown on the LDP and an opportunity exists for a joint project with the City of Albany to provide car parking for both the beach and the Café/Restaurant/Bar.

5.2.4 Power and Communications

Power and telecommunications were previously connected to the former caravan park and are available to be connected to the proposed development.

5.2.5 Water

As previously noted, Stage 2 will require scheme water to be extended to the site. The Great Southern Development Commission has been approached to facilitate the extension of the Scheme water capacity by way of regional development funding. Scheme water is not only required for this project but also to service Whaleworld, the Oyster Hatchery and associated expansion. A co-ordinated approach is required to address this constraint if the tourist potential of the area is to be realised.

5.2.6 Wastewater Disposal

As previously noted, connection to the Water Corporation's reticulated waste water system is not economically viable and advanced secondary treatment systems with nutrient removal are proposed.

As noted in section 4.1 above a Site Soil Evaluation has been prepared by Bio Diverse Solutions which confirms that the site is suitable of on-site effluent disposal and can comply with the Government Sewerage Policy.

5.2.7 Drainage

The porous sandy soils of the property facilitate disposal of stormwater drainage by infiltration. The reduced footprint of this proposal in terms of both buildings and accessways will also assist in managing stormwater in accordance with City of Albany guidelines. Further detail will be provided at the Development Application stage of development.

5.2.8 Rubbish Collection

Waste management associated with the development will be coordinated for each stage with two waste storage/bin pick up areas nominated on the plan. One will serve the Stage 1 Lodge development and a second will serve the Stage 2 development. Both sites are located adjacent to the internal access ways which can be accessed by waste collection vehicles.

5.2.9 Vegetation Retention and Fauna Habitat

A 'Habitat Assessment and Tree Retention Report' was prepared by Bio Diverse Solutions in October 2017.

The survey noted that "there was no significant evidence of highly utilised or significant trees identified for the three Threatened Black Cockatoos" and although the site contained potential foraging habitat, the quality of the forage is marginal and the area is not currently a favoured feeding site. There were signs of ringtail possum activity and consequently, significant trees identified in the survey have been shown on the LDP to ensure they are retained.

As the footprint of the proposed single bedroom Chalets is smaller than the units approved by JDAP in June 2018, there is also an opportunity to retain additional remnant vegetation throughout the site providing it can also conform to the bushfire management guidelines.

5.2.10 Bushfire Management

As Lots 1 and 2 Frenchman Bay Road are located within a 'bushfire prone area', a bushfire management plan (BMP) has been prepared and is attached in Appendix 'E'.

All buildings are located within BAL 29 or less. The glamping tents adjacent to the northern boundary are located within BALFZ as they are not classified as "buildings" and under the DPLH Tourism statement, the lots of these structures are identified as "tolerable risk".

As Frenchmen Bay Road is a long culs de sac, the proposal cannot meet the requirements of two access routes under the bushfire guidelines. This is a legacy issue and will be addressed either by the provision of a community refuge facility or by providing an on-site refuge associated with the Café/Restaurant/Bar. The latter option will entail the size, location and construction of the building to be reconsidered.

No culs-de-sac are proposed in the development with perimeter access provided to ensure two-way access between the three Precincts is available at all times.

The development will be provided with a reticulated water supply which will enable it to meet bushfire management guidelines.

Apart from the issue of two access routes, the proposal is deemed to be compliant with the bushfire guidelines.

6. CONCLUSION

The acquisition of the Frenchman Bay tourism site by one of the State's most experienced and awarded tourism developers provides an opportunity to create an outstanding development which will make the most of the special characteristics of the site.

In particular, it will provide high quality tourist accommodation which will help to overcome the acknowledged short fall of such accommodation in the region.

The proponent acknowledges the constraints of the site in relation to coastal erosion, protection of the Vancouver Spring catchment, management of waste water and stormwater, vegetation protection, fire management and provision of essential services, such as scheme water. As noted in the report, Stage Two of the proposed development is unlikely to proceed until the location of an on-site refuge or community refuge area has been confirmed and scheme water extended to service the development.

City of Albany assistance with the Coastal Hazard Assessment is appreciated and further work in preparing a CHRMAP has provided sufficient confidence to proceed with the project based on a 40-year timeline. The form and construction details of the proposal have been reconsidered and will have regard to this development timeframe.

Following recent erosion of the parking and picnic area adjacent to the beach immediately below the site, there is an opportunity to work with the City of Albany to upgrade the area at the eastern end off Lot 1 where the existing ablution block and car parking area are located. The development of Café/Restaurant/Bar/Shop and amphitheatre in association with the improvements to the amenity of the Council managed reserve has the potential to create a significant tourist destination which will complement Albany's Historic Whaling Station.

The City of Albany's assistance in expediting the processing and endorsement of the LDP is requested, so that Architects can be appointed to prepare a detailed Development Application for the first stage which will incorporate the Lodge and maintenance shed within Lot 2.

LEGEND

- Subject Land
- Existing Lot Boundary
- Proposed Lot Boundary
- Single Storey Development Setback
- 2061 Coastal Erosion Hazard Line
- 65m Vancouver Spring Setback
- Lane Way / Fire Access

ORIG A3
SCALE 1:1000
0 5 10 15 20 25

A	10-12 Bedroom Lodge
B	Maintenance Shed
C	Chalets
D	Reception, Kiosk/Shop & Cafe
E	Day Spa
F	Manager's Accommodation
	Significant Trees
	8 GlampingTents
Ⓗ	Potable Water Tanks
Ⓖ	Waste Storage/Bin Area
I	Bore Water Tank

ALL AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY

301
VCL

300
Reserve 21337
35.7978ha

AMPHITHEATRE
ALFRESCO AREA
D
Ⓖ
Lot 1
POOL
STAGE 2
C
F
Ⓖ

Lot 2
POOL
SINGLE STOREY
STAGE 1
TWO STOREY
B
A
E
Ⓗ
Ⓗ
28
288
I

FRENCHMAN BAY ROAD
WHALING STATION ROAD

8099
Reserve 50239
8.4664ha

19-17-LDP-(L)

AYTON PLANNING
POBox 5476, ALBANY WA 6332
Ph 9842 2304

LOCAL DEVELOPMENT PLAN

Lots 1 & 2 Frenchman Bay Road
Frenchman Bay, City of Albany
April 2022

APPENDIX 'A': COASTAL HAZARD ASSESSMENT

m p rogers & associates pl ABN 14 062 681 252
creating better coasts and ports

R1630 Rev 0

January 2021

City of Albany

Frenchman Bay
Coastal Hazard Assessment

marinas
boat harbours
canals
breakwaters
jetties
seawalls
dredging
reclamation
climate change
waves
currents
tides
flood levels
water quality
siltation
erosion
rivers
beaches
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www.coastsandports.com.au

m p rogers & associates pl
creating better coasts and ports

Suite 1, 128 Main Street, Osborne Park, WA 6017
p: +618 9254 6600
e: admin@coastsandports.com.au
w: www.coastsandports.com.au

K1944, Report R1630 Rev 0
Record of Document Revisions

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A	Draft for Client review	C Doak	K Worth	C Doak	13/12/2021
0	Issued for Client use	C Doak	K Worth	C Doak	28/01/2022

Form 035 18/06/2013

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1. Introduction

Frenchman Bay is located on the southern shoreline of King George Sound and, unique for a shoreline along the south coastal region, has a northerly aspect (refer Figure 1.1). Frenchman Bay has an interesting history, being the site of a Norwegian whaling station which was constructed in 1913. The tenure at the whaling station was short lived, with the station ultimately closing in 1915. Much of the infrastructure was removed following the closure of the whaling station; however, some relics remain on the beach (refer Figure 1.2). These relics have influenced the shoreline behaviour over the ensuing century.

Figure 1.1 Location of Frenchman Bay

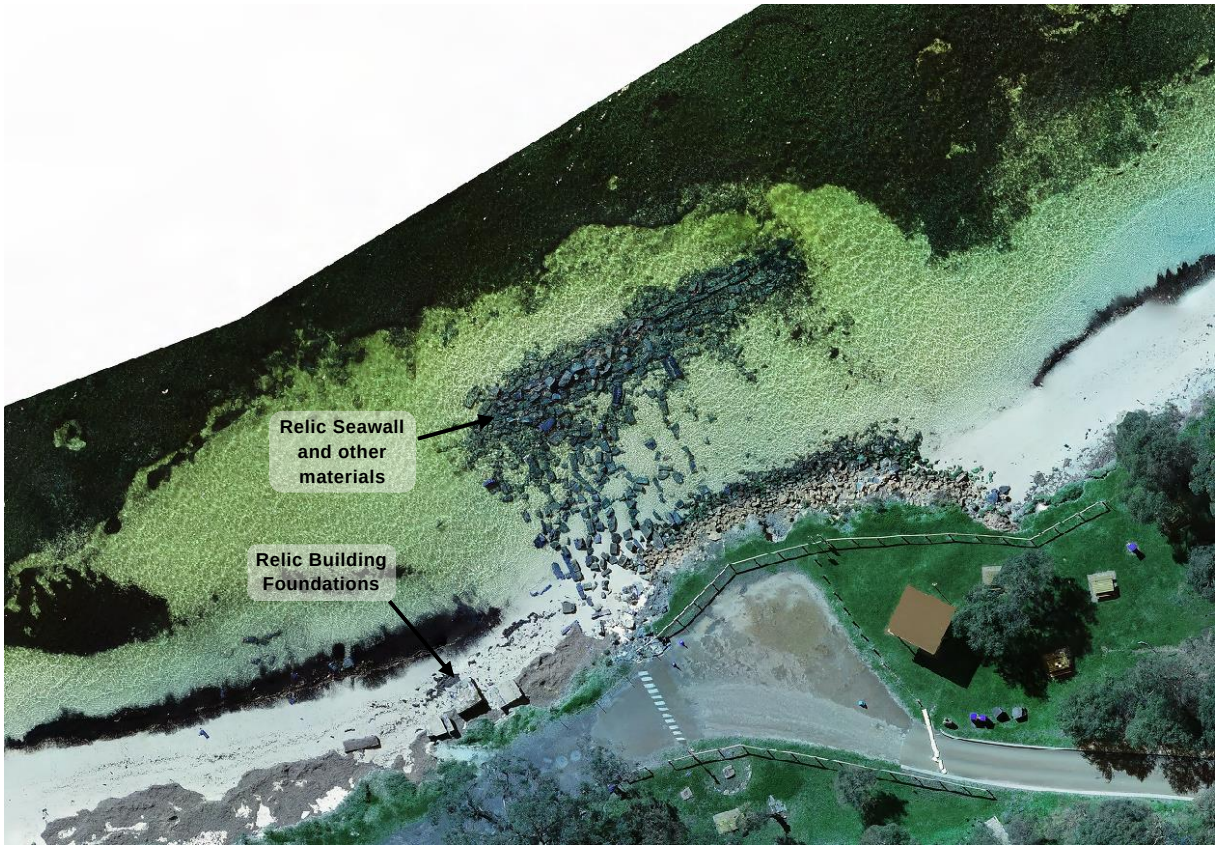

Figure 1.2 Relics from the Norwegian Whaling Station

In the present day, Frenchman Bay is a popular beach and foreshore area with both locals and tourists alike. Lots 1 and 2 Frenchman Bay Road are also slated for the development of Tourist Accommodation within the City of Albany Local Planning Scheme No. 1. Whilst an approval for the development of Lots 1 and 2 is in place, the approved development is understood to not be commercially viable, so modifications to the Local Development Plan (LDP) are proposed.

To enable review of the proposed development in the context of coastal hazard risk, as well as to enable planning for the siting of public infrastructure within the foreshore, the City of Albany engaged specialist coastal engineers M P Rogers & Associates Pty Ltd (MRA) to complete a coastal hazard assessment for Frenchman Bay. The requirement for the assessment of coastal hazard risk is even more profound given that the shoreline fronting the main coastal node has experienced noticeable erosion over the past few years.

Provision of guidance with regard to future coastal hazard risk requires an understanding of the potential zones of impact from local coastal processes. Within Western Australia, State Planning Policy 2.6 – the State Coastal Planning Policy (SPP2.6; WAPC, 2013) provides a methodology to determine the extent of areas adjacent to the coastline that could be influenced by coastal processes.

This report presents the results of investigations into the potential extent of impacts from coastal processes over a variety of planning horizons. These coastal hazard risk areas can then be used to guide a coastal hazard risk management and adaptation planning process in future stages of work.

2. Site Setting

2.1 Location

Frenchman Bay is a curved 700 m long north-facing beach located between Vancouver Point to the west and Waterbay Point to the east (Short, 2006). The presence of the Flinders Peninsula to the south and east provides protection to Frenchman Bay from offshore wave conditions, with refracted and diffracted wave heights generally less than around 1 m at the shoreline. The protrusion of Waterbay Point also provides further sheltering to the shoreline, and wave energy generally decreases from west to east along the beach (Short, 2006).

These local features are shown in Figure 2.1, which is an extract of the local nautical chart for the area.

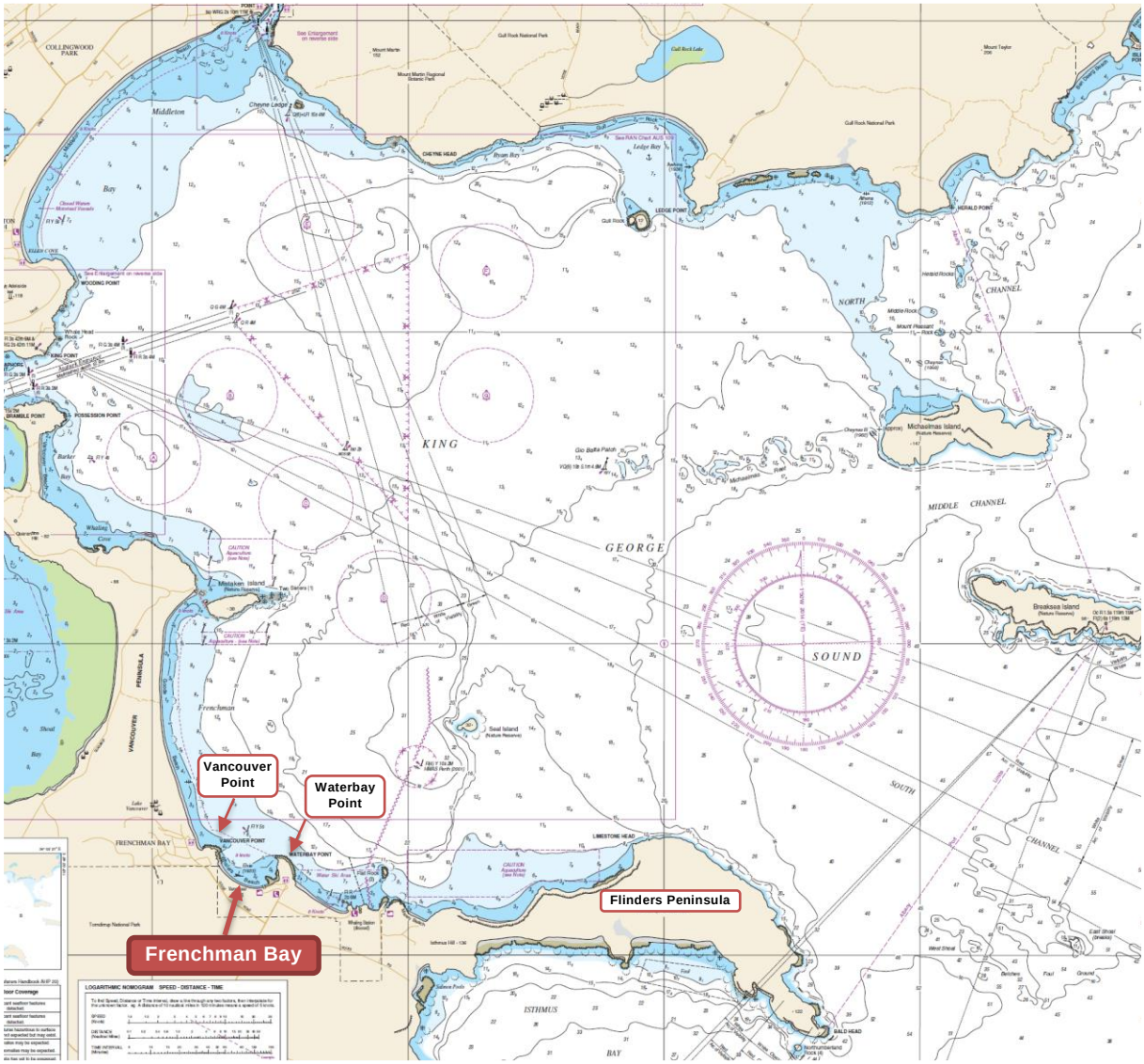

Figure 2.1 Extract from Local Nautical Chart (WA1083: DoT 2014)

2.2 Geology & Geomorphology

The Frenchman Bay shoreline consists of a reflective sandy beach. Behind the beach the land slopes steeply up to an elevation of approximately 25 mAHD before the land continues to rise at a

gentler grade. The area is underlain by a basement that is PreCambrian "Granitoid Gneiss" which is overlain by a Tertiary Planagenet Group (Landform Research, 2008). The Granitoid basement outcrops to form both Vancouver and Waterbay Points.

Given the northerly aspect of the beach, which faces away from the prevailing conditions, a conventional dune system is conspicuously absent along this shoreline.

In 2008, Landform Research completed geotechnical drilling within Lots 1 and 2 to further review the local geology. The drilling determined that there was a deep layer of sand which was underlain by a siltier material. Significantly, none of the boreholes intersected the granitoid rock basement despite drill depths down to -1.7 mAHD in some areas. Whilst this drilling assessment was limited to the areas within Lots 1 and 2, it is anticipated that similar geological conditions would be encountered over the full extent of Frenchman Bay. As a result, assessment of the shoreline will be based on a sandy coastline classification.

Figure 2.2 View of Granitoid Outcrop that Forms Waterbay Point

Figure 2.3 View West Along Frenchman Bay Towards Vancouver Point

2.3 Historical Norwegian Whaling Station

The Norwegian Whaling Station was originally constructed in 1913, but was ultimately closed in 1915. At its peak, the whaling station boasted a range of different buildings, as shown in Figure 2.4.

Figure 2.4 Image of the Norwegian Whaling Station from 1913 (Frenchman Bay Association, 2021)

The Frenchman Bay Association (2021) provides a succinct summary of the history of the site. In particular, it is noted that following closure of the station the owners disassembled much of the machinery and relocated it to the site of their new facility at Point Cloates. However, it is noted that a large storm in 1921 wrecked the remaining slipway and loading jetty and eroded the seawall that protected the foundations of some buildings, causing them to topple. Whilst an amount of material was salvaged or removed, some of the material remained on site. An image of the remaining material is shown in Figure 2.5. This figure shows the remnants footings of some of the buildings as well as what is understood to be the remains of the initial seawall.

Figure 2.5 Remnant Material from the Norwegian Whaling Station (Frenchman Bay Association, 2021)

Given their location on the beach, the remains of the Whaling Station have impacted the local coastal processes along the eastern portion of Frenchman Bay. It is currently understood that the City of Albany are reviewing heritage preservation opportunities and requirements for these relics. It must be acknowledged that any changes to the location or configuration of these relics could further influence the local shoreline dynamics. This will be discussed further in latter sections of this report.

2.4 Metocean Conditions

Consideration of beach stability and coastal processes is enhanced by an understanding of the fundamental driving forces. Consequently, data on the magnitude and variation in the winds, waves, tides and currents is important in assessing the coastal processes.

2.4.1 Wind Regime

The seasonal weather patterns at Albany are largely controlled by the position of the so called Subtropical High Pressure Belt. This is a series of discrete anticyclones that encircle the earth at the mid-latitudes (latitudes of 20 degrees to 40 degrees). Throughout the year, these high pressure cells are continuously moving from west to east across the southern portion of the Australian continent. A notional line joining the centres of these cells is known as the High Pressure Ridge.

In winter, this ridge lies across Australia typically between 25 to 30 degrees south and is to the north of Albany which is located at around 35 degrees south. Consequently, the migrating low pressure systems which exist to the south of the High Pressure Ridge, are located sufficiently northward to bring a westerly wind regime to the southwest of Western Australia and the adjacent waters. Cold fronts associated with these low pressure systems pass over the Albany region. These can bring storm force winds with directions from northwest, through west, to southwest.

During summer, the High Pressure Ridge moves south of Albany and lies between 35 and 40 degrees south. Under these circumstances, the Albany region comes under the influence of the high pressure cells of the High Pressure Ridge. These cells cause anti-cyclonic winds that rotate anti-clockwise in the Southern Hemisphere. At Albany, these winds arrive from the southeast to east as the high pressure cell approaches from the west.

In addition to these synoptic scale effects which cause seasonal variations, the meso-scale phenomenon of a land / sea-breeze system is commonly experienced during summer at Albany and adjacent coastal regions.

The Bureau of Meteorology has recorded the wind speed and direction at Albany Airport since 1965 and have used this data to prepare seasonal wind roses. These are presented as Figures 2.6 and 2.7 for the expanded winter (May to September) and summer (October to April) periods. Figure 2.6 shows the predominance of winter winds from the northwest and southwest sectors. Often the wind speeds exceed 50 kph in the winter storms.

The wind roses for summer, Figure 2.7, shows the common wind directions in summer as southeast and southwest. The detailed wind records show the land sea-breeze effect with the summer morning winds typically from the east and southeast at 20 to 40 kph, while the afternoon winds in summer tend to be of slightly stronger and generally from the southeast to southwest.

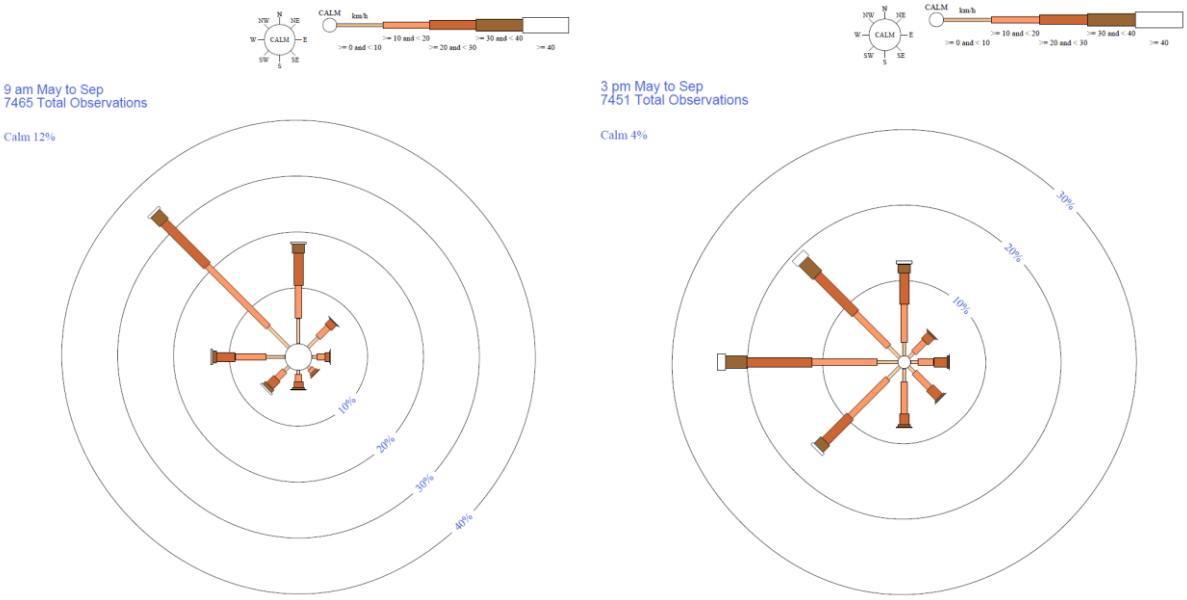

Figure 2.6 Albany Wind Roses for the Expanded Winter Period (BoM, 2014)

Figure 2.7 Albany Wind Roses for the Expanded Summer Period (BoM, 2014)

These records were taken at the Albany Airport which is about 20 km from Frenchman Bay. Differences in the local topography are likely to cause changes in the wind speeds and local directions. Nevertheless, the records presented are believed to be fairly representative of the main wind patterns and the seasonal changes that are experienced at Frenchman Bay.

The wind regime influences coastal processes through the generation of waves and currents.

2.4.2 Wave Climate

The nearshore wave climate at Frenchman Bay comprises two distinct sources. The first is that from the open ocean to the south of Albany, and the second are those waves that are generated by local winds across the short fetches of King George Sound.

This local generation of waves across King George Sound that causes waves to be directly incident upon Frenchman Bay is caused by winds from the north-easterly quadrant. However, as seen in the previous wind roses, strong winds from this quadrant are not overly persistent.

The deepwater wave climate to the south of Albany is quite severe. The Department of Transport record wave conditions in 60m of water south of Albany using a Waverider buoy. The location of the Waverider is shown in Figure 2.8. Wave measurements from this location are available since 2005.

Figure 2.8 Location of the DoT Waverider Buoy

The data recorded from the Albany Waverider is plotted in Figure 2.9. This figure shows both the time history of recorded wave heights as well as cross plots of the sea and swell wave heights verses their associated directions.

Figure 2.9 shows that the most common direction for these offshore waves is from the southwest, but they also approach King George Sound from the south and occasionally the southeast. The severity of the wave heights also mirrors the persistence, with the most severe waves from the south through west. Interestingly, the plot of recorded wave heights shows that the winter of 2020 was relatively severe, with a cluster of higher wave heights than previously observed within the data record. This may explain some of the erosion pressures that have been experienced at Frenchman Bay over the past couple of years.

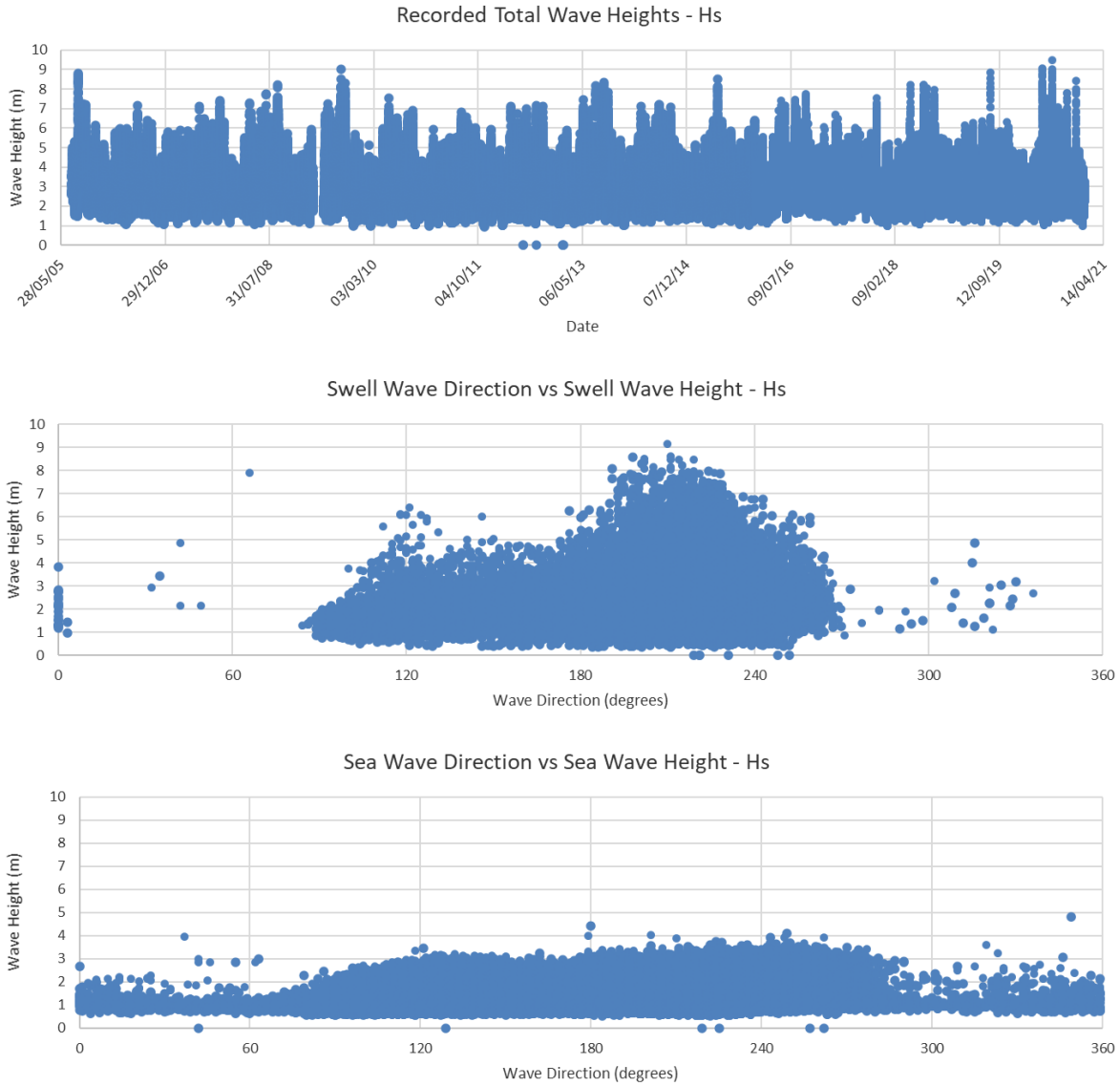

Figure 2.9 Wave Data Recorded from the Albany Waverider Buoy

The shape of King George Sound provides Frenchman Bay with excellent natural protection from these open ocean waves (refer to Figure 2.1). In particular, the extent and position of Flinders Peninsula limits the energy of ocean waves that reach Frenchman Bay. The large ocean waves are greatly attenuated by the processes of refraction, diffraction, bottom friction and breaking as they travel from the open ocean to the sheltered shore.

Small to very small swell waves reach the shores of Frenchman Bay throughout the year. Because of the extensive refraction, the swell waves are bent around and arrive at the shore with crests generally parallel to the beach. This is an important feature as it means that if there are changes to swell conditions then the alignment of the beach will likely change as a result.

Given the location of Frenchman Bay, the most important fetches for locally generated waves are from the north-east quadrant. During the summer months there will be periods of winds that generate local seas from this direction across King George Sound. These seas will often reach 1 metre in height with wave periods of about 4 seconds. During very extreme events of strong winds from the east, the local seas may reach 2 metres in Frenchman Bay.

The waves that break on the beach are very important in the transport of sand in the littoral zone.

2.4.3 Tides & Water Levels

The astronomical tides at Albany are predominantly diurnal (one tidal cycle each day) and relatively limited in range. The daily range is typically about 0.6 metres during spring tides and about 0.3 metres during neap tides.

Seasonal shifts in the sea level occur due to meteorological effects. Typically, the mean sea level at Albany rises 0.1 metre during winter and falls 0.1 metre during summer.

During storms events, barometric and wind effects can cause significant storm surges. In typical winter storms, the surge is often about 0.4 metres above the astronomical tide level. The storm surge can be in the order of 1 metre during a very rare winter storm.

Given the small astronomical tides, the level of the sea would generally have a secondary effect on the sand transport along the beaches, except during storm events when high water levels would enable the waves to attack the rear of the sandy beaches.

2.4.4 Nearshore Currents

As the tidal range is quite small, it is likely that the nearshore tidal currents in Frenchman Bay are also small. From work in Princess Royal Harbour (Environmental Protection Authority, 1990) it is expected that the largest currents in the nearshore area at Frenchman Bay would result from the action of the wind blowing over the water surface. These wind driven currents are generally less than 0.5 m/s.

The magnitude of these nearshore currents is such that they will have a minor effect on the movement of sand on the adjacent beaches.

2.5 Coastal Processes

Frenchman Bay is located within the Possession Point to Bald Head coastal compartment (refer Figure 2.10). This compartment is characterised by embayed beaches generally separated by granite outcrops that exhibit morphological control.

Over the planning horizons considered in this assessment (up to 100 years) Frenchman Bay can be treated as a closed sediment cell. This is due to the fact that Vancouver and Waterbay Points essentially restrict sediment transport into or out of the Bay.

Figure 2.10 Extent of Coastal Sediment Cells

Based on the above information regarding the various physical processes, the movement of sand within Frenchman Bay is believed to be dominated by wave induced processes.

The transport of sand along a coast is a fundamental mechanism in beach dynamics. A simplistic description of this mechanism is that in the surf zone of sandy beaches, the breaking waves agitate the sand and place it into suspension. If the waves are approaching the beach at an angle, then a longshore current can form and this can transport the suspended sand along the beach. The suspended load transport is accompanied by a bed load transport where sand is rolled over the bottom by the shear of the water motion.

At Frenchman Bay the swell waves generally approach normal to the shoreline, though there is the potential for changes to the swell wave periods to change the alignment of the swell waves slightly as they approach the beach. Given the protection provided by Waterbay Point, the incident wave heights will also be higher at the western end of the Bay than they are at the eastern end. The western end of the Bay is also more exposed to summer easterly seas, increasing the potential for sediment transport along the western shoreline. Despite these different processes, the fact that Frenchman Bay is essentially a closed sediment cell means that the alignment of the shoreline would not be expected to change markedly over time. There may be reorientations or rotations of the overall beach driven by the incident wave energy, but ultimately such changes are expected to be relatively small.

The other significant coastal process, is by the onshore / offshore movement of beach sand. During storm events the steep waves and high water levels would cause sand to be eroded from

the beach and carried offshore. The long, low swell that persistently arrives at this coast between storm events would tend to move sand back onto the beach. This cyclical onshore / offshore movement of sand is not expected to be large by volume within Frenchman Bay, however the absence of a defined dune, which would typically provide a buffer against storm erosion, means that any erosion effects are generally more noticeable.

3. Coastal Hazard Identification

An understanding of potential future coastal hazards and risks is critical for the assessment and determination of appropriate locations for siting of new development as well as for the development of management and adaptation actions.

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

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

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

3.1 Severe Storm Erosion (S1 Allowance)

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

Estimation of the S1 allowance for Frenchman Bay first requires selection of an appropriate storm event. This is particularly relevant given the level of sheltering that the shoreline receives. The selected storm will then be modelled to determine the potential extent of shoreline erosion that could result.

3.1.1 Storm Event

As outlined previously, Frenchman Bay has a northerly aspect and so is protected from the most severe wave energy from the south by the Flinders Peninsula. As a result, wave energy that arrives at the shoreline during the largest wave events (typically from the south to south west) is significantly attenuated due to the extent of diffraction required for the waves to reach the shoreline. For example, based on diffraction diagrams provided in Goda (2010) (refer Figure 3.2), even a wave coming directly from the south would be attenuated to less than 10% of its total offshore wave height by the time that it diffracted around Bald Head and made it to the nearshore area fronting Frenchman Bay.

Given the above, storm events that are predominately from the west through south would be expected to have little impact on the shoreline fronting the resort. Events with the majority of the wave energy originating from the south through east would have a much greater impact on this

section of shoreline since less wave diffraction would be required for the wave to reach the shoreline.

MRA (2018) completed a review of storm conditions appropriate for the simulation of potential coastal erosion events and discussed the effects of event directionality with particular focus on the Albany region. Results of that analysis showed that even though a storm event experienced in August 1984 was not classified as one of the top storm events, the directionality of the event being from the south east, resulted in significant erosion of shorelines within King George Sound. The extent of erosion observed during the August 1984 event was actually greater than for any other storm event within the period of record, which dated back to 1943.

Given the critical nature of a south easterly wave for the realisation of storm erosion impacts within Frenchman Bay, wave records were therefore interrogated to assess only those events with severe waves arriving from the south through east. The assessed wave data included the information from the DoT Waverider Buoy as well as results from the WW3 global hindcast wave model (NOAA 2016), and other available hindcast modelling results completed by WNI (1996).

An extreme analysis was completed on the filtered wave events to show the average recurrence of wave heights from the south through east. Results of this extreme analysis are presented in Figure 3.1.

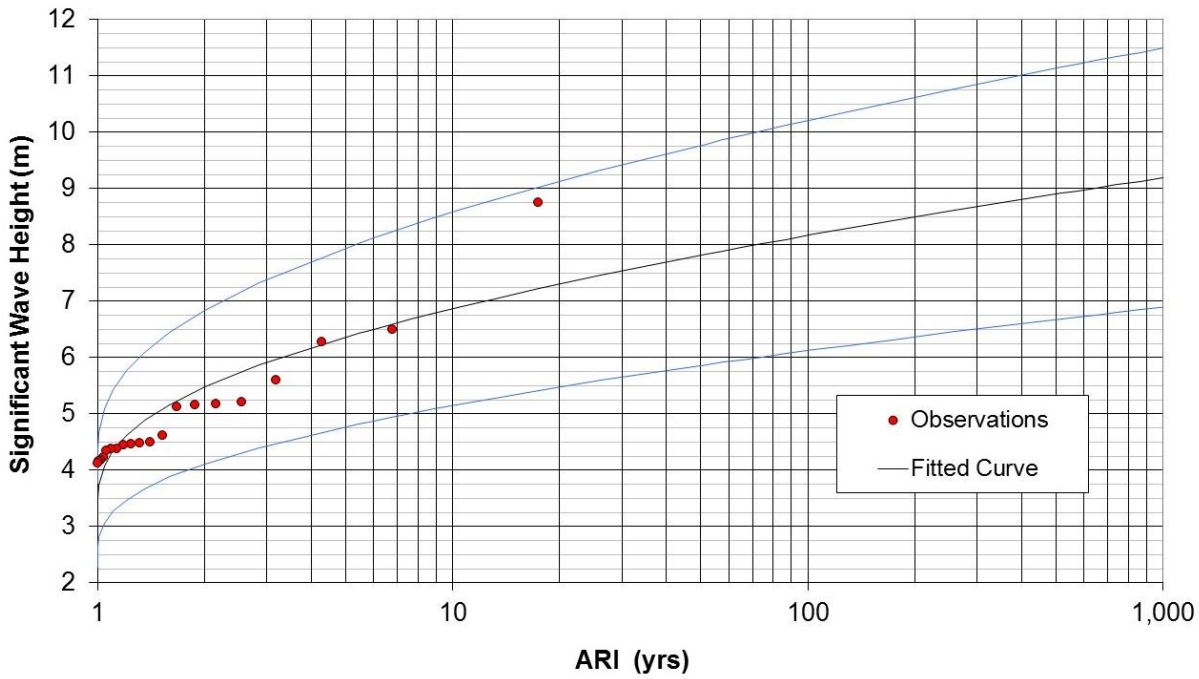

Figure 3.1 Extreme Wave Height Analysis for Waves from the South through East

The most notable feature of the extreme analysis is that there is one event that is significantly more severe than the over events. This event is the August 1984 event.

Even though this event was predominately from a south easterly direction, waves still need to diffract around Bald Head in order to reach the nearshore area adjacent to Frenchman Bay. The hindcast wave conditions were therefore adjusted to account for the attenuation caused by this diffraction using the diffraction diagrams presented in Goda (2010) (refer Figure 3.2). Using this diffraction diagram, it was possible to estimate the wave conditions offshore from Frenchman Bay.

This method is akin to that used by MRA (2017). For clarity, two examples showing how the wave transformation was completed are shown in Figure 3.3.

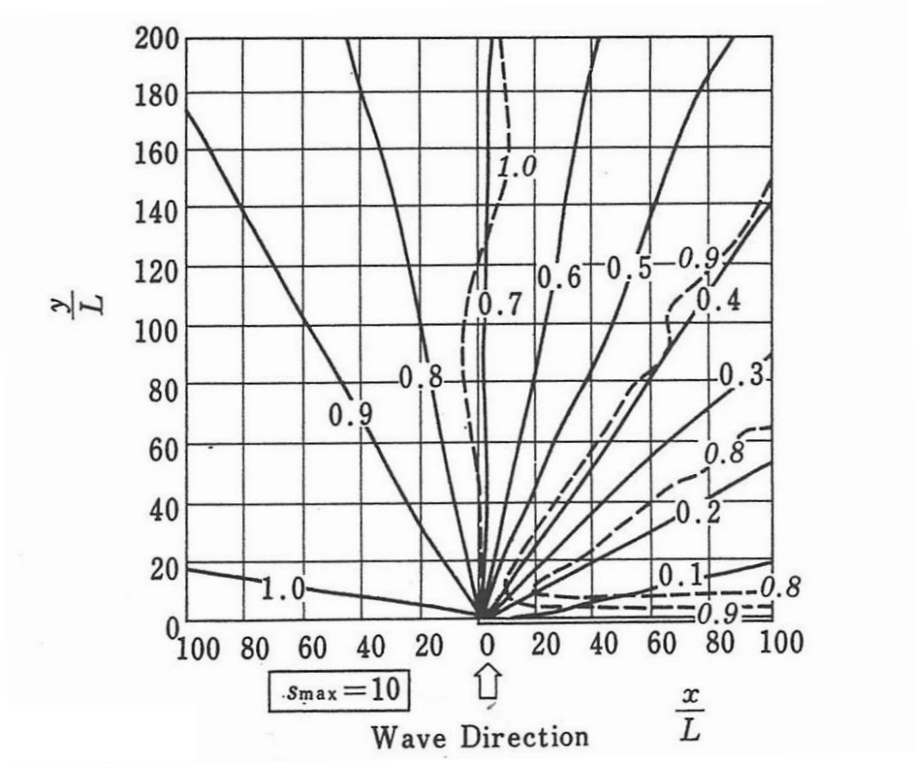

Figure 3.2 Diffraction Diagram from Goda (2010)

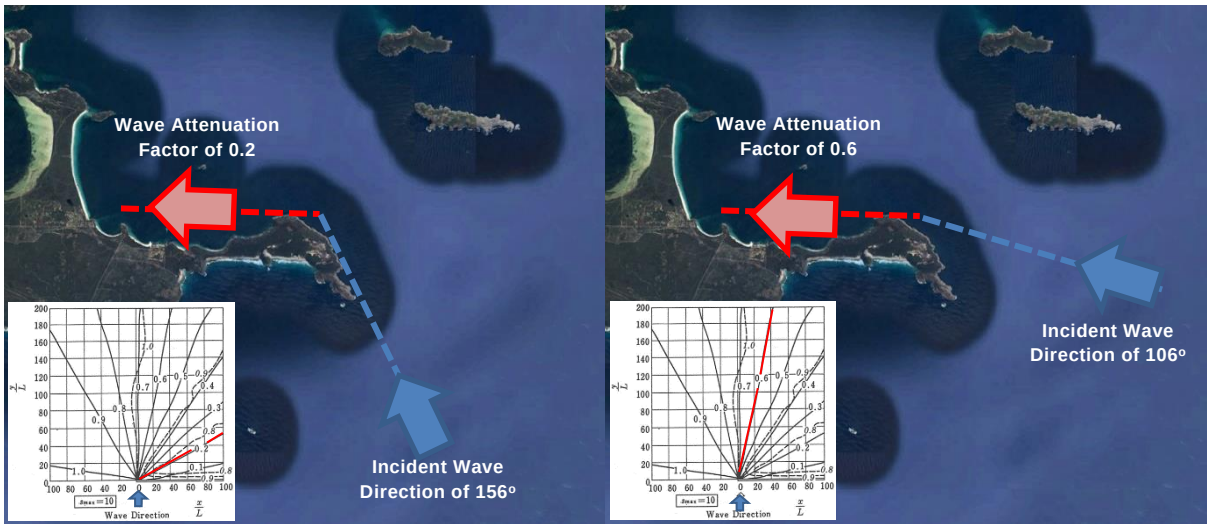

Figure 3.3 Examples of Wave Diffraction Attenuation Calculations

The diffracted wave conditions were determined for a location offshore from Waterbay Point. From this location incident waves would be further diffracted around the point or would be refracted over the local bathymetry. However, as the ensuing processes are relatively complex and will not necessarily result in energy losses that are consistent with an additional application of the diffraction diagrams due to changes in the incident wave directions, the conditions as determined at this location have been used to assess the potential for beach erosion. This is a somewhat conservative approach.

Unfortunately no water level records are available for the duration of the August 1984 event. As a result, the predicted tidal level during this event was scaled to peak at the 10 year ARI water level as determined within MRA (2018).

It is noted that scaling of the water level to peak at the 10 year ARI level is likely to be conservative for this event since the event was actually associated with the passage of a strong high pressure system. The high atmospheric pressure of this system is likely to have resulted in a set-down of water level over the general area, rather than a storm surge. However in the absence of more detailed information the 10 year ARI water level has been used to maintain conservatism within the assessment.

The August 1984 event had sustained waves from the south through east for a period of around 60 hours. The full duration of this event was therefore used for the modelling of the severe storm erosion impact. In accordance with the recommendation of SPP2.6, three repeats of this event have been used to determine the potential extent of storm erosion within Frenchman Bay. The wave heights and water level used in the modelling are presented in Figure 3.4.

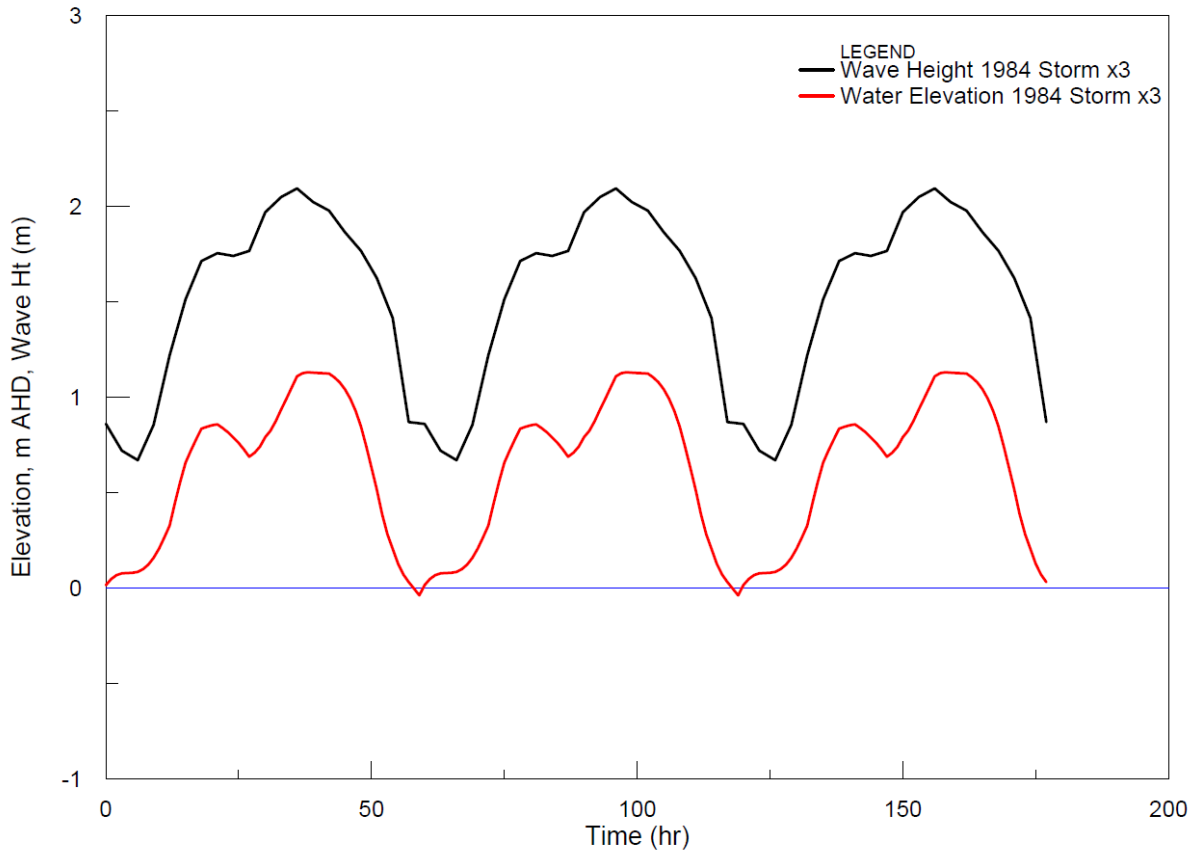

Figure 3.4 Storm Conditions for use in Storm Erosion Modelling (as determined for the area immediately offshore from the Resort site)

3.1.2 SBEACH Storm Modelling

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

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

Given the change in aspect of Frenchman Bay, two different beach profiles have been used to simulate the potential extent of severe storm erosion. The input beach profiles used in the modelling were taken from a combination of topographic survey data, hydrographic survey information and local nautical charts. The approximate location and alignment of the profiles are presented in Figure 3.5.

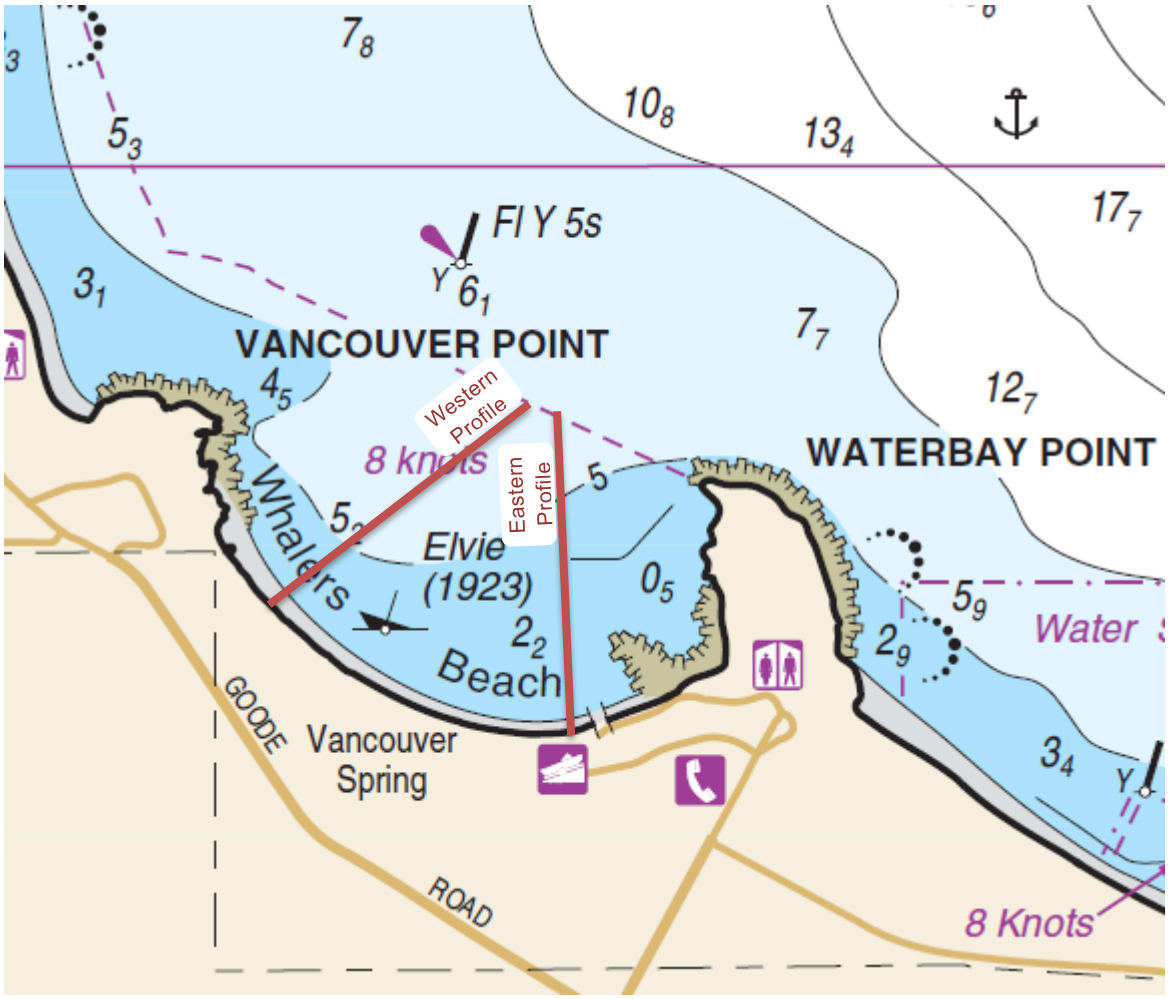

Figure 3.5 SBEACH Profile Location & Alignment

The results of the storm simulation are presented in Figures 3.6 and 3.7. These figure present the pre- and post-storm beach profiles, the maximum water elevation and maximum wave height during the event. The output from the model, the SBEACH Reports, have also been included in Appendix A.

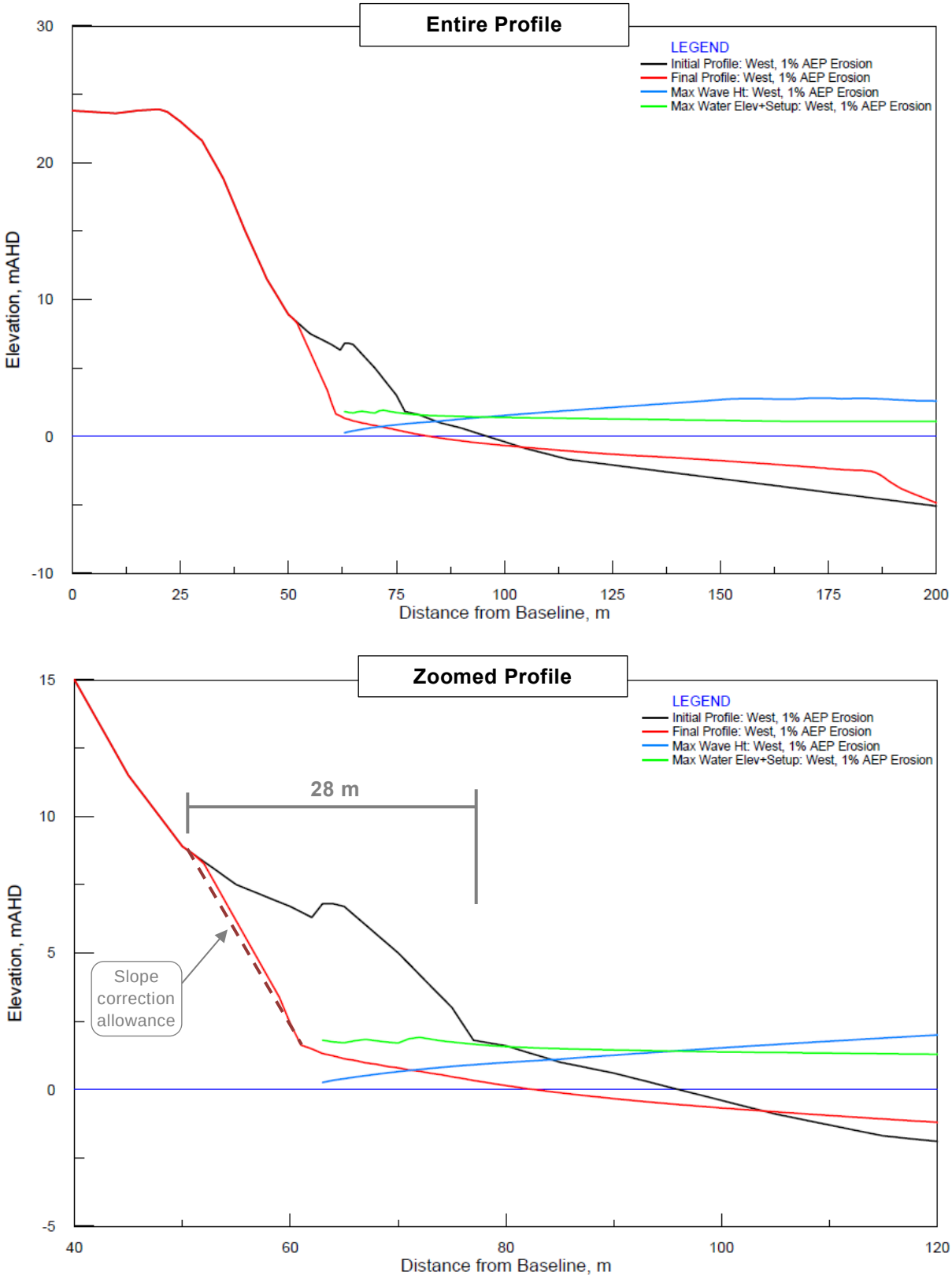

Figure 3.6 Severe Storm Erosion Modelling Results for the Western Profile

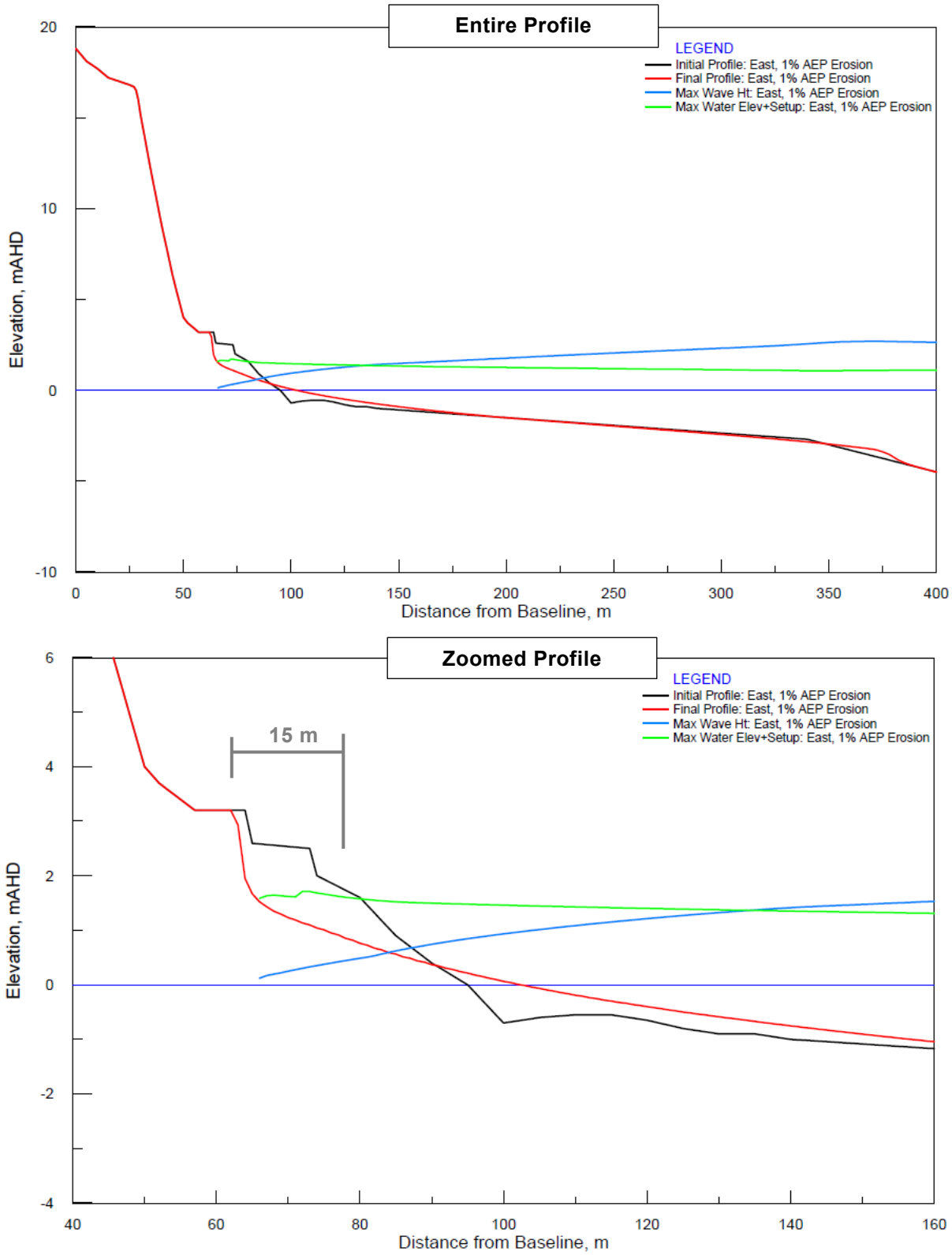

Figure 3.7 Severe Storm Erosion Modelling Results for the Eastern Profile

The S1 allowance is determined as the maximum extent of erosion behind the Horizontal Shoreline Datum (HSD). The HSD corresponds to the seaward shoreline contour representing the peak steady water level of the modelled event. The HSD was calculated as the 1.8 mAHD contour based on the results of the SBEACH modelling.

The results of the modelling show that there is potentially a greater degree of erosion potential along the western end of the bay compared to the east. There are a number of contributing factors to this, however the modelling shows that differences arise due to the shallower offshore bathymetry at the eastern end of the bay, which helps to reduce wave heights at the shoreline.

The total extents of predicted shoreline erosion caused by the storm sequence were 28 m and 15 m respectively for the western and eastern profiles. This estimate includes an allowance for dune slope correction based on a maximum avalanching slope of 30° to the horizontal to ensure stability of the eroded dune face. This applies to the result from the modelling of the western profile as shown on Figure 3.6.

Given that different erosion extents have been predicted between the western and eastern ends of the bays, and the fact that there is an intuitive understanding of why this result is reasonable, it follows that a different S1 allowance should be applied along the western and eastern ends of the shoreline. The areas covered by each allowance have been reviewed based on the nearshore bathymetry and the required allowances are shown in Figure 3.8. It should be noted that the same S1 allowance is required for each planning timeframe, as SPP2.6 requires a design storm with 1% AEP, regardless of the timeframe being considered.

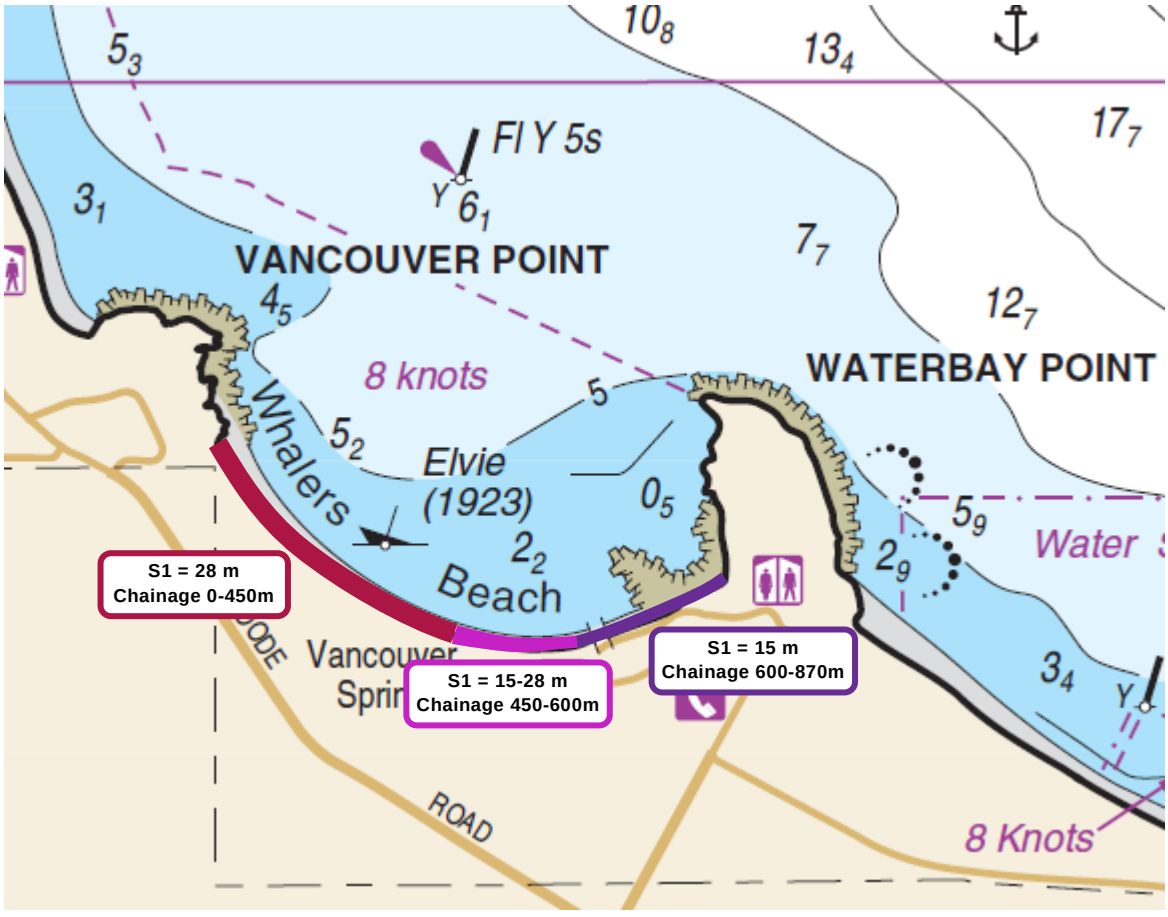

Figure 3.8 Summary of S1 Allowances

3.2 Historical Shoreline Movement (S2 Allowance)

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

3.2.1 Shoreline Movement

MRA mapped the position of the coastal vegetation line from aerial photography captured in 1977, 1988, 1996, 2001, 2007, 2011, 2014, 2016, 2019, 2020 and 2021. Mapping of the coastal vegetation lines was completed in accordance with DoT's methodology and specification for mapping (DoT, 2009). The accuracy of the position of these vegetation lines is believed to be in the order of ±5 m, depending on the resolution of the aerial photographs and the rectification process. A shoreline movement plan presenting the mapped vegetation lines is presented in Appendix B.

Using the mapped vegetation lines, the position of the shoreline was determined at intervals of 50 m or less along Frenchman Bay. The chainage intervals for the measurement of shoreline change are shown in Figure 3.9. The position of the shoreline relative to the 1977 location was determined at each interval from the shoreline movement plan, with results presented in Figure 3.10.

Figure 3.9 Intervals for Measurement of Shoreline Movement

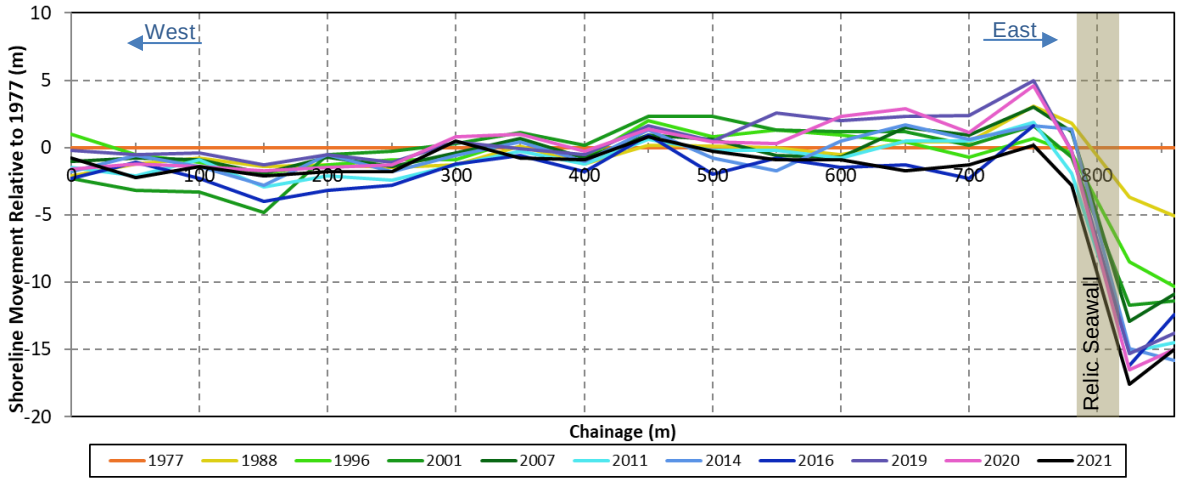

Figure 3.10 Historical Shoreline Movement Relative to 1977

The historical shoreline movement plot shows a stark difference between the behaviour of the majority of the Frenchman Bay shoreline and the small section of shoreline to the east of the relic seawall. The area to the east of the relic seawall has experienced erosion in the order of 15 to 20 metres since 1977, whilst the remainder of the bay has experienced a slight rotation, with a general accretion at the eastern end and erosion at the western end. Nevertheless, total movement of the shoreline across the majority of the Bay has been less than plus or minus 5 metres from the 1977 position.

Overall, the observed movements of the shoreline confirm the assertion that the shoreline is essentially an enclosed sediment cell, as the volume of sediment within the Bay appears to be conserved. Importantly for the management of the current infrastructure and assets at the site, the shoreline movements do show an erosion of the eastern end of the beach in the period between 2020 and 2021. Noting that these lines are from the 1st of May 2020 and September 2021 respectively, this period covers two winter seasons. It was identified through the review of metocean conditions that the 2020 winter appeared to be quite severe, and the expectation is that 2021 would also have been similar. This likely provides the reasoning behind the observed erosion in this area.

To better illustrate the trends in shoreline movement over time, time history plots have been prepared for selected chainages. These time history plots are shown in Figure 3.11.

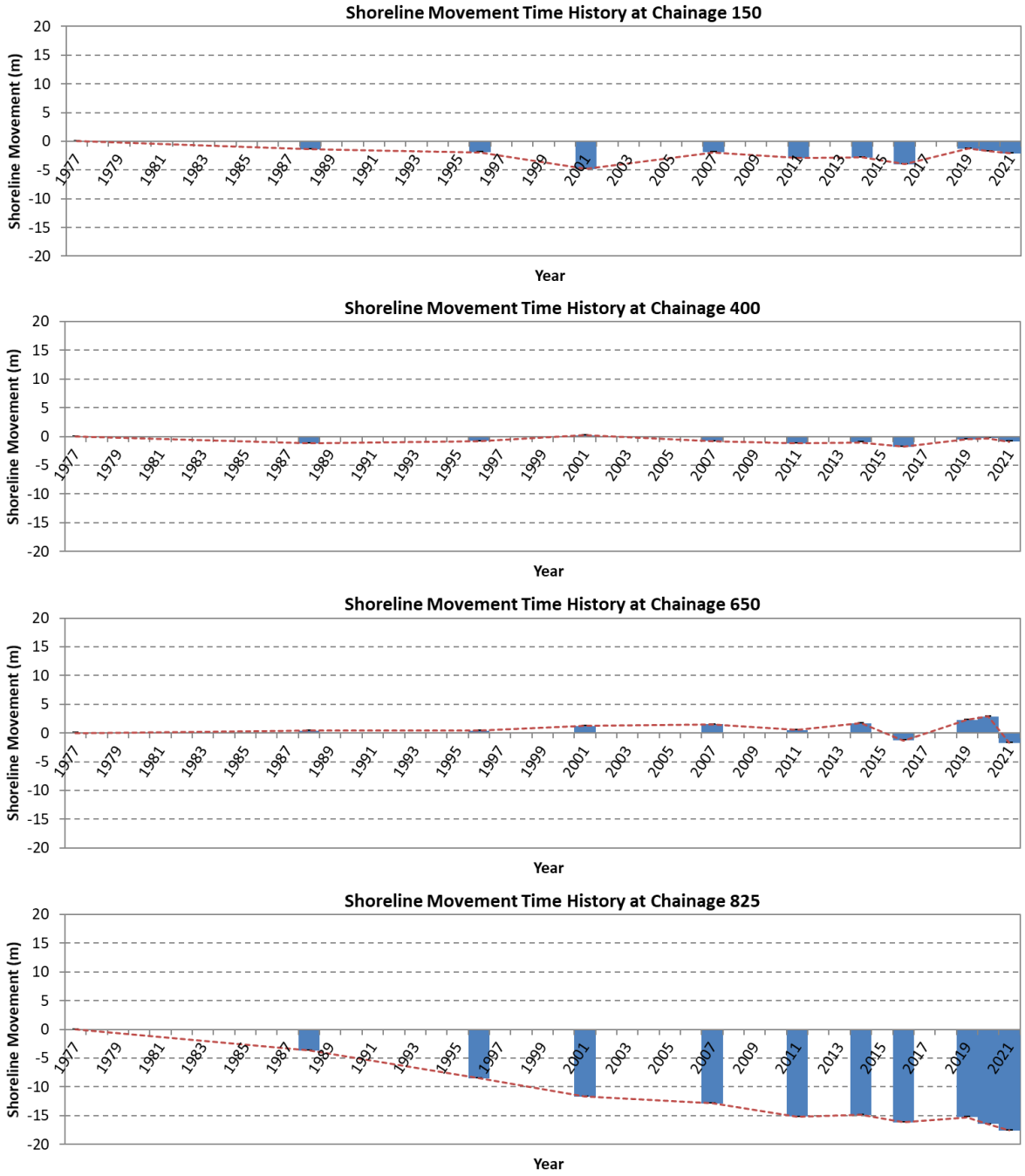

Figure 3.11 Time History Plots of Shoreline Movements at Selected Chainages

The time history plots show generally consistent trends across the duration of the record at each location. In particular the time history plots show the following.

- At the western end of the site, the plot from chainage 150 shows a reasonably consistent erosion trend, with some degree of fluctuation.
- The plot from the eastern end of the beach at chainage 650 shows a slight accretion trend, with the observed recent erosion between 2020 and 2021, though a similar erosion event was also observed in 2016.

- Chainage 400 is approximately the midpoint of the Bay and shows very little movement. This observation is not uncommon for enclosed bays such as this, as sediment dynamics generally result in rotations of the beach about the midpoint of the Bay.

- The shoreline movement at chainage 825 shows a consistent rate of erosion across the duration of record. The rate of erosion observed in this area is far greater than across the remainder of the bay. In this regard, it must be considered that this rate of erosion is attributable to other factors, in particular the presence of the relic seawall and its resultant impact on the position of the shoreline.

Figure 3.12 shows a zoomed in view of a selection of mapped shoreline positions adjacent to the relic seawall. The figure shows an obvious disparity between the historical positions of the shoreline to the west and east of the structure. Note that this figure also includes a coastal vegetation line from 1961 which was mapped for this project but ultimately not used due to issues at the western end of Frenchman Bay.

Figure 3.12 Shoreline Positions Adjacent to the Relic Seawall

The figure shows that the shoreline position to the east of the seawall was very similar between 1961 and 1977, though this position was significantly further seaward than the shoreline to the west of the seawall. Thereafter the shoreline east of the structure began to experience the observed erosion, although in some areas this erosion hasn't really continued beyond 2011.

Based on review of aerial imagery and the associated shoreline movement lines, it seems that the relic seawall was providing a strong degree of shoreline control and was holding material on its eastern side. As a result, the shoreline to the east of the seawall was essentially an artificial shoreline. At some point, most likely between 1977 and 1988, it appears that the degree of shoreline control provided by the structure decreased and sediment held to the east of the seawall

was able to be transported westwards out of this area. The change in the structure that resulted in this reduction in shoreline control could have been associated with a settlement of the structure under storm conditions, such as those associated with the 1984 storm event.

Regardless of the cause of the change to the seawall, and its associated level of shoreline control, it appears that the shoreline east and west of the structure are now better aligned and as a result, it is anticipated that chronic movement of the shoreline in this area would reduce in the future. Nevertheless, the fact that between 15 and 20 m of foreshore has been lost in this area means that the existing foreshore does not interface well with the adjoining beach. The absence of a dune system, or the mechanism for the natural formation of a dune system, in this area therefore further exacerbates the issue as it means that the foreshore is prone to impacts from severe storm erosion events and high water levels. This has been observed over the winter of 2021, with the City of Albany installing coir logs (refer Figure 3.13) to try and combat erosion of the foreshore area.

Figure 3.13 Coir Logs Installed by the City of Albany in 2021 to Combat Erosion

On the whole, the examination of shoreline movement suggests that the shoreline is likely to be quite stable in the future from a chronic shoreline movement perspective. This is on the basis that the erosion to the east of the relic seawall has now reached a point where the embayed alignment of the shoreline is generally consistent along its entire extent. Impacts associated with storm events and high water levels would still be expected in this area, however these considerations are dealt with by the S1 Allowance.

To determine the appropriate S2 allowance a review of longer term shoreline movement rates has been completed. These long term shoreline movement rates are shown in Figure 3.14. Rates across different long term periods have been considered to reduce the potential for a single abnormal shoreline position to influence the results. Based on this review, it is apparent that a 0.05 m/year allowance should be provided across the full extent of Frenchman Bay. This will provide security against fluctuations in shoreline position over and above those caused by storm events.

The resulting S2 allowances for the different planning horizons are provided in Table 3.1.

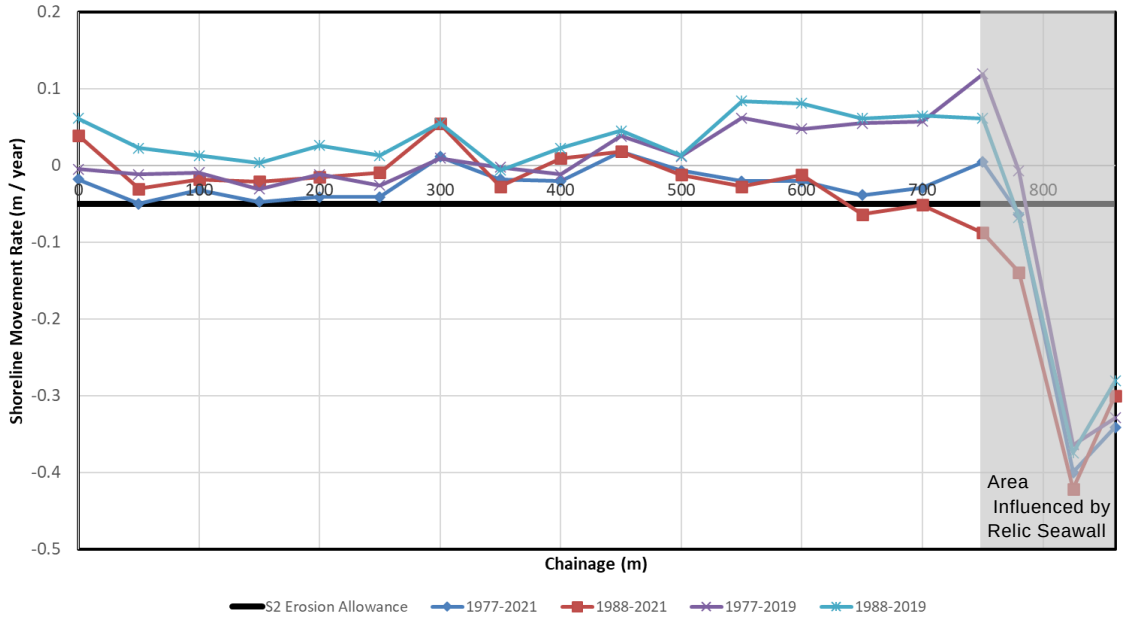

Figure 3.14 Shoreline Movement Rates

Table 3.1 S2 Shoreline Movement Allowances

Planning Timeframe	S2 Allowance (m)
Present Day (2021)	0
2041	1
2061	2
2081	3
2101	4
2121	5

3.3 Sea Level Rise (S3 Allowance)

Climate change is believed to cause an increase in mean sea level as a result of two main processes:

- the melting of land based ice, increasing the volume and height of the ocean waters; and
- a decrease in ocean density through thermal expansion, which increases the volume and thus the ocean height (CSIRO 2007).

Observations of sea levels have been carried out for centuries, at some locations, allowing historical trends to be identified. The global mean sea level rose by between 0.12 to 0.22 m over the 20th century, which equates to an average of around 1.8 mm/yr (IPCC 2007).

Within Western Australia reliable water level data is available from Fremantle for the period from 1950. The Fremantle records indicate that between 1950 and 1991, there was a relatively slow rise in sea levels, however over the ensuing period there has been a more rapid sea level rise. Figure 3.15, shows a plot of sea level rise at Fremantle since 1950.

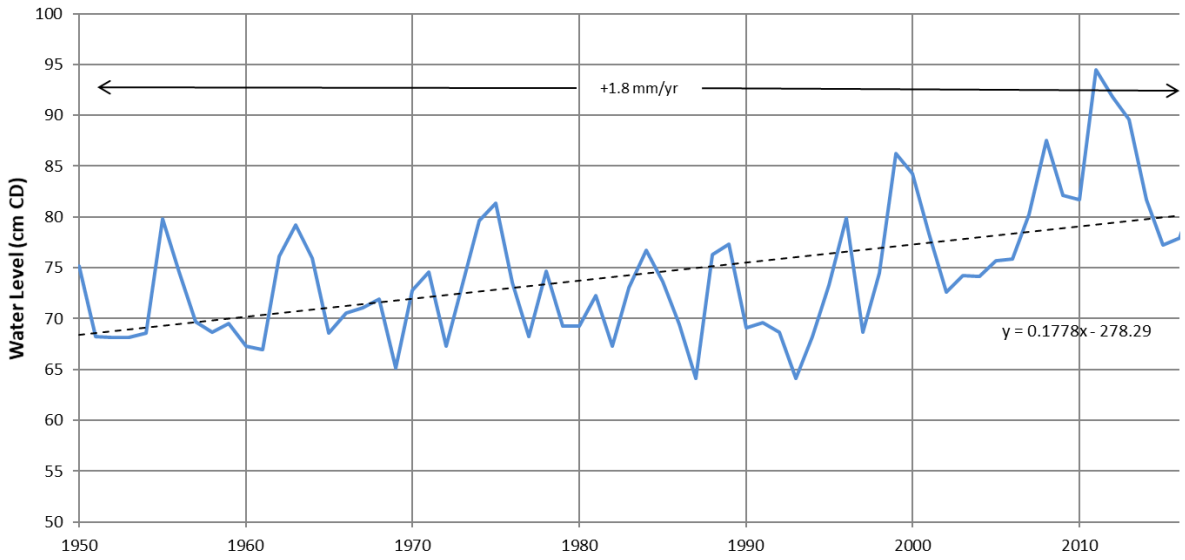

Figure 3.15 Fremantle Water Level 1950 to 2020

Through review of this and other data and research, DoT released recommendations on the appropriate allowances for future climate change and sea level rise to be used for coastal planning and development in Western Australia (DoT 2010). These recommendations were adopted by SPP2.6 and are presented in Figure 3.16.

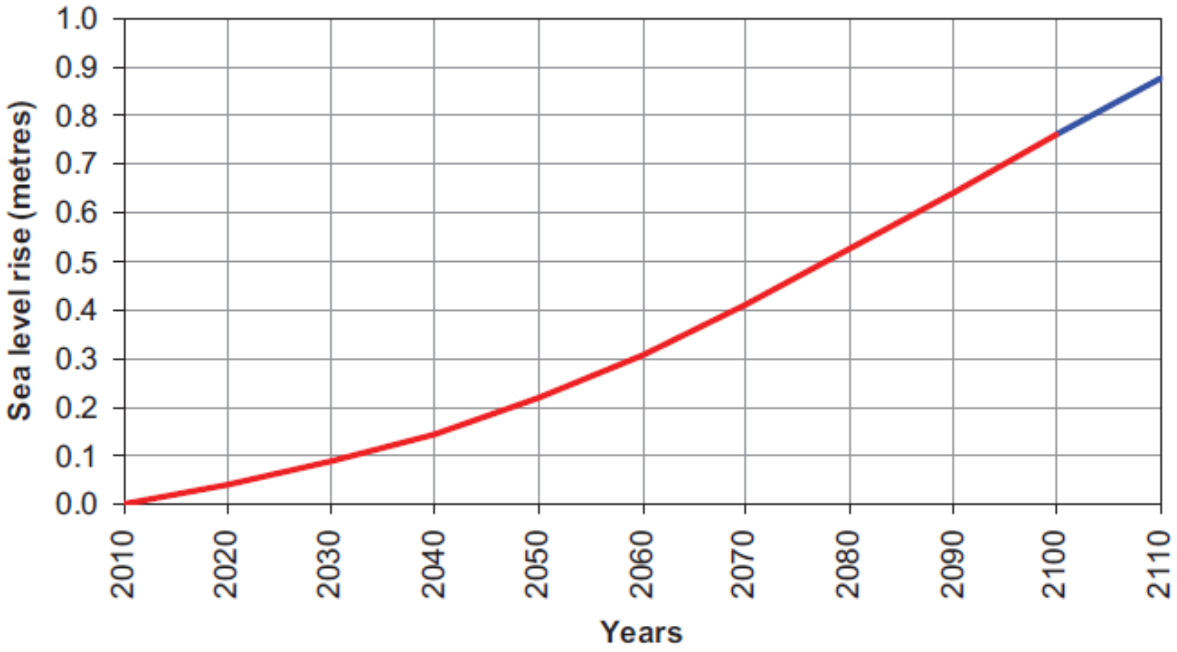

Figure 3.16 Recommended Allowance for Sea Level Rise (DoT 2010)

The recommended allowances for future sea level rise for each of the planning timeframes have been determined and are presented in Table 3.2. All of these increases in sea level are referenced to 2021.

Table 3.2 Sea Level Rise Allowances

Planning Timeframe	SLR Allowance (m)
Present Day (2021)	0.00
2041	0.11
2061	0.27
2081	0.49
2101	0.73
2121	0.97

The effect of sea level rise on the coastline is difficult to predict. Komar (1998) provides a reasonable treatment for sandy shorelines, including examination of the Bruun Rule (Bruun 1962).

The Bruun Rule relates the recession of the shoreline to the sea level rise and slope of the nearshore sediment bed:

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

where: R = recession of the shore.

θ = average slope of the nearshore sediment bed.

S = sea level rise.

Komar (1998) suggests that the general range for a sandy shore is R = 50 S – 100S. SPP2.6 requires that for sandy shorelines the recession be taken as 100 times the estimated rise in sea level. Therefore, the required allowances for shoreline recession due to sea level rise are presented in Table 3.3.

Table 3.3 S3 Shoreline Recession Due to Sea Level Rise Allowances

Planning Timeframe	SLR Allowance (m)
Present Day (2021)	0
2041	11
2061	27
2081	49
2101	73
2121	97

3.4 Summary of Coastal Erosion Allowances

The allowances for coastal processes determined hereto are presented in Table 3.4. As required by SPP2.6, a 0.2 m/year allowance for uncertainty has also been included. The total allowances should be measured from the HSD.

Table 3.4 Summary of Allowances for Coastal Erosion Hazards

Timeframe	Chainage (m)	S1 (m)	S2 (m)	S3 (m)	Uncertainty (0.2 m/yr)	Total Allowance (m)
Present Day (2021)	0 - 450	28	0	0	0	**28**
	450 - 600	28 - 15				**28 - 15**
	600 - 870	15				**15**
2041	0 - 450	28	1	11	4	**44**
	450 - 600	28 - 15				**44 - 31**
	600 - 870	15				**31**
2061	0 - 450	28	2	27	8	**65**
	450 - 600	28 - 15				**65 - 52**
	600 - 870	15				**52**
2081	0 - 450	28	3	49	12	**92**
	450 - 600	28 - 15				**92 - 79**
	600 - 870	15				**79**
2101	0 - 450	28	4	73	16	**121**
	450 - 600	28 - 15				**121 - 108**
	600 - 870	15				**108**
2121	0 - 450	28	5	97	20	**150**
	450 - 600	28 - 15				**150 - 137**
	600 - 870	15				**137**

The sum of each of the allowances outlined in the above table provides an indication of the areas that may be at risk from coastal erosion in the respective planning timeframes. These are presented on Coastal Hazard Maps included in Appendix C. In preparing the coastal hazard maps it should be note that the presence of the existing seawall has been neglected. This is on the basis that the seawall structure is in extreme disrepair and it is expected that the influence it will have on the coastline will diminish over time. This has already been seen with respect to the loss of shoreline control, and therefore its stabilising effect, on the beach immediately east of the structure.

3.5 Storm Surge Inundation (S4 Allowance)

With respect to inundation, SPP2.6 requires that development consider the potential effects of an event with an AEP of 0.2% per year. This is equivalent to an inundation event with an ARI of 500 years.

Assessment of the inundation level requires consideration of peak storm surge, including wave setup. A storm surge occurs when a storm with high winds and low pressures approaches the coastline (refer Figure 3.17). The strong onshore winds and large waves push water against the coastline (wind and wave setup) and the barometric pressure difference creates a region of high water level. These factors acting in concert create the storm surge. The size of the storm surge is influenced by the following factors.

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

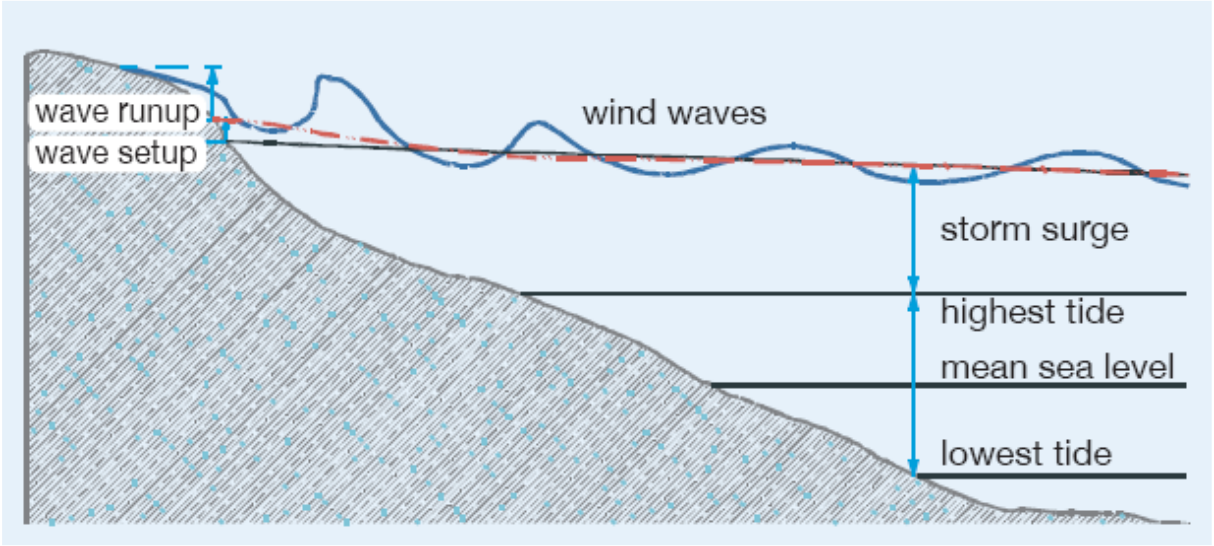

Figure 3.17 Storm Surge Components

The extreme analysis of the Albany water level record was completed by MRA (2018). This analysis showed that the estimated 500 year ARI water level at the tide gauge is approximately 1.13 mAHD (refer Figure 3.18).

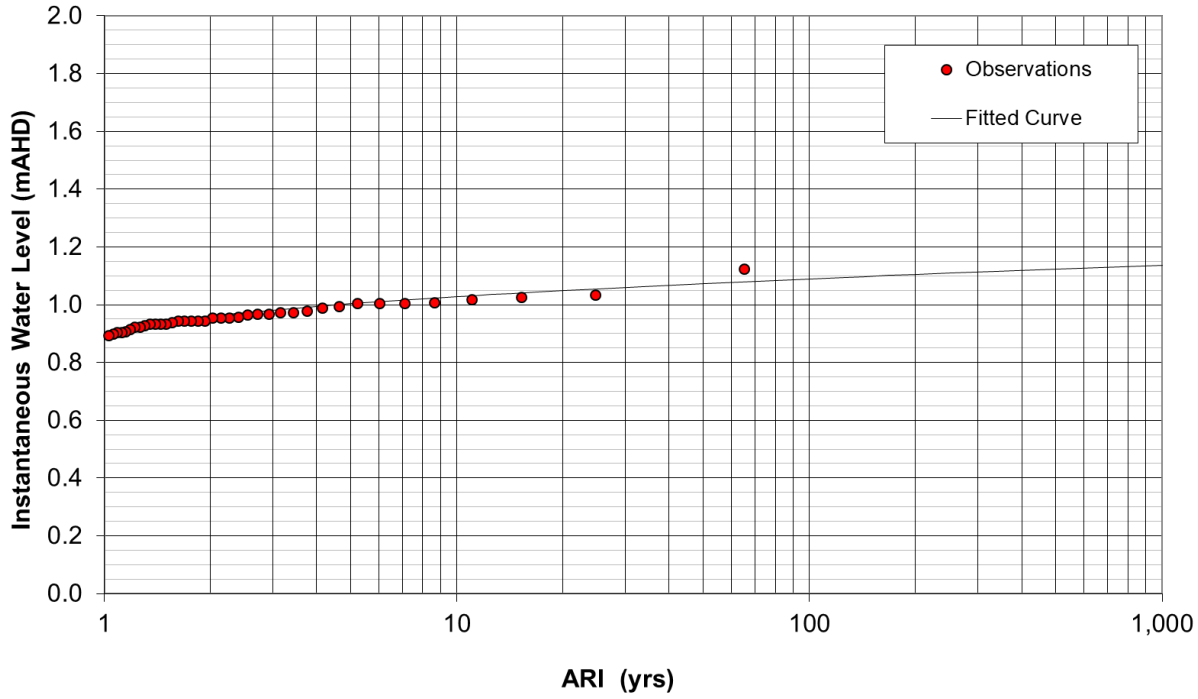

Figure 3.18 Extreme Water Level Analysis for Albany (MRA, 2018)

As indicated in Figure 3.17, closer to the shore, wave setup can increase the water levels. Dean and Walton (2008) provide a comprehensive review of wave setup on beaches, which confirms that the majority of setup occurs on the beach face. This is not entirely accounted for in the measurements at the Albany tide gauge and therefore needs to be determined.

The SBEACH model was setup and run for the 500 year ARI water level, to translate the water level from the nearshore area to the shoreline to estimate the additional wind and wave setup. It was estimated that an additional setup in the order of 0.8 metres could be expected at the site. This has been included in estimates of the appropriate inundation levels for the various planning timeframes, presented in Table 3.5. It is noted that these inundation levels are likely to be conservative given that the shoreline has a northerly aspect yet the majority of the conditions that cause elevated water levels along the south coast will have a southerly component to the incident event directions.

Table 3.5 S4 Inundation Levels

Component	Planning Timeframe					
	Present Day (2021)	2041	2061	2081	2101	2121
500 year ARI peak steady water level at tide gauge (mAHD)	1.13					
Allowance for nearshore setup - wind and wave (m)	0.80					
Allowance for sea level rise (m)	0.00	0.11	0.27	0.49	0.73	0.97
Total Inundation Level (mAHD)	**1.93**	**2.04**	**2.20**	**2.42**	**2.66**	**2.90**

These potential inundation levels should be considered in the planning for any future development along the foreshore. Nevertheless, it is noted that due to the topography of the site, any development associated with Lots 1 and 2 would be well above these elevations.

4. Conclusions

This report presents the results of the coastal hazard assessment for the Frenchman Bay shoreline. The coastal hazard assessment has been completed in accordance with the recommendations and requirements of SPP2.6. As such, the potential extent of coastal hazard impacts that have been mapped provide a justifiably conservative representation of areas that could potentially be vulnerable to coastal hazard risk in the future. It must be noted that the coastal hazard lines are not a prediction of future shoreline location, but rather a representation of areas that could be at low risk of coastal hazards over each of the respective timeframes. Coastal hazard risk management and adaptation planning is therefore required as the next step in this process to ascertain the interplay between the likelihood and consequence of each of these lines being realised and what it would mean for any existing or proposed assets or infrastructure.

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6. Appendices

Appendix A **SBEACH Reports**

Appendix B **Shoreline Movement Plan**

Appendix C **Coastal Hazard Map**

Appendix A SBEACH Reports

K1944 Frenchman Bay
Reach: West Storm: 1% AEP Erosion

Report
Project: K1944 Frenchman Bay
Reach: West
Storm: 1% AEP Erosion
MODEL CONFIGURATION

INPUT UNITS (SI=1, AMERICAN CUST.=2): 1
NUMBER OF CALCULATION CELLS: 215
GRID TYPE (CONSTANT=0, VARIABLE=1): 0
CONSTANT CELL WIDTH: 1.0
NUMBER OF TIME STEPS AND VALUE OF TIME STEP IN MINUTES: 2124, 5.0
TIME STEP(S) OF INTERMEDIATE OUTPUT 1: 708
TIME STEP(S) OF INTERMEDIATE OUTPUT 2: 1416
NO COMPARSION WITH MEASURED PROFILE.
PROFILE ELEVATION CONTOUR 1: 5.00
PROFILE ELEVATION CONTOUR 2: 0.00
PROFILE ELEVATION CONTOUR 3: -1.00
PROFILE EROSION DEPTH 1: 0.50
PROFILE EROSION DEPTH 2: 1.00
PROFILE EROSION DEPTH 3: 1.50
REFERENCE ELEVATION: 0.00
TRANSPORT RATE COEFFICIENT (m^4/N): 1.75E-6
COEFFICIENT FOR SLOPE DEPENDENT TERM (m^2/s): 0.0020
TRANSPORT RATE DECAY COEFFICIENT MULTIPLIER: 0.50
WATER TEMPERATURE IN DEGREES C : 16.0

WAVE TYPE (MONOCHROMATIC=1, IRREGULAR=2): 2
WAVE HEIGHT AND PERIOD INPUT (CONSTANT=0, VARIABLE=1): 1
TIME STEP OF VARIABLE WAVE HEIGHT AND PERIOD INPUT IN MINUTES: 180.0
WAVE ANGLE INPUT (CONSTANT=0, VARIABLE=1): 0
CONSTANT WAVE ANGLE: 0.0
WATER DEPTH OF INPUT WAVES (DEEP WATER = 0.0): 5.0
SEED VALUE FOR WAVE HEIGHT RANDOMIZER AND % VARIABILITY: 4567, 20.0
TOTAL WATER ELEVATION INPUT (CONSTANT=0, VARIABLE=1): 1
TIME STEP OF VARIABLE TOTAL WATER ELEVATION INPUT IN MINUTES: 60.0
WIND SPEED AND ANGLE INPUT (CONSTANT=0, VARIABLE=1): 1
TIME STEP OF VARIABLE WIND SPEED AND ANGLE INPUT IN MINUTES: 180.0

TYPE OF INPUT PROFILE (ARBITRARY=1, SCHEMATIZED=2): 1
DEPTH CORRESPONDING TO LANDWARD END OF SURF ZONE: 0.30
EFFECTIVE GRAIN SIZE DIAMETER IN MILLIMETERS: 0.26
MAXIMUM PROFILE SLOPE PRIOR TO AVALANCHING IN DEGREES: 45.0

NO BEACH FILL IS PRESENT.

NO SEAWALL IS PRESENT.

NO HARD BOTTOM IS PRESENT.

COMPUTED RESULTS

DIFFERENCE IN TOTAL VOLUME BETWEEN FINAL AND INITIAL PROFILES:
0.0 m^3/m

MAXIMUM VALUE OF WATER ELEVATION + SETUP FOR SIMULATION
1.91 m

K1944 Frenchman Bay
Reach: West Storm: 1% AEP Erosion

TIME STEP AND POSITION ON PROFILE AT WHICH MAXIMUM VALUE
OF WATER ELEVATION + SETUP OCCURRED
447, 72.0 m
MAXIMUM ESTIMATED RUNUP ELEVATION: 5.20 m
(REFERENCED TO VERTICAL DATUM)

POSITION OF LANDWARD MOST OCCURRENCE OF A 0.50 m EROSION DEPTH:
54.0 m

DISTANCE FROM POSITION OF REFERENCE ELEVATION ON INITIAL PROFILE
TO POSITION OF LANDWARD MOST OCCURRENCE OF A 0.50 m EROSION DEPTH:
42.0 m

POSITION OF LANDWARD MOST OCCURRENCE OF A 1.00 m EROSION DEPTH:
55.0 m

DISTANCE FROM POSITION OF REFERENCE ELEVATION ON INITIAL PROFILE
TO POSITION OF LANDWARD MOST OCCURRENCE OF A 1.00 m EROSION DEPTH:
41.0 m

POSITION OF LANDWARD MOST OCCURRENCE OF A 1.50 m EROSION DEPTH:
56.0 m

DISTANCE FROM POSITION OF REFERENCE ELEVATION ON INITIAL PROFILE
TO POSITION OF LANDWARD MOST OCCURRENCE OF A 1.50 m EROSION DEPTH:
40.0 m

MAXIMUM RECESSION OF THE 5.00 m ELEVATION CONTOUR:
13.33 m

MAXIMUM RECESSION OF THE 0.00 m ELEVATION CONTOUR:
13.78 m

MAXIMUM RECESSION OF THE -1.00 m ELEVATION CONTOUR:
6.09 m

K1944 Frenchman Bay
Reach: East Storm: 1% AEP Erosion

Report
Project: K1944 Frenchman Bay
Reach: East
Storm: 1% AEP Erosion
MODEL CONFIGURATION

INPUT UNITS (SI=1, AMERICAN CUST.=2): 1
NUMBER OF CALCULATION CELLS: 440
GRID TYPE (CONSTANT=0, VARIABLE=1): 0
CONSTANT CELL WIDTH: 1.0
NUMBER OF TIME STEPS AND VALUE OF TIME STEP IN MINUTES: 2124, 5.0
TIME STEP(S) OF INTERMEDIATE OUTPUT 1: 708
TIME STEP(S) OF INTERMEDIATE OUTPUT 2: 1416
NO COMPARSION WITH MEASURED PROFILE.
PROFILE ELEVATION CONTOUR 1: 5.00
PROFILE ELEVATION CONTOUR 2: 0.00
PROFILE ELEVATION CONTOUR 3: -5.00
PROFILE EROSION DEPTH 1: 0.50
PROFILE EROSION DEPTH 2: 1.00
PROFILE EROSION DEPTH 3: 1.50
REFERENCE ELEVATION: 0.00
TRANSPORT RATE COEFFICIENT (m^4/N): 1.75E-6
COEFFICIENT FOR SLOPE DEPENDENT TERM (m^2/s): 0.0020
TRANSPORT RATE DECAY COEFFICIENT MULTIPLIER: 0.50
WATER TEMPERATURE IN DEGREES C : 16.0

WAVE TYPE (MONOCHROMATIC=1, IRREGULAR=2): 2
WAVE HEIGHT AND PERIOD INPUT (CONSTANT=0, VARIABLE=1): 1
TIME STEP OF VARIABLE WAVE HEIGHT AND PERIOD INPUT IN MINUTES: 180.0
WAVE ANGLE INPUT (CONSTANT=0, VARIABLE=1): 0
CONSTANT WAVE ANGLE: 0.0
WATER DEPTH OF INPUT WAVES (DEEP WATER = 0.0): 5.0
SEED VALUE FOR WAVE HEIGHT RANDOMIZER AND % VARIABILITY: 4567, 20.0
TOTAL WATER ELEVATION INPUT (CONSTANT=0, VARIABLE=1): 1
TIME STEP OF VARIABLE TOTAL WATER ELEVATION INPUT IN MINUTES: 60.0
WIND SPEED AND ANGLE INPUT (CONSTANT=0, VARIABLE=1): 1
TIME STEP OF VARIABLE WIND SPEED AND ANGLE INPUT IN MINUTES: 180.0

TYPE OF INPUT PROFILE (ARBITRARY=1, SCHEMATIZED=2): 1
DEPTH CORRESPONDING TO LANDWARD END OF SURF ZONE: 0.30
EFFECTIVE GRAIN SIZE DIAMETER IN MILLIMETERS: 0.26
MAXIMUM PROFILE SLOPE PRIOR TO AVALANCHING IN DEGREES: 45.0

NO BEACH FILL IS PRESENT.

NO SEAWALL IS PRESENT.

NO HARD BOTTOM IS PRESENT.

COMPUTED RESULTS

DIFFERENCE IN TOTAL VOLUME BETWEEN FINAL AND INITIAL PROFILES:
0.0 m^3/m

MAXIMUM VALUE OF WATER ELEVATION + SETUP FOR SIMULATION
1.71 m

K1944 Frenchman Bay

Reach: East Storm: 1% AEP Erosion

TIME STEP AND POSITION ON PROFILE AT WHICH MAXIMUM VALUE
OF WATER ELEVATION + SETUP OCCURRED
438, 73.0 m
MAXIMUM ESTIMATED RUNUP ELEVATION: 3.10 m
(REFERENCED TO VERTICAL DATUM)

POSITION OF LANDWARD MOST OCCURRENCE OF A 0.50 m EROSION DEPTH:
64.0 m

DISTANCE FROM POSITION OF REFERENCE ELEVATION ON INITIAL PROFILE
TO POSITION OF LANDWARD MOST OCCURRENCE OF A 0.50 m EROSION DEPTH:
31.0 m

POSITION OF LANDWARD MOST OCCURRENCE OF A 1.00 m EROSION DEPTH:
64.0 m

DISTANCE FROM POSITION OF REFERENCE ELEVATION ON INITIAL PROFILE
TO POSITION OF LANDWARD MOST OCCURRENCE OF A 1.00 m EROSION DEPTH:
31.0 m

A 1.50 m EROSION DEPTH DID NOT OCCUR ANYWHERE ON THE PROFILE.

THE 5.00 m CONTOUR DID NOT RECEDE

MAXIMUM RECESSION OF THE 0.00 m ELEVATION CONTOUR:
0.08 m

MAXIMUM RECESSION OF THE -5.00 m ELEVATION CONTOUR:
0.00 m

Appendix B Shoreline Movement Plan

AT CORRECT SCALE THIS IS 100 mm

AT CORRECT SCALE THIS IS 100 mm

m p rogers & associates pl
coastal and port engineers

Suite 1, 128 Main Street
Osborne Park 6017 t: +61 8 9254 6600
Western Australia admin@coastsandports.com.au

DRAWN C Doak

CHECKED C Doak

Shoreline Movement Plan

Frenchman Bay Coastal Hazard Assessment

SCALE AT A3 1:2,000

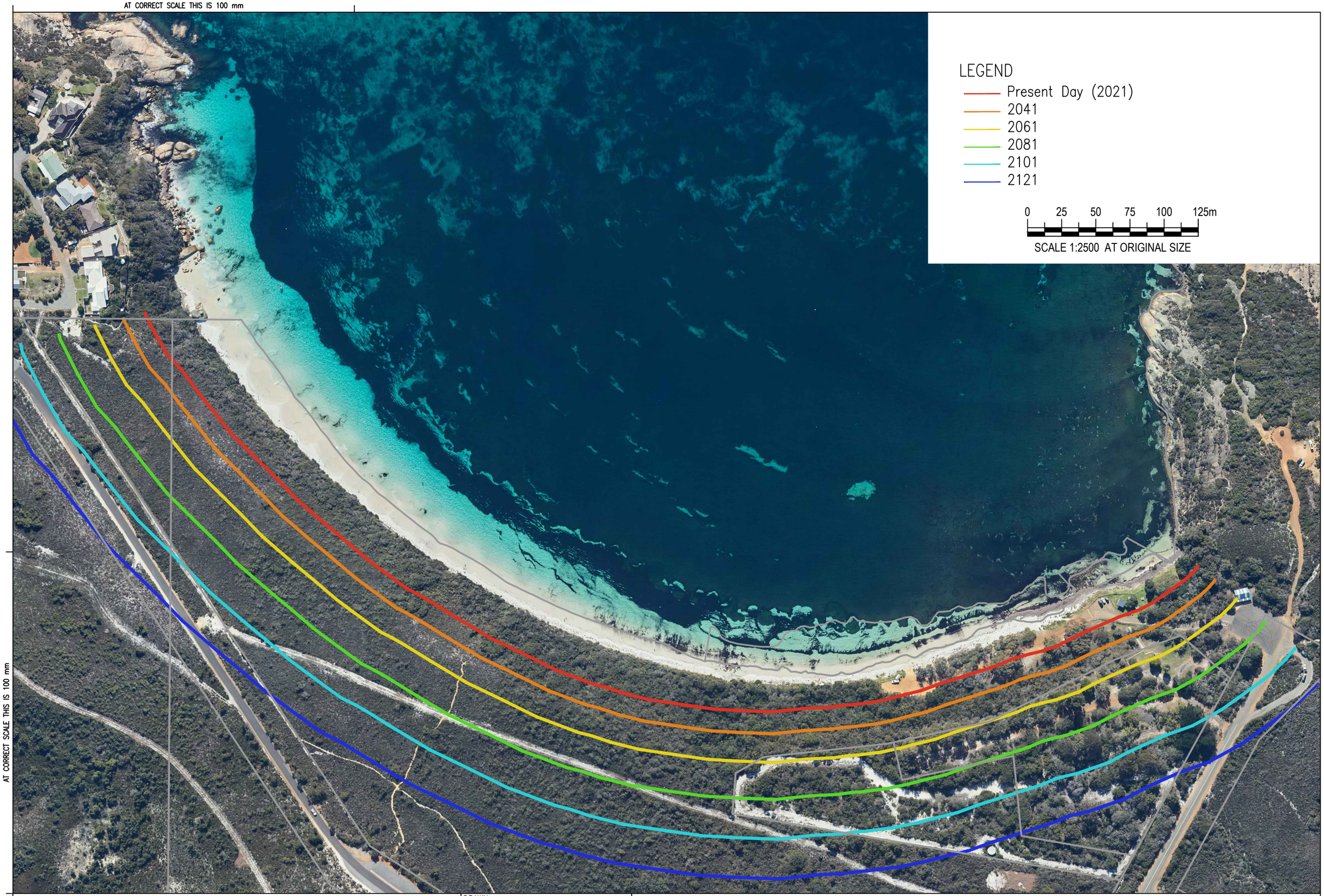
January 2021

SK1944-01-01

P:\MRA Paying Jobs\K1944 CoA – Frenchman Bay CHA\5 MRA Dwgs\Sketches\211210 Coastal Hazard Lines

Appendix C Coastal Hazard Map

AT CORRECT SCALE THIS IS 100 mm



AT CORRECT SCALE THIS IS 100 mm

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Osborne Park 6017 t: +61 8 9254 6600
Western Australia admin@coastsandports.com.au

DRAWN C Doak

CHECKED C Doak

Coastal Erosion Hazard Lines

Frenchman Bay Coastal Hazard Assessment

SCALE AT A3 1:2,500

January 2021

SK1944–01–02

P:\MRA Paying Jobs\K1944 CoA – Frenchman Bay CHA\5 MRA Dwgs\Sketches\211210 Coastal Hazard Lines

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APPENDIX 'B': COASTAL HAZARD RISK MANAGEMENT AND ADAPTION PLANNING REPORT

m p rogers & associates pl ABN 14 062 681 252
creating better coasts and ports

R1643 Rev 1

April 2022

Seashells Hospitality Group

Frenchman Bay
Coastal Hazard Risk Management & Adaptation Plan

marinas
boat harbours
canals
breakwaters
jetties
seawalls
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K1961, Report R1643 Rev 1
Record of Document Revisions

Rev	Purpose of Document	Prepared	Reviewed	Approved	Date
A	Draft for MRA review	T Irvine	C Doak	C Doak	28/01/2022
0	Issued for Client use	T Irvine	C Doak	C Doak	21/02/2022
1	Updated and re-issued	T Irvine	C Doak	C Doak	14/04/2022

Form 035 18/06/2013

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1. Introduction

Seashells Hospitality Group (SHG) is planning to develop Lot 1 & 2 Frenchman Bay Road (Site) into a high-end tourist destination. The site is located in Frenchman Bay, south-east of Albany, Western Australia. The locality of the site is shown in Figure 1.1.

The City of Albany (City) has designated the site as Special Use Site No. 13 under the provisions of the Local Planning Scheme No. 1. The special use allocation provides for the development of holiday accommodation, caravan park, caretaker's dwellings and a shop. It is identified as a strategic site in the Council's Local Tourism Planning Strategy (Ayton Baesjou Planning, 2021). The City has previously approved a Local Development Plan (LDP) for the site in 2015.

As part of the planning process, there is a requirement to assess the risks to the development from coastal hazards. SHG has therefore engaged M P Rogers & Associates Pty Ltd (MRA) to complete a coastal hazard assessment and Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) for the development.

The requirements and framework for CHRMAP are outlined in the State Planning Policy No. 2.6 - State Coastal Planning Policy (SPP2.6) and more specifically in the CHRMAP Guidelines (WAPC 2019). The CHRMAP for the SHG Frenchman Bay Development has been completed in accordance with those documents and covers the following key items:

- Establishment of the context.
- Coastal hazard assessment (Previously completed (MRA, 2022)).
- Risk analysis and evaluation.
- Risk management and adaptation planning.
- Monitoring and review.

This report outlines the methods, data and outcomes of the CHRMAP assessment.

Figure 1.1 Location of Site

1.1 State Planning Policy 2.6

Within Western Australia, State Planning Policy 2.6: State Coastal Planning Policy (SPP2.6; WAPC 2019) provides guidance for land use and development decision-making within the coastal zone, including the establishment of coastal foreshore reserves to protect, conserve and enhance coastal values. SPP2.6 also provides guidance on the assessment of coastal hazard risks for assets located in close proximity to the coast.

The objectives of SPP2.6 are wide ranging, however a key component of the policy is the identification of appropriate areas for the sustainable use of the coast. This includes use for tourism and commercial purposes, which are relevant to the proposed development. Table 1.1 provides details of how SHG is addressing the stated objectives of SPP2.6.

Table 1.1 Alignment of SHG Development with SPP2.6 Objectives

SPP2.6 Policy Objective		Description of Proposed SHG Development
1	Ensure that development and the location of coastal facilities takes into account coastal processes, landform stability, coastal hazards, climate change and biophysical criteria.	The identification of Coastal Hazards is addressed within Section 3 of this CHRMAP. This section assesses the coastal processes at the proposed development location, within the context of the coastal geomorphology and geology as recommended by SPP2.6. This CHRMAP aims to inform and provide appropriate guidance to key stakeholders with respect to future management of the aforementioned factors.
2	Ensure the identification of appropriate areas for the sustainable use of the coast for housing, tourism, recreation, ocean access, maritime industry, commercial and other activities.	The location of the proposed holiday accommodation will bring more people to this underutilised section of the coast. The site was previously used as a caravan park, but has sat vacant for many years. The City has identified this site as a strategic tourist site and designated it as Special Use Site No. 13 within the Local Planning Scheme. This includes provisions for holiday accommodation and other related facilities. The region has acknowledged a short fall of high-quality tourist accommodation, the proposed development will address this need and take tourism pressure off existing over-crowded areas. The location of the proposed development will enable greater access to the coast to tourists given its proximity. In addition, it will increase patronage to the existing historical whaling station, encouraging engagement with the region's rich maritime history. The existing carpark and beach access to the eastern end of the site will be maintained, with additional beach access planned as part of the proposal. This CHRMAP aims to inform the current and future uses to ensure sustainability with regard to the identified coastal hazards.
3	Provide for public coastal foreshore reserves and access to them on the coast.	The plans for the development include access via existing stairs to public foreshore reserve 21337 which includes a grassed picnic area behind the sandy beach. As mentioned above, the existing public carpark and beach access is to be preserved, with potential for future upgrades to the public amenity in conjunction with government authorities. Carparks for patrons utilising the facility are included within the LDP.
4	Protect, conserve and enhance coastal zone values, particularly in areas of landscape, biodiversity and ecosystem integrity, indigenous and cultural significance.	The SHG design recognises the strong support for retaining public access to the beaches and foreshore reserve as well as preserving the surrounding natural environment for future generations. The design also conserves and enhances engagement with the significant cultural heritage of the area, particularly the historic Norwegian whaling station.

The guidance on the assessment of coastal hazard risk is provided within SPP2.6 in the form of a methodology to assess the potential extent of coastal hazard impacts, as well as for the development of Coastal Hazard Risk Management and Adaptation Planning (CHRMAP). Further details in this regard are also provided in the CHRMAP Guidelines (WAPC 2019).

The key requirement of CHRMAP is to develop a risk based adaptation framework for assets that could be at risk of impact by coastal hazards over the relevant planning timeframe. Importantly, the balance of these risks needs to be considered with reference to the expected lifetime of the relevant assets.

This CHRMAP report has been prepared to provide guidance regarding the risks posed by coastal hazards. Specifically, it covers the following items:

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

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

2. Context

2.1 Purpose

The potential vulnerability of the coastline and the subsequent risk to the community, economy and environment needs to be considered for any coastal development.

SPP2.6 requires that the responsible management authority completes CHRMAP where an existing or proposed development may be at risk from coastal hazards over the planning timeframe. The main purpose of the CHRMAP is to define areas of the coastline which could be vulnerable to coastal hazards and to outline the preferred approach to the monitoring and management of these hazards where required.

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

Specifically, the purpose of this CHRMAP is as follows.

- Determine the specific extent of coastal hazards in relation to the proposed SHG development.
- Determine the coastal hazard risks associated with the proposed SHG development and how these risks may change over time.
- Establish the basis for present and future risk management and adaptation.
- Provide guidance on appropriate management and adaptation planning for the future, including monitoring.

2.2 Objectives

The key objectives of this CHRMAP are as follows:

- Ensure that SHG and key stakeholders understand the potential likelihood of assets within the proposed development being impacted by coastal hazards over the 100 year planning timeframe.
- Identify vulnerability trigger points and respective timeframes for risk management and adaptation actions.
- Present management and adaptation measures that are informed by, and are acceptable to, SHG and key stakeholders.
- Outline the required coastal adaptation approach in an Implementation Plan that is acceptable to SHG and key stakeholders.
- Incorporate management and adaptation measures into short and long term decision making documentation.

2.3 Scope

The *CHRMAP Guidelines* (WAPC 2019) provide a specific framework for the preparation of a CHRMAP. This is outlined in the flowchart presented in Figure 2.1 which shows the risk management process adapted to coastal planning.

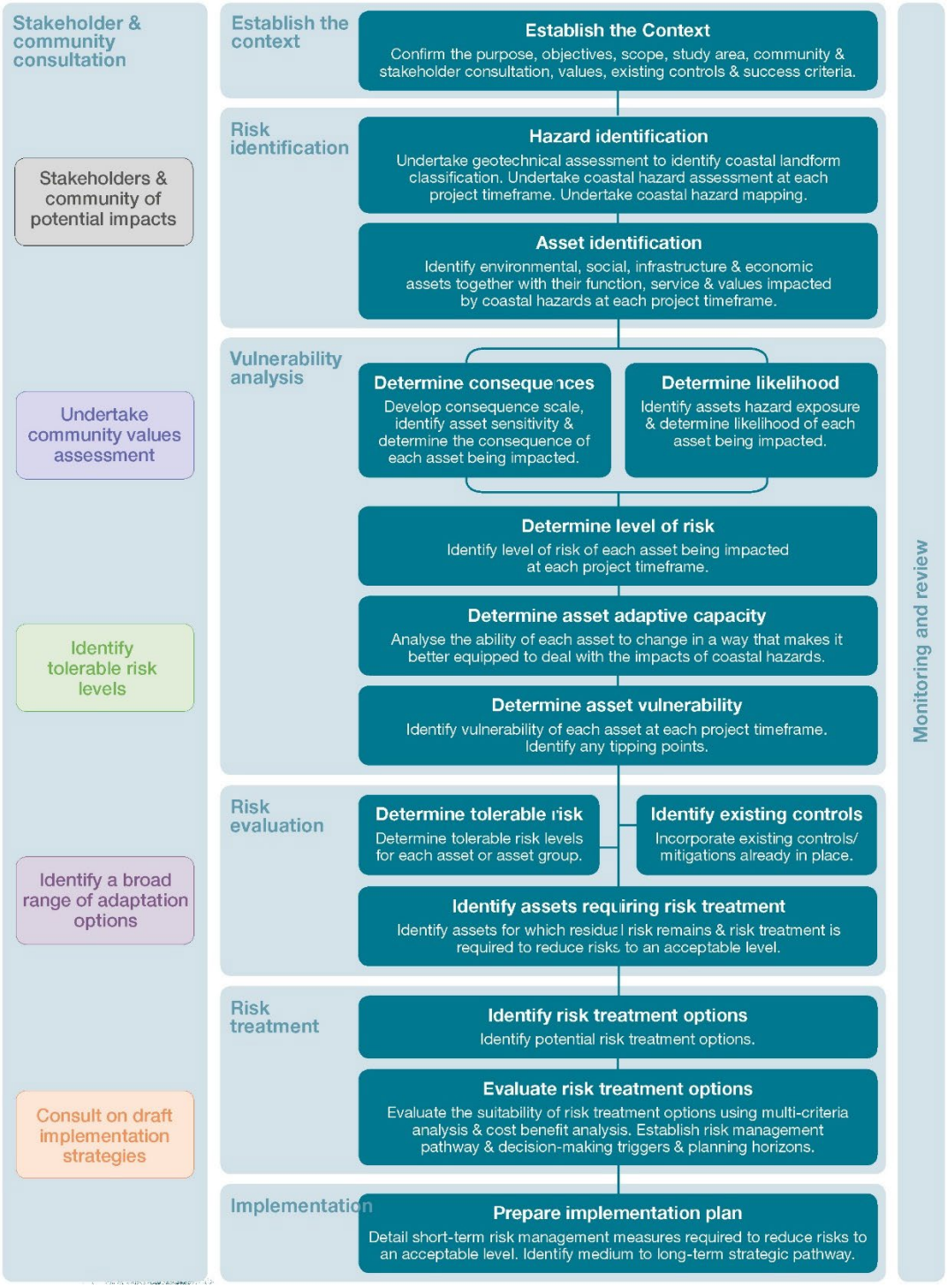

Figure 2.1 Risk Management & Adaptation Process Flow Chart (WAPC 2019)

As presented in the flowchart, the process for the development of a meaningful CHRMAP process requires a number of fundamental inputs. These inputs enable the assessment and analysis of

risk, which should ultimately be informed by input received from key stakeholders, to help shape the subsequent adaptation strategies.

The management of coastal hazard risk associated with the proposed SHG development will be required to present a proposed adaptation plan that is acceptable to the stakeholders. As a result, the approach that has been taken for this plan is to develop a management methodology that allows for flexibility into the future.

The development of the adaptation plan will be informed by the assessment of the coastal erosion and inundation hazards at the site. The identification of the coastal erosion and inundation hazards for the proposed SHG development is discussed within Section 3 of this report.

This CHRMAP will consider the potential risks posed by coastal hazards over a range of horizons covering the 100 year planning timeframe. This planning timeframe is required by SPP2.6 for development on the coast.

Intermediate planning horizons will also be considered to assess how risk profiles may change in the future and to inform the requirement for adaptation strategies. The intermediate planning horizons that will be considered in this CHRMAP are listed below, with present day taken as 2021 (the time when this CHRMAP process was initiated).

- Present day (2021).
- 20 years to 2041.
- 40 years to 2061.
- 60 years to 2081
- 80 years to 2101
- 100 years to 2121.

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

The actual requirement for implementation of these management actions should ultimately be informed by a coastal monitoring regime. The purpose of this coastal monitoring regime is to identify changes in the shoreline or sea level that could alter, either positively or negatively, the risk exposure of the proposed assets and infrastructure. A recommended coastal monitoring regime is included within the implementation plan, presented within Section 6.2 of this report.

2.4 The Site

This site setting which forms the basis of the CHRMAP has been discussed in detail in the Coastal Hazard Assessment completed by MRA in January 2022. It is advised that the reader view the two documents concurrently.

2.5 Stakeholder Engagement

SHG has been in consultation with the City and other key stakeholders in reviewing the original LDP put forth by an earlier proponent. This LDP went through a round of public and stakeholder consultation. SHG is planning to go through further public and stakeholder consultation once the revised LDP is advertised by the City.

2.6 Key Assets

Key assets within the study area and surrounds have been summarised in Table 2.1 and are shown in Figure 2.2. The risk assessment will focus on these assets to identify their vulnerability and consequently the requirement for risk management. For this type of assessment, it is not considered necessary to break down this list of assets any further into their component parts, as it is the vulnerability of the overall assets that is the important factor.

Figure 2.2 Assets within Proposed Holiday Park Development

Table 2.1 Key Assets Identified for Analysis

Type	Key Assets
Social/Economic	Maintenance Shed
	Tennis Court
	Lodge
	Pool 1
	Glamping Tents
	Pool 2
	Chalets
	Reception
	Carpark
	Amphitheatre

It is noted that the list of assets considered in this report relates solely to the social and economic assets that will be located within the development itself. It is understood that the City of Albany are separately going to undertake a CHRMAP process for the public and heritage assets in the area.

2.7 Success Criteria

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

- Demonstrated understanding by the key stakeholders regarding the likelihood, consequence and subsequent risk of coastal hazards impacting identified assets over each planning horizon.
- Evidence of stakeholder engagement outcomes being incorporated throughout the development of risk management and adaptation measures.
- Acceptance of a risk management and adaptation plan for the 100 year planning timeframe by key stakeholders.
- Evidence of the required changes to existing management controls being implemented.
- Adoption of the Implementation Plan by key stakeholders going forward.

The outcomes of the success criteria listed above are presented in later sections of this report.

3. Coastal Hazard Assessment

The Coastal Hazard Assessment aspect of the CHRMAP process was completed by MRA in January 2022, the reader is referred to MRA, 2022 to view this section of the CHRMAP. Figure 3.1 demonstrates the most important outcome of the Coastal Hazard Assessment. This figure shows the locations of the Coastal Erosion Hazard lines relative to the proposed development locations.

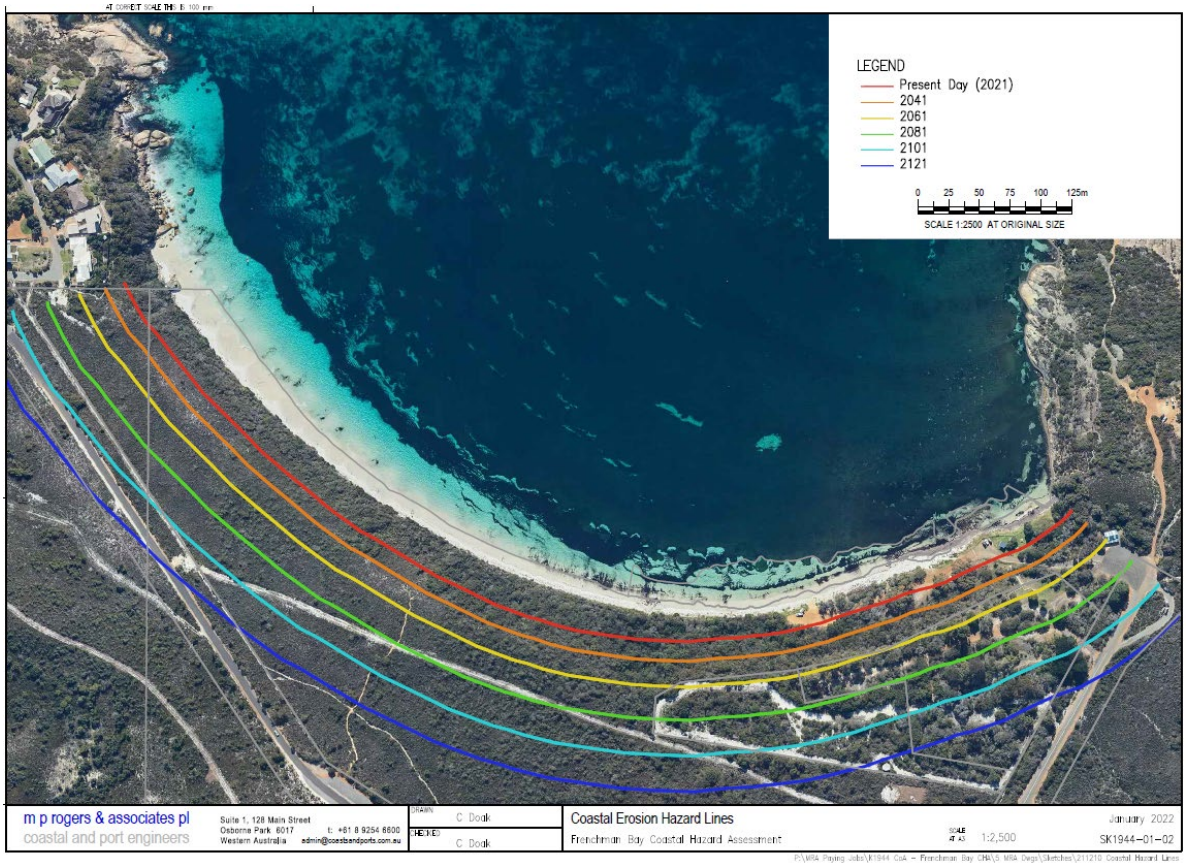

Figure 3.1 Coastal Hazard Map (MRA, 2022)

Inundation hazards were also considered within the Coastal Hazard Assessment; however, given the elevation of the site is above 12 mAHD, inundation will not be an issue.

4. Risk Analysis

In accordance with WAPC (2019), a risk based approach will be used to assess the hazards and required mitigation and adaptation options for the proposed SHG development. As coastal hazards are the focus of this assessment, it is the likelihood and consequences of these coastal hazards that need to be considered. It is inherent in the development plan that there be no negative social or environmental impacts as a result of the SHG development, with mitigation strategies already highlighted to address these issues.

4.1 Likelihood

Likelihood is defined as the chance of something happening (AS/NZS ISO 31000:2009). WAPC (2019) defines the likelihood as the chance of erosion or storm surge inundation occurring or how often they impact on existing and future assets and values. This requires consideration of the frequency and probability of the event occurring over a given planning timeframe.

The probability of an event occurring is often related to the Average Exceedance Probability (AEP) or the ARI. The use of the AEP to define impacts of coastal hazards over the planning timeframe assumes that events have the same probability of occurring each year. In the case of climate change and sea level rise, which has a large influence on the assessed coastal hazard risk, this is not true. In addition, there is insufficient data available to properly quantify the probability of occurrence. A scale of likelihood has therefore been developed and is presented in Table 4.1.

Table 4.1 Scale of Likelihood

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

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

4.1.1 Coastal Erosion

The likelihood ratings given to the relevant assets are based on the coastal erosion hazard lines presented in Appendix A and the consideration of the probabilities of each of the allowances occurring within the respective planning horizons.

It is important to note that the hazard lines reaching a particular asset at the end of the planning horizon do not necessarily mean that this will occur. This is due to the fact that it requires all of the following to occur.

- The upper estimate of erosion caused by sea level rise.
- Ignoring the existing shoreline movement trend of variability between erosion and accretion and assuming only erosion.
- The severe storm event to be experienced at the end of the planning timeframe (ie when the other allowances have been realised).

Only if all of these occur will the erosion hazard lines be realised. This has been considered in the assessment of likelihood for the relevant assets.

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

Table 4.2 Assessment of Likelihood of Coastal Erosion Impact

Asset	Present Day	2041	2061	2081	2101	2121
Maintenance Shed	Rare	Rare	Rare	Unlikely	Possible	Likely
Tennis Court	Rare	Rare	Rare	Unlikely	Possible	Likely
Lodge	Rare	Rare	Rare	Unlikely	Possible	Likely
Pool 1	Rare	Rare	Rare	Unlikely	Possible	Likely
Glamping Tents	Rare	Rare	Rare	Unlikely	Possible	Likely
Pool 2	Rare	Rare	Rare	Rare	Unlikely	Possible
Chalets	Rare	Rare	Rare	Unlikely	Possible	Likely
Reception	Rare	Rare	Rare	Unlikely	Possible	Likely
Carpark	Rare	Rare	Rare	Unlikely	Possible	Likely
Amphitheatre	Rare	Rare	Rare	Unlikely	Possible	Likely

The assessment of the likelihood of coastal erosion impact shows that it is rare that coastal erosion will impact the key assets over the 40 year planning timeframe to 2061. However, over the 100 year timeframe to 2121, it is likely that these assets will be impacted by coastal erosion.

4.1.2 Coastal Inundation

Based on the coastal inundation assessment, S4 allowance, outlined in the Coastal Hazard Assessment (refer MRA, 2022), the proposed elevations of the SHG development on Lots 1 & 2 are well above the 500-year ARI inundation water level which is 2.9 mAHD. This level is inclusive of allowance for nearshore wind and wave setup and allowance for the full extent of sea level rise. Review of multiple topographic sources suggest that the absolute lowest level on the site is likely above 12 mAHD. As such, the development is not likely to be impacted by coastal inundation hazards and will not be assessed further in this report.

4.2 Consequence

Consequence is the impact of erosion and storm surge inundation on existing and future assets and the value assigned to that asset (WAPC 2019). Within the context of the vulnerability assessment, consequence is used to consider the sensitivity of an asset to coastal erosion and inundation hazards over the 100 year planning timeframe.

A scale of consequence has been developed which provides a range of impacts and is generally consistent with the Australian Standard Risk Management Principles and Guidelines (ISO 31000:2009) and the Coastal Hazard Risk Management and Adaptation Planning Guidelines (WAPC 2019). The consequence scale is presented in Table 4.3

Table 4.3 Scale of Consequences

Rating	Social	Economic	Environment	Infrastructure	Safety
Catastrophic	Large long term or permanent (~1 yr) loss of services, public access/amenity, employment, wellbeing or culture. No suitable alternative sites exist within the LGA.	Permanent and/or entire loss or damage to property, plant and equipment, finances > $10 million. Regional economic decline, widespread business failure and impacts on state economy.	Permanent and entire loss of flora, fauna conservation or heritage area (no chance of recovery).	Damage to majority or all of infrastructure (Greater than 75%). Asset with step change sensitivity and no adaptive capacity.	Death or permanent disabilities.
Major	Medium term (~1 month) disruption to services, employment wellbeing, or culture. Very limited suitable alternative sites exist within the LGA.	Permanent and/or large scale loss or damage to property, plant and equipment, finances $2 - $10 million. Lasting downturn of local economy with isolated business failures and major impacts in regional economy.	Long-term and/or large scale loss of flora, fauna or heritage area (limited chance of recovery) with local impact.	Damage to significant portion (50% - 75%) or asset with step change sensitivity. Asset with step change sensitivity and some adaptive capacity	Extensive injuries or disabilities.
Moderate	Major short term or minor long-term (~1 week) disruption to services, public access/amenity, employment, wellbeing, or culture. Limited suitable alternative sites exist within the LGA.	Permanent and/or medium scale loss or damage to property, plant and equipment, finances $100,000 - $2 million. Significant impacts on local economy and minor impacts on regional economy.	Medium-term and/or medium scale loss of flora, fauna or heritage area (recovery likely) with local impact.	Damage to no more than half of the infrastructure (25% - 50%). Asset with step change sensitivity with adaptive capacity.	Medical treatment.
Minor	Small to medium short-term (~1 day) disruption to services, public access/amenity, employment, wellbeing, or culture. Many suitable alternative sites exist within the LGA.	Permanent and/or small scale loss or damage to property, plant and equipment, finances $10,000 - $100,000. Individually significant but isolated impact on local economy.	Short-term and/or small scale loss of flora, fauna or heritage area (strong recovery) with local impact.	Minor damage to infrastructure (10% - 25%).	First aid treatment.
Insignificant	Minimal short-term (~1 hr) inconveniences to services, public access/amenity, employment, wellbeing, or culture. Many suitable alternative sites exist within the LGA.	Permanent and/or small loss or damage to property, plant and equipment, finances < $10,000. Very minor short-term impacts on local economy.	Negligible to no loss of flora, fauna or heritage area (strong recovery) with local impact.	Little or no damage to infrastructure (Less than 10%).	No injuries or illness.

The assessed consequences of coastal erosion for each of the planning horizons are outlined in Table 4.4. As shown in the table, the consequences of erosion vary for some key assets over different timeframes due to the potential effects of increased erosion.

Table 4.4 Assessment of Consequence of Coastal Erosion Impact

Asset	Present Day	2041	2061	2081	2101	2121
Maintenance Shed	Insignificant	Insignificant	Insignificant	Minor	Minor	Minor
Tennis Court	Insignificant	Insignificant	Insignificant	Moderate	Moderate	Moderate
Lodge	Insignificant	Insignificant	Insignificant	Major	Major	Major
Pool 1	Insignificant	Insignificant	Insignificant	Minor	Minor	Minor
Glamping Tents	Insignificant	Insignificant	Insignificant	Minor	Minor	Minor
Pool 2	Insignificant	Insignificant	Insignificant	Insignificant	Minor	Minor
Chalets	Insignificant	Insignificant	Insignificant	Moderate	Moderate	Moderate
Reception	Insignificant	Insignificant	Insignificant	Moderate	Moderate	Moderate
Carpark	Insignificant	Insignificant	Insignificant	Minor	Moderate	Moderate
Amphitheatre	Insignificant	Insignificant	Insignificant	Moderate	Moderate	Moderate

Erosion is deemed to have a low consequence if the asset is landward of the coastal hazard line for the assessed planning horizon, since the extent of impact to the social, economic and environmental criteria is based on the extent of the potential erosion.

The key assets are situated landward of the coastal erosion hazard lines up to 2061 and were therefore assessed to have an insignificant level of consequence to coastal erosion. Beyond 2061 through to 2121, some assets were evaluated to have a moderate to major consequence of coastal erosion, in line with the assessed scale of consequence in Table 4.3.

5. Risk Evaluation

5.1 Risk Evaluation Matrix

The risk rating is assessed through a matrix of "likelihood" vs "consequence". A risk matrix defining the levels of risk has therefore been developed. This risk matrix is generally consistent with WAPC (2019) and the principles of AS 5334 (Standards Australia 2013) and is presented in Table 5.1.

Table 5.1 Risk Matrix

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

A risk tolerance scale assists in determining which risks are acceptable, tolerable and unacceptable. The risk tolerance scale used for the assessment is presented in Table 5.2. The risk tolerance scale shows that the extreme and high risks need to be managed.

Table 5.2 Risk Tolerance Scale

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

5.2 Risk Assessment

The risk assessment for the study area will be completed in accordance with the recommendations of AS5334 (2013), which requires a detailed risk analysis to include a vulnerability analysis to thoroughly examine how coastal hazards and climate change may affect the assets. This includes consideration of the adaptive capacity and vulnerability of the relevant assets.

Table 5.3 presents the assessed coastal erosion risk levels for each of the identified key assets potentially at risk over the 100 year planning timeframe.

Table 5.3 Assessment of Risk of Coastal Erosion Impact

Asset	Present Day	2041	2061	2081	2101	2121
Maintenance Shed	Low	Low	Low	Low	Low	Medium
Tennis Court	Low	Low	Low	Medium	Medium	Medium
Lodge	Low	Low	Low	Medium	High	High
Pool 1	Low	Low	Low	Low	Low	Medium
Glamping Tents	Low	Low	Low	Low	Low	Medium
Pool 2	Low	Low	Low	Low	Low	Low
Chalets	Low	Low	Low	Medium	Medium	Medium
Reception	Low	Low	Low	Medium	Medium	Medium
Carpark	Low	Low	Low	Low	Medium	Medium
Amphitheatre	Low	Low	Low	Medium	Medium	Medium

The results of the risk assessment show that the key assets are at low risk from coastal erosion hazards during the 40 year planning timeframe to 2061. Beyond this timeframe through to 2121, the assets have an increased level of risk from coastal erosion, from medium to high risk and would therefore require action to mitigate the risk.

5.3 Vulnerability

As per the recommendations of AS 5334 *Climate change adaptation for settlements and infrastructure*, a detailed risk analysis should include a vulnerability analysis to thoroughly examine how coastal hazards and climate change may affect the assets. This includes consideration of the adaptive capacity and vulnerability of the assets previously assessed for coastal hazard risk.

The vulnerability of the identified assets as part of the proposed SHG development are related to the risk from coastal hazards, as well as their sensitivity to the impacts caused by these hazards and their ability to respond to them (termed adaptive capacity). This is demonstrated in the *CHRMAP Guidelines* (WAPC 2019) by the following Figure 5.1.

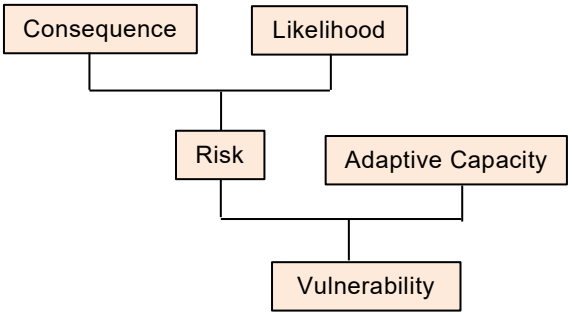

Figure 5.1 Vulnerability Assessment Flowchart (WAPC 2019)

5.3.1 Adaptive Capacity

Adaptive capacity is defined in AS5334 as the ability to respond to climate change to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

This should be considered in conjunction with any changes to the current risk factors over time which may influence an assets future adaptive capacity. A scale of adaptive capacity has been developed for this assessment and is presented in Table 5.4.

Table 5.4 Adaptive Capacity Ratings

Adaptive Capacity Rating	Description
Low	Little or no adaptive capacity. Asset cannot respond to coastal hazard impact and functionality cannot be restored. For example, roads, carparks or buildings that once impacted will require significant modifications to restore functionality.
Moderate	Small amount of adaptive capacity. Asset can partially adapt to coastal hazard impact and functionality can be somewhat restored through repair or redesign. For example, parks or undeveloped lots that once impacted can be modified to restore partial functionality.
High	Decent adaptive capacity. Asset can adapt to coastal hazard impact and functionality can be restored. Additional adaption measures should be considered. For example, portable homes / dongas, prefabricated modular units such as stairs, floating jetties.
Very High	Good adaptive capacity. Asset can respond to coastal hazard impact and functionality can be restored. For example, drink fountains, furniture or shelters that once impacted can be modified relatively easily to restore original functionality.

5.3.2 Vulnerability

To determine the vulnerability of the key assets as part of the SHG development, the following matrix was developed for this assessment. Essentially, the vulnerability of each identified asset increases or decreases where the asset has a low or high adaptive capacity respectively.

Table 5.5 Vulnerability Matrix

VULNERABILITY LEVELS		Risk			
		Low	Medium	High	Extreme
Adaptive Capacity	Low	Low	High	Very High	Very High
	Moderate	Low	Medium	High	Very High
	High	Low	Medium	High	High
	Very High	Low	Medium	Medium	High

A vulnerability tolerance scale is important to define the level at which adaptive capacity is deemed acceptable, tolerable or intolerable/unacceptable. The following tolerance scale has been adopted for this assessment.

Table 5.6 Vulnerability Tolerance Scale

Vulnerability Level	Further Action Required	Vulnerability Tolerance
Very High	Asset has minimal capacity to cope with the impacts of coastal hazards without additional action. Adaptation needs to be considered as a priority.	Unacceptable / Intolerable
High	Asset has limited ability to cope with the impacts of coastal hazards. Adaptation should be considered to reduce vulnerability to acceptable levels.	Tolerable, if as low as possible
Medium	Asset has some ability to cope with the impacts of coastal hazards. Actions should be considered to reduce vulnerability as low as reasonably practical (ALARP).	Tolerable / Acceptable
Low	Assets has high resilience and is able to cope with the impacts of coastal hazards without additional action.	Acceptable

The vulnerability tolerance scale shows that assets with ***High*** and ***Extreme*** vulnerability need to be managed to reduce vulnerability levels to ***Medium*** or ***Low***. Despite being considered acceptable, assets with ***Medium*** or ***Low*** vulnerabilities should also be considered and adaptation measures should be implemented to reduce vulnerability levels as low as reasonably practical (ALARP). This is discussed in Section 6 of this CHRMAP.

The vulnerabilities of each of the identified assets have been calculated and are shown in Table 5.7. The assets identified as having ***High*** and ***Extreme*** vulnerability from coastal erosion impact require management over the 100 year planning timeframe.

Table 5.7 Assessment of Vulnerability of Coastal Erosion Impact

Asset	Present Day	2041	2061	2081	2101	2121
Maintenance Shed	Low	Low	Low	Low	Low	Medium
Tennis Court	Low	Low	Low	Medium	Medium	Medium
Lodge	Low	Low	Low	High	Very High	Very High
Pool 1	Low	Low	Low	Low	Low	Medium
Glamping Tents	Low	Low	Low	Low	Low	Medium
Pool 2	Low	Low	Low	Low	Low	Low
Chalets	Low	Low	Low	Medium	Medium	Medium
Reception	Low	Low	Low	High	High	High
Carpark	Low	Low	Low	Low	High	High
Amphitheatre	Low	Low	Low	High	High	High

The results of the risk and vulnerability assessments show that the key assets have a tolerable (low) level of vulnerability to coastal erosion hazards over the 40 year planning timeframe through to 2061. Beyond the 40 year and into the 100 year planning timeframe to 2121, some assets are identified as having a High to Very High vulnerability to coastal erosion hazards. These high vulnerability assets (i.e. lodge, reception, carpark, amphitheatre) require additional adaptation measures to be implemented into the management plan to reduce the vulnerability levels as low as reasonably practical. These measures will be discussed in the following section of the report.

6. Risk Adaptation & Mitigation Strategies

6.1 Available Risk Mitigation Strategies

Risk adaptation and mitigation strategies are required for SHG to address the coastal hazard risks and asset vulnerabilities identified in Section 5. SPP2.6 outlines a hierarchy of risk adaptation and mitigation options, where options that allow for a wide range of future strategies are considered more favourably. This hierarchy of options is reproduced in Figure 6.1.

Figure 6.1 Risk Management & Adaptation Hierarchy

These four broad option categories are generally outlined below.

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

The assessment of these options is generally done in a progressive manner, moving through the various options until an appropriate mitigation strategy is found. Adaptation options can vary depending on the type of asset, and often a range of complementary strategies may be required to mitigate coastal hazard risks.

6.2 Proposed Management Strategy

Being a tourist development that will have a finite timeframe until the facilities need to be replaced, the requirement for a coastal risk mitigation strategy for the proposed SHG resort development is informed by the design life of the infrastructure. The vision for the development is to provide luxury tourist accommodation with chalets and a lodge in a similar model to that provided at Seashells Units in Yallingup, Western Australia. It will also provide a number of highly adaptable glamping tents as well as relevant tourist facilities. The design of the resort will therefore be sensitive to the natural environment with the intention of being as visually unobtrusive as possible from both the beach and surrounding land areas.

Being a luxury resort and given the coastal nature of the infrastructure, it is envisaged that the design life of the structures will be limited to around 40 years, to 2061. Therefore, the proposed coastal management strategy should be focused on a 40 year planning horizon when considering the initial construction of the resort.

For the initial construction of the resort the intention is to **avoid** risks associated with coastal hazards. As a result, the built form of the Resort will be located landward of the coastal erosion hazard line for the 40 year planning horizon, to 2061. Similarly, the finished floor levels of the resort will be located well above 2.9 mAHD, avoiding risks associated with coastal inundation. This avoidance of the coastal hazard risk over the 40 year planning horizon means that there will be an almost insignificant chance of the development being impacted by erosion over this period. Further, it would be expected that, given the conservatism that is inherent in the assessment of the coastal hazard risk, development in this location would probably be unaffected by coastal hazards for a period longer than 40 years.

Given the approach outlined above, the initial concept layout plan for the resort has been prepared and is shown in Figure 6.2. This figure also shows the location of the coastal erosion hazard lines for the various planning horizons. As shown, all of the built form is located behind the 2061 erosion hazard line, therefore avoiding the risk of coastal erosion hazards over the design life of the structures. Nevertheless, whilst the proposed management strategy avoids the risk for the coming 40 years, SPP2.6 requires the development of an adaptation strategy that extends to a 100 year planning horizon. In this regard, further management actions are required.

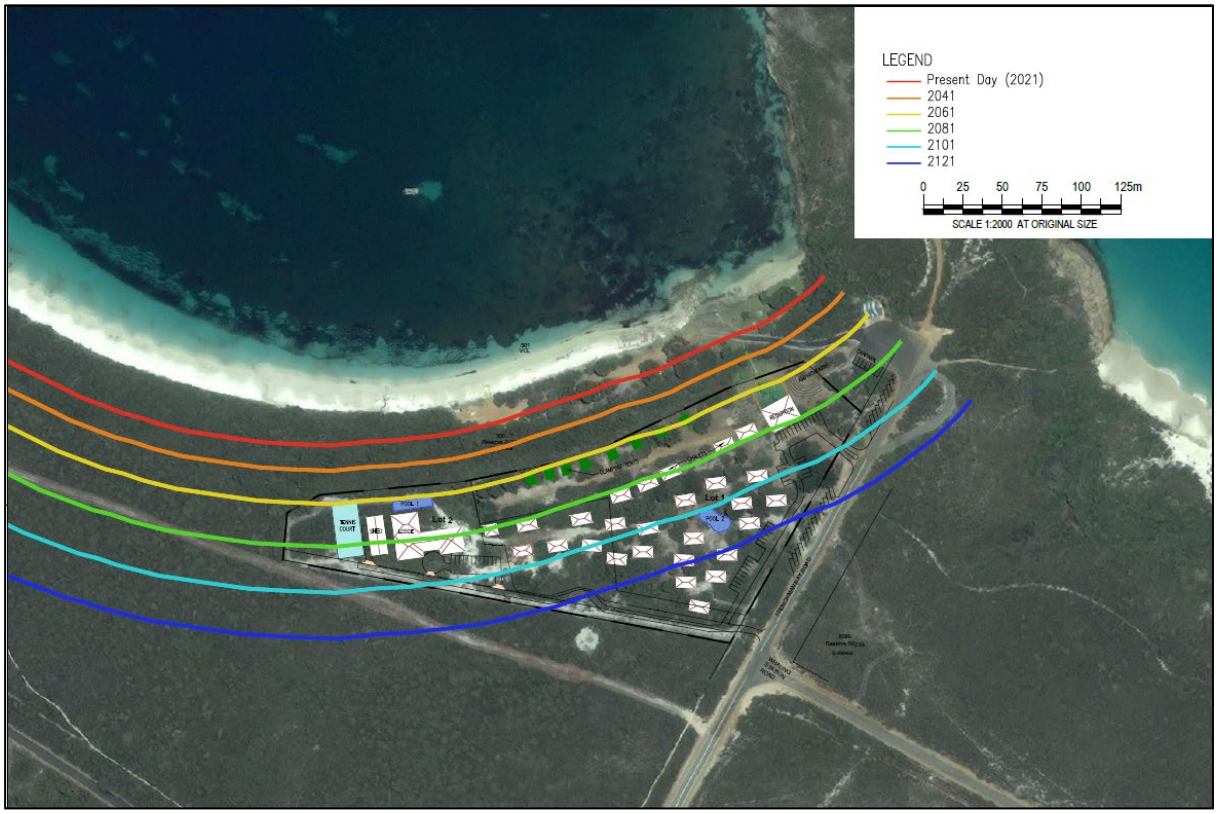

Figure 6.2 Initial Resort Concept Layout & Erosion Hazard Lines

The long term adaptation strategy is **managed retreat**. This managed retreat shall be initiated by a coastal monitoring regime which revolves around a **trigger point**. It is recommended the trigger point be located a distance from the seaward boundary of each asset that is equal to the S1

allowance plus 5m factor of safety. Explicitly, when the shoreline retreat reaches a point 33m from each asset the managed retreat shall be initiated. This is expected to take place sometime beyond the initial 40 year planning horizon and likely after the built forms need replacing. This replacement of the built form will provide a convenient and pre-emptive opportunity for a **managed retreat** of the infrastructure. Under this scenario the replacement infrastructure should be relocated to an area that is deemed to be safe for the ensuing planning horizon based on the results of an updated coastal hazard assessment completed at that time. The design of the new layout for the resort will therefore need to respond to the results of that coastal hazard assessment.

Similarly, as the behaviour of any coastline can be complex and subject to change, ongoing monitoring of the coastline should be completed in perpetuity. Details of the proposed monitoring are provided in Table 6.1.

Table 6.1 Proposed Coastal Monitoring

Type of Monitoring	Description	Requirement / Frequency
Visual Inspections	Visual inspection and monitoring of the beach to identity any significant changes in the shoreline. Changes would be evident through the erosion of the beach and presence of an erosion scarp with or without the loss of vegetation.	Ongoing as part of the operation of the Resort. The character of the beach will be constantly monitored as part of the operation of the resort.
Shoreline Mapping	Ortho-rectified aerial photographs will be purchased and the coastal vegetation line mapped to track the movement of the shoreline. This method will help to ascertain if there is any creep in shoreline position that is not being picked up through the visual inspections.	Every 5 years or when the visual inspections suggest a significant change in the beach/shoreline.
Survey Cross Sections	Survey of the beach and foreshore along four profiles fronting the resort site. The profiles would seek to capture the foreshore out to a water depth of approximately 5 m. These surveys would help to determine the extent of the change in the shoreline profile that is occurring.	This level of survey would only be required if the eroded shoreline came within a horizontal distance of approximately 43 m of the resort site (the S1 allowance plus 15m). If this were to occur then the survey cross sections should be completed every 1 to 2 years depending on the recommendations of a coastal engineer at that time.

This monitoring should be used to identify if the shoreline erodes to the extent that a trigger position is reached where the risk of coastal hazards becomes too great. If this were to occur, then the at-risk infrastructure should be removed and relocated to an area that is considered safe based on the results of a coastal hazard assessment at that time. For this shoreline the trigger value should be the S1 allowance plus 5 m as a factor of safety. Therefore, if the shoreline (denoted by the coastal vegetation line or toe of an erosion scarp where present) recedes to the point that it comes within 33 m of the seaward boundary of a resort asset, then the managed retreat of the infrastructure that is at risk should commence.

It is noted that all of the requirements outlined above are the full responsibility of the landowner, with the landowner ultimately responsible for all costs and any other requirements to enable the coastal adaptation strategy to be completed. Whilst this is acknowledged and accepted by the current land owner, it is important that this requirement is conveyed to any prospective future landowners. As a result, it is recommended that a notification be placed on the titles of Lots 1 & 2 Frenchman Bay Road advising that the subject land is at risk from coastal hazards and is subject to management in accordance with this coastal management strategy.

For clarity, a summary of the proposed coastal management strategy has been prepared and is presented in Figure 6.3.

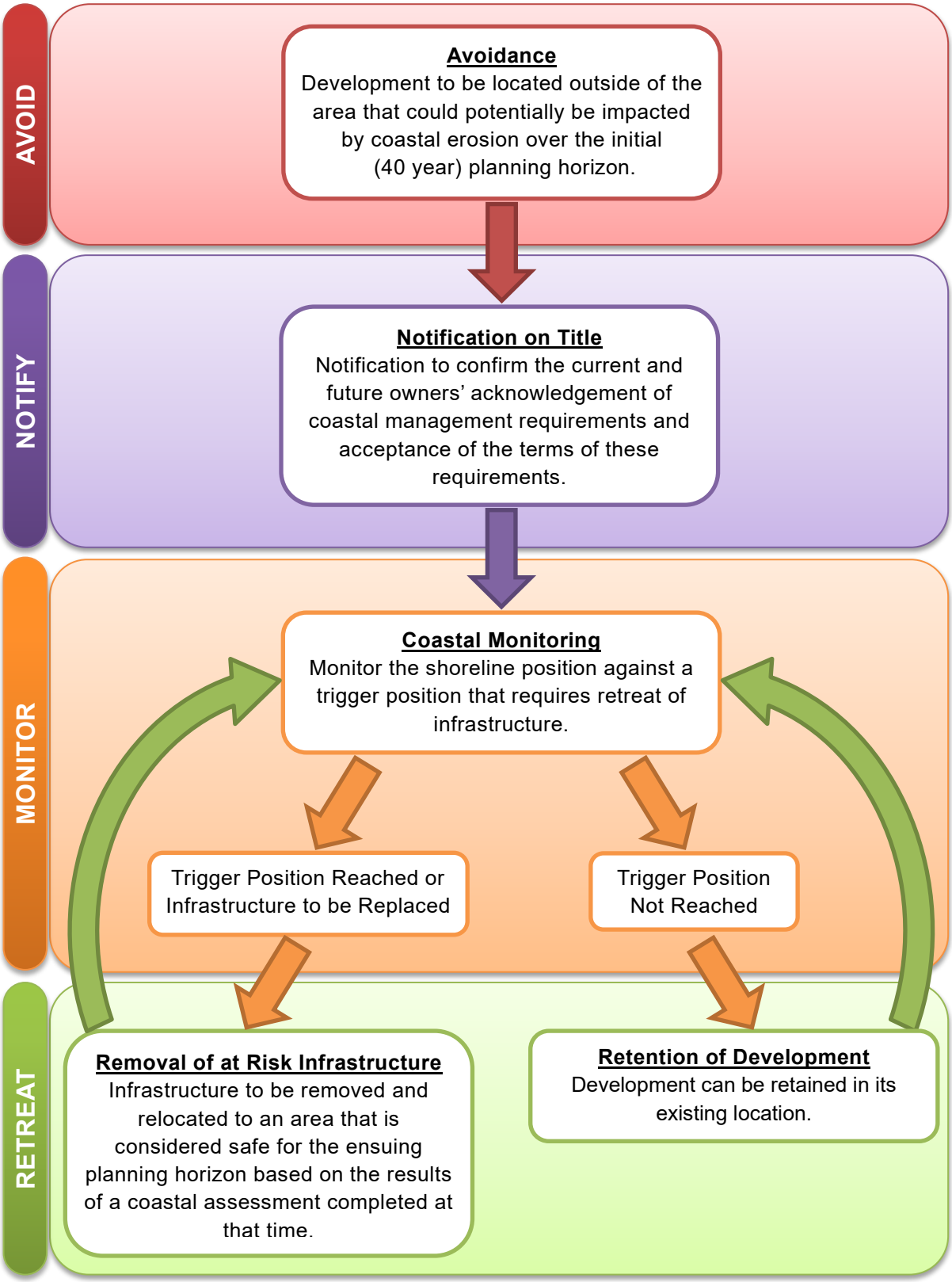

Figure 6.3 Summary of Coastal Management Strategy

7. Conclusions

This CHRMAP has been completed to provide guidance on required adaptation and management actions associated with the proposed SHG development. The coastal hazard assessment completed previously and referred to in Section 3 as well as this CHRMAP report have been completed in line with the recommendations of SPP2.6 and WAPC (2019).

Lots 1 & 2 Frenchman Bay Road have long been earmarked for the development of a tourist resort site. The current owner of Lots 1 & 2, Paul King (SHG), proposes to develop luxury holiday accommodation in the form of a resort on the site. The vision for the resort is to provide luxury tourist accommodation that is sensitive to the natural environment and local aesthetics.

An assessment of the potential future areas of impact caused by the action of coastal hazards was completed in accordance with the requirements of SPP2.6. The results of this assessment show that the shoreline fronting the site could be vulnerable to change caused by a combination of severe storm erosion and sea level rise. In this regard, it is prudent to consider the potential future shoreline changes and the possible impacts on the resort site in the context of future coastal adaptation and management requirements. It is noted however that an assessment of the historical movement of the shoreline fronting the site shows that the beach has experienced very little gross movement over the last half a century with the exception of the erosion adjacent to, and likely caused by, the redundant historical seawall. This demonstrates the apparent stability of the shoreline and highlights that the results of the coastal hazard assessment are likely to be conservative for this location.

The completion of the coastal hazard risk assessment for the proposed SHG development has shown that there is a risk of coastal hazard impact over the 100 year planning timeframe. However, these risks are limited to erosion impacts and are tolerable during the 40 year planning timeframe to 2061. The serviceable design lifetime of the built form structures within the proposed development are within this planning timeframe. As such the short term (40 year plan) is to avoid the potential coastal hazards. The long term (100 year plan) is a managed retreat, which shall be initiated by erosion beyond the trigger point as mentioned in section 6 of this report.

A coastal management and adaptation strategy was presented within this report that outlines the proposed future management strategy. This strategy is based on an avoidance of risk over the design life of the built form structures, followed by a managed retreat of the structures triggered by erosion of the shoreline, or at such time as the structures need to be replaced. The requirements of this coastal management and adaptation strategy are understood and accepted by the land owner. Furthermore, for the avoidance of doubt, it is noted that all costs associated with the requirements of this strategy will be borne by the landowner. To make any future prospective owners of this site aware of this requirement, it is suggested that a notification also be included on the title for the Lots.

Given the proposed management strategy, the proposed SHG development should appropriately respond to risks posed by coastal hazards in the short, medium and long term.

8. References

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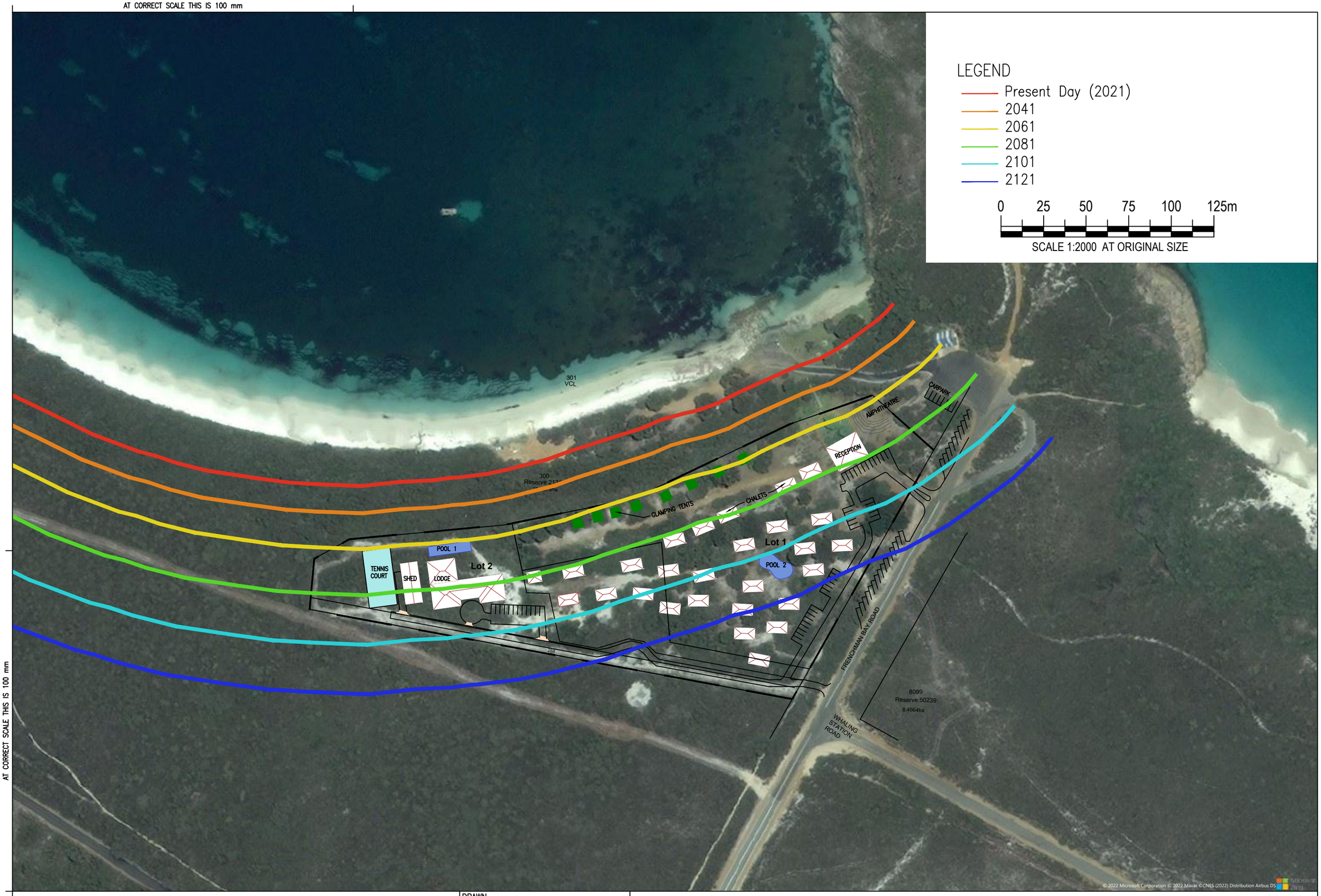
WAPC 2019. *Coastal Hazard Risk Management and Adaptation Planning Guidelines*. Government of Western Australia, Perth.

9. Appendices

Appendix A Coastal Erosion Hazard Lines – SK1961-01B

Appendix A Coastal Erosion Hazard Lines – SK1961-01B

AT CORRECT SCALE THIS IS 100 mm



AT CORRECT SCALE THIS IS 100 mm

m p rogers & associates pl
coastal and port engineers
Suite 1, 128 Main Street
Osborne Park 6017
Western Australia
t: +61 8 9254 6600
admin@coastsandports.com.au

DRAWN TBI
CHECKED CRD

Coastal Erosion Hazard Lines

Frenchman Bay CHRMAP

SCALE AT A3 1:2,000

April 2022

SK1961-01B

P:\MRA Paying Jobs\K1961 Frenchman Bay CHRMAP\5 MRA Dwgs\Sketches\SK1961-01

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www.coastsandports.com.au

APPENDIX 'C': DEVELOPMENT EXAMPLES

Roys Peak Crib

https://www.masonandwales.com/work/roys-peak-crib

Queenstown Houses

https://www.masonandwales.com/work/queenstown-houses

Wanaka Houses

https://www.masonandwales.com/work/wanaka-houses

APPENDIX 'D': SITE SOIL EVALUATION

Lot 1 and 2 Frenchman Bay Road, Frenchman Bay WA

Site Soil Evaluation

Bio Diverse Solutions

12/04/2022

DOCUMENT CONTROL

TITLE: Site Soil Evaluation – Lot 1 & 2 Frenchman Bay Road, Frenchman Bay

Author (s): Chiquita Cramer (Bio Diverse Solutions)

Reviewer (s): Bianca Theyer & Nick Ayton

Job No.: MSC0403

Client: Frenchman Bay Albany Pty Ltd

REVISION RECORD

Revision	Summary	Revised By	Date
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Draft Id 13/07/2021	Submitted to Ayton Baesjou for review	N. Ayton	13/07/2021
Final Id 03/0802021	Submitted to Ayton Baesjou for client submission	C. Cramer	03/08/2021
Final 22/03/2022	Updated to include modified concept plan	C. Cramer	22/03/2022
Final 05/04/2022	Updated to include further modified concept plan	C. Cramer	12/04/2022

Bio Diverse Solutions Australia Pty Ltd

Albany Office
29 Hercules Crescent
Albany WA 6330
08 9842 1575

Denmark Office
Unit 7, 40 South Coast Highway
Denmark WA 6333
08 9848 1309

Esperance Office
Unit 2A, 113 Dempster Street
Esperance WA 6450
08 9072 1382

www.biodiversesolutions.com.au

ABN 46 643 954 929

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Appendices

1 Introduction

Frenchman Bay Albany Pty Ltd commissioned Bio Diverse Solutions to prepare a Site Soil Evaluation (SSE) to determine effluent disposal suitability for a proposed tourism development at Lot 1 and 2 Frenchman Bay Rd, Frenchman Bay WA (herein referred to as the Subject Site). This report details the site soils and suitability for on-site effluent disposal at the site in relation to the proposed development.

1.1 Alignment to Legislation, Policy and Guidelines

Bio Diverse Solutions has prepared this report aligned to the following legislation:

- State Planning Commission, Land Capability Assessment for Local Rural Strategies (1989);
- *Government Sewerage Policy (2019);*
- *Draft Country Sewerage Policy (Amended 2003);*
- *Health Act (1911)* and draft *Health Act (2008);*
- *Country Area Water Supply Act 1947;*
- Code of Practise for the design, manufacture and operation of Aerobic Treatment Units (2001); and
- Australian Standard (AS)1547-2012.

1.2 Location

The Subject Site is defined as Lot 1 and 2 Frenchman Bay Road, Frenchman Bay, within the municipality of the City of Albany (CoA). It is located approximately 21km southeast of the Albany CBD. The site is bound by Frenchman Bay Road to the east, Frenchman Bay beach to the north and CoA reserve to the south and west. The location of the Subject Site is shown on Figure 1.

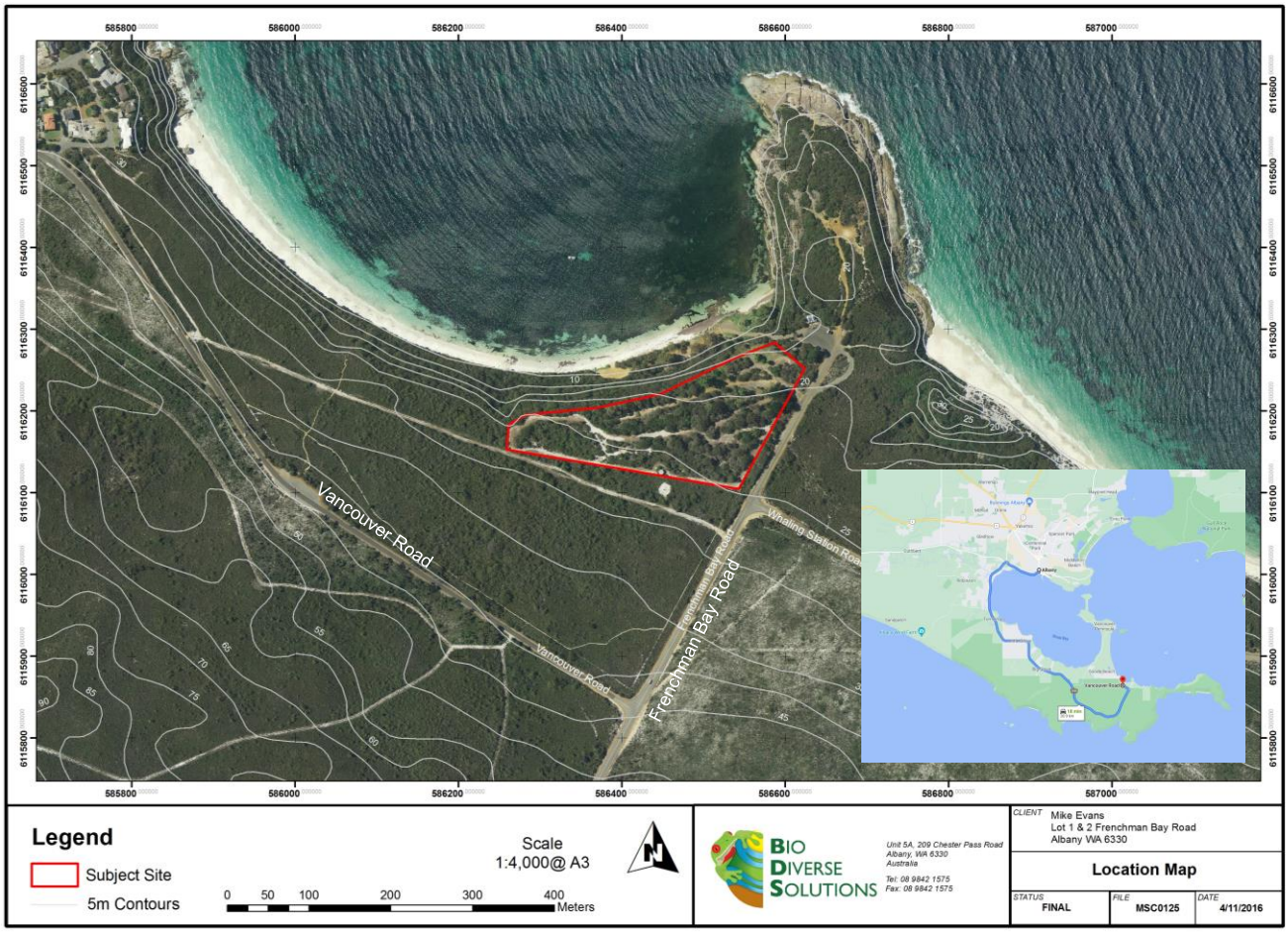


Figure 1: Location Plan

2 Development Proposal

In September 2015, the CoA approved a Local Development Plan (LDP) for Lots 1 and 2 Frenchman Bay Road, which are designated as Special Use Site No. 13 under the provisions of the City of Albany's Local Planning Scheme No. 1. The Special Use site provides for the development of Holiday accommodation, Caravan Park, Caretaker's Dwelling and a shop, and is identified as an important Local Strategic Tourist site in City of Albany's Local Tourism Planning Strategy. Following approval of the LDP, a development application was lodged with the Southern Joint Development Assessment Panel in December 2017 and approved in June 2018. The developer subsequently resolved not to proceed with the development and the property has more recently been acquired by Frenchman Bay Albany Pty Ltd.

Frenchman Bay Albany Pty Ltd propose an alternative development to what was previously proposed. They propose separating the site into three components consisting of:

- A luxury holiday lodge with 10-12 bedrooms;
- Up to 25 single bedroom holiday chalets, eight glamping tents, day spa and manager's accommodation; and
- A signature café/restaurant with associated kiosk/shop and reception office.

The proposed LDP is shown in Figure 2.

Figure 2: Proposed Local Development Plan

3 Desktop Assessment

3.1 Topography and slope

The Subject Site is situated at the top of a steep slope extending from the coast line below. Topography across the sight is gently sloping, ranging in height from 14m AHD in the northeast corner of the site to 28m AHD in the southwest corner of the site. Topographic Contours are shown in Figure 3.

3.2 Geology and Soils

Department of Primary Industries and Regional Development (DPIRD) (2018) Soil Landscape Mapping - Systems (DPIRD-064) dataset shows the Subject Site lies within the Albany Sandplain Zone (242) and is described as; '*Gently undulating plain dissected by a number of short rivers flowing south. Eocene marine sediments overlying Proterozoic granitic and metamorphic rocks. Soils are sandy duplex soils, often alkaline and sodic, with some sands and gravels'.*

In 2008 Landform Research conducted a geological study of the site for a previous proposed development. In summary six air blast drill holes were constructed to varying depths from 15 – 21 m BGL, the drill holes were tested for soil type and presence of groundwater. Soil type in all six drill holes was found to be predominantly Quaternary coastal, Aeolian sands (from 0m BGL to between 6.5 and >16 m BGL). Holes 1, 2, 3 and 5 consisted of Quaternary coastal, Aeolian sands overlying possible Pallinup Siltstone, with the depth of the siltstone layer ranging from 6.5 - 16.5 m BGL in Hole 3 to 16 - >21 m BGL in Hole 1. Peats consistent with the Werillup Formation were found at Hole 3 only (from 16.5 m BGL). The location of the drill holes is shown in Figure 3.

Figure 3: Topography and Geology

3.3 Surface Hydrology

There are no existing drainage networks or water bodies within the Subject Site. Surface water generally runs off the site in a north easterly direction towards the coastal foreshore. There are however many localised low points across the site which would trap most of the surface runoff from the site during a storm event. The north-eastern portion of the site has a steeper slope with fewer localised low points and as such surface water here would drain directly off the site, via sheet flow, down the embankment towards the foreshore.

There are two natural springs (Vancouver Spring and Small Spring) located approximately 65m and 40m respectively, from the north-west corner of the Subject Site and only a very small portion of the Subject Site drains towards the springs.

Surface water from the section of Frenchman Bay Road adjacent to the Subject Site, including the adjoining beach car park and turn around area, is directed towards the foreshore via the road network. There are two kerb breaks in the steeper section of the road leading down to the foreshore directing stormwater off the road and down the embankment towards the beach. The surface water hydrology of the Subject Site is shown in Figure 4.

3.4 Hydrogeology and Groundwater

Australian Geoscience Mapping and Department of Water and Environmental Regulation (DWER) 250K Hydrogeological mapping places the Subject Site within the *Tertiary - Cainozoic - Phanerozoic (TPw) period: Werillup Formation – bryozoans limestone, siltstone, sandstone, peat and basal conglomerate; weathered.* The aquifer is a sedimentary aquifer with intergranular porosity – extensive aquifers, major groundwater resources. Hydrogeological mapping is shown on Figure 4.

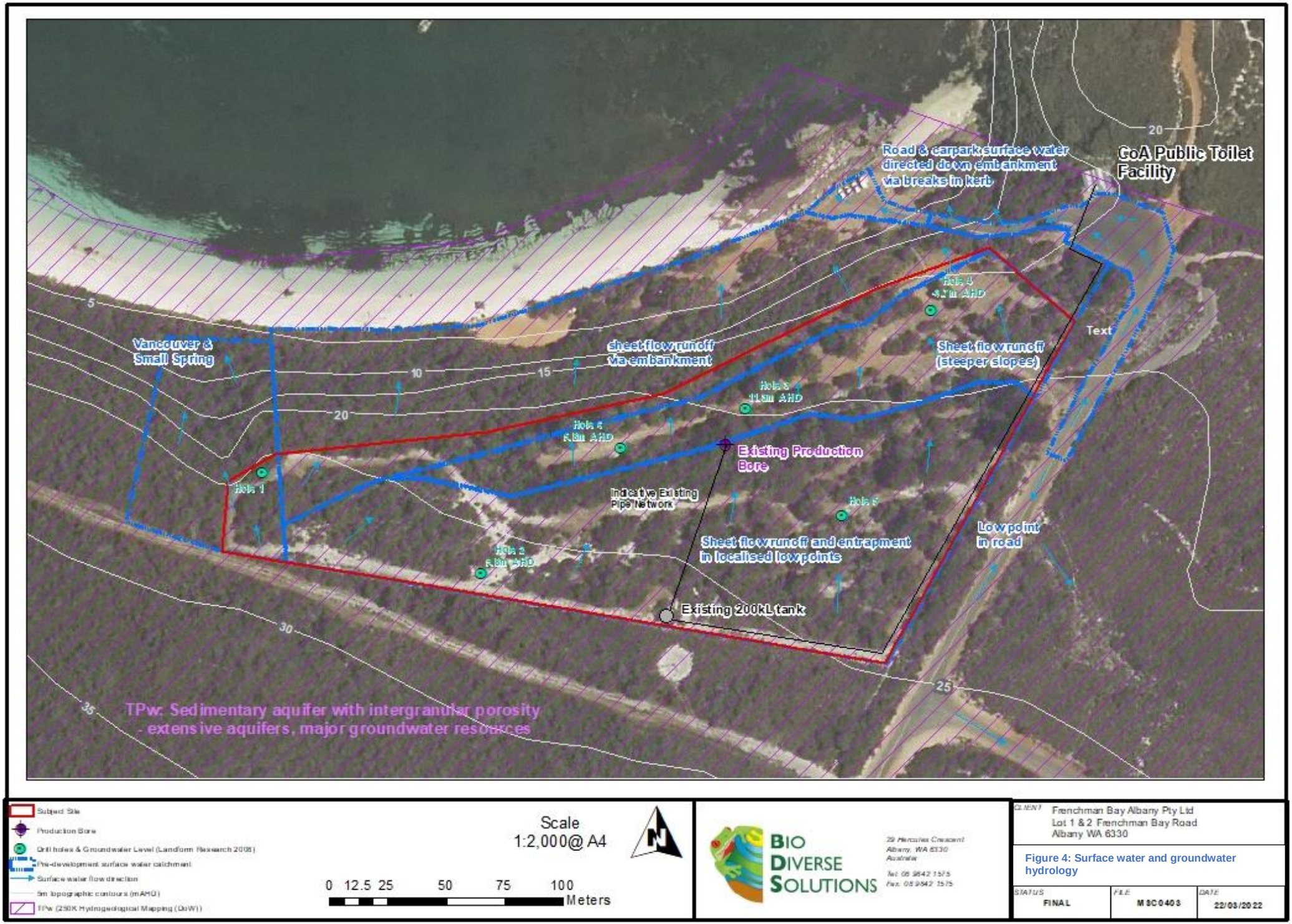
DWER 250K Hydrogeological mapping is consistent with findings by Landform Research (2008) which showed peats consistent with the Werillup Formation and encountered groundwater at Hole 2 (9.8m AHD), Hole 3 (11.3m AHD), Hole 4 (-0.7m AHD) and Hole 6 (5.8m AHD). The drill holes and their respective groundwater levels are shown in Figure 4.

There is one existing production bore located at the Subject Site. The production bore was previously used for water supply to the caravan park via a 200kL tank located at the high point of the site, however since the caravan park's closing it has been used by the City of Albany to supply water to an adjacent public toilet facility. The location of the production bore and the 200kL tank are shown in Figure 4.

Desktop analysis of the Subject Site indicates it is not located within a designated Public Drinking Water Source Area (PDWSA) as defined by the *Country Areas Water Supply Act 1947.* The closest designated PDWSA is located 1.4km to the southwest, being Limeburners Creek Catchment (Priority 1) (DWER, 2021).

3.5 Flooding Potential

The Subject Site is not subjected to regular flooding given the dry climate in the area and the elevation of the Subject Site.



Subject Site
Production Bore
Drill holes & Groundwater Level (Landform Research 2008)
Pre-development surface water catchment
Surface water flow direction
5m topographic contours (mAHD)
TPw (250K Hydrogeological Mapping (DoW))

Scale
1:2,000@ A4

0 12.5 25 50 75 100
Meters

BIO DIVERSE SOLUTIONS
39 Hercules Crescent
Albany, WA 6330
Australia
Tel: 08 9842 1575
Fax: 08 9842 1575

CLIENT: Frenchman Bay Albany Pty Ltd
Lot 1 & 2 Frenchman Bay Road
Albany WA 6330

Figure 4: Surface water and groundwater hydrology

STATUS	FILE	DATE
FINAL	MSC0403	22/03/2022

3.1 Environmentally Sensitive Areas

The Subject Site is located 212m away from an Environmentally Sensitive Area (ESA) being; Torndirrup National Park. This meets the usual requirement of 100m separation from ESA's and the proposed development poses minimal risk to the ESA, in addition the Subject Site is located down-gradient from the ESA.

3.2 Sewerage Sensitive Areas

The Subject Site is not located in a Sewerage Sensitive Area. The *Government Sewerage Policy* (DPLH, 2019a) outlines Sewage Sensitive Areas as:

'Land that drains to and is within two kilometres of Irwin Inlet, Wilson Inlet, Torbay Inlet, Manarup Lagoon, Lake Powell, Princess Royal Harbour and Oyster Harbour'.

and

'Within one kilometre up-groundwater- gradient and 250 metres down-groundwater-gradient of a significant wetland; or where the groundwater gradient is unknown or seasonably variable within one kilometre of the significant wetland'.

The Subject Site is outside of Princess Royal Harbour and not within close proximity of a significant wetland and therefore is not within a Sewerage Sensitive Area. Sewerage Sensitive Area mapping is shown on Figure 5.

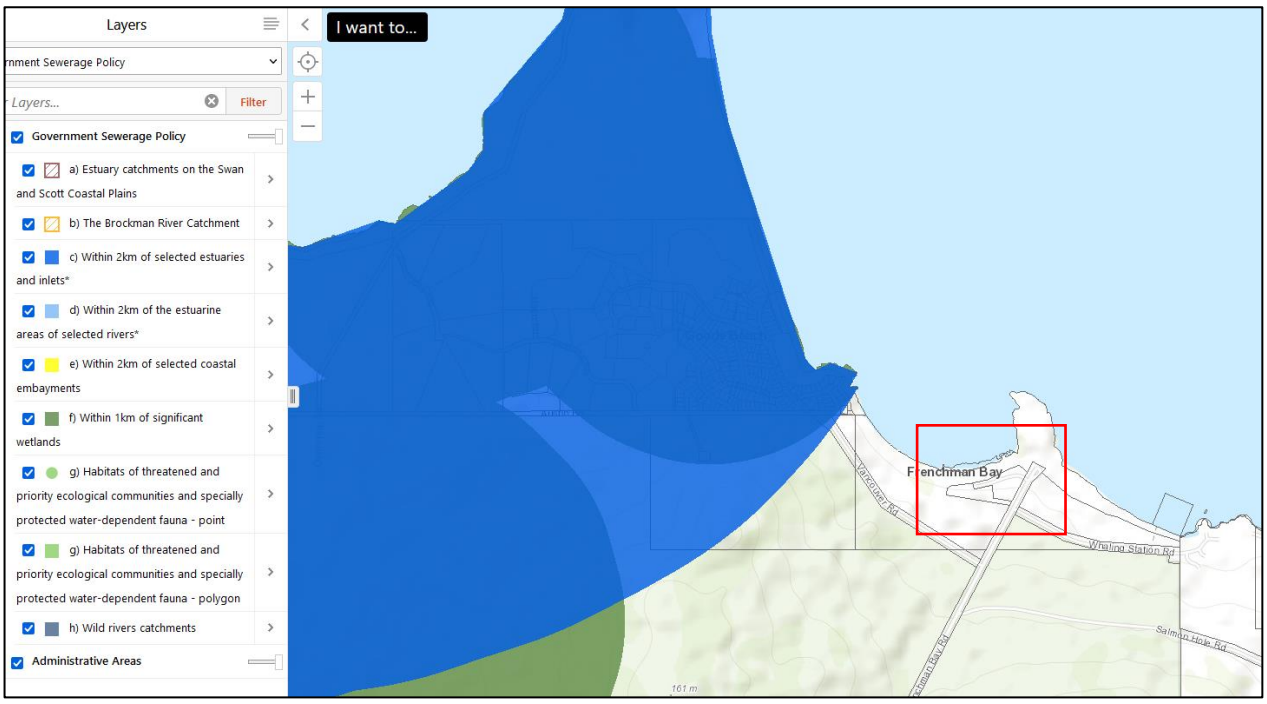


Figure 5: Sewerage Sensitive Area Mapping

4 Soil Testing

4.1 Soil Testing Method

A Site Soil Investigation was conducted on the 30th September 2016 by Great Southern Geotechnics (GSG) and Bio Diverse Solutions as part of the previously proposed and approved development. The site investigation included the construction of six test holes to a depth of 2.0metres, photographing and logging of soils to the depth of the holes, and inspection and measuring of the water table if found to be present. The location of the six soil test holes is shown on Figure 6 and the Site Soil Investigation (GSG, 2016) report showing the bore hole logs is included as Appendix A.

Figure 6: Soil testing hole locations

A follow up Site Soil Investigation to capture soil characteristics along the eastern and southern boundaries was conducted on the 22nd March 2018. The site investigation included the construction of a further six test holes to a depth of 2.0metres, photographing and logging of soils to the depth of the holes and inspection and measuring of the water table. The location of the additional six soil test holes is shown in Figure 7 and the Site Soil Investigation (GSG, 2018) report is included as Appendix B.

Figure 7: 2018 Soil testing hole locations

Soil test holes during both the 2016 and 2018 investigation were excavated to a depth of 2.0 metres using a Kubota KX41-3V mini excavator with a 300mm auger. The boreholes were logged and left open for a minimum of 1 hour to examine any water table or water seepage into the soil profile.

A Falling Head Permeability Test was performed by Liquid Labs WA on the sand with silt layer present at the site from TP1 (0-500mm) and TP2 (0-1200mm) during the 2016 soil investigation and TP3(2) (400-1000mm) and TP5(2) (800-2000mm) during the 2018 soil investigation.

Analysis of the site for suitability of effluent disposal was undertaken with a desktop assessment of publicly available databases and assessment of the site soils in relation to the Government Sewerage Policy (DPLH, 2019a) and AS1547-2012.

4.2 Soil Testing Results

The 12 test holes revealed that soils across the site were relatively consistent and classified predominantly as sand with silt from the surface to the depth of the hole.

Details of the 2016 site soils as classified by Great Southern Geotechnics are provided in Table 1 and the details of the 2018 site soils is provided in Table 2. The 2016 and 2018 Site Investigation Reports (including bore logs) are shown in Appendix A and B, respectively.

Table 1: Soil Testing Results (GSG, 2016)

Test Pit	Depth (mm)	Soil Type	Soil Description
TP1	0-500mm	Sand with silt	Dark grey to grey, fine to medium grained, roots and root fibres.
	500-1800mm	Sand with silt	Light grey/white, fine to medium grained.
			No water table was encountered.
TP2	0-300mm	Sandy gravel	Brown, fine to medium gravel, sub-rounded to sub angular, fine to medium grained sand, roots and root fibres.
	300-800mm	Sand with silt	Dark grey to grey, fine to medium grained, roots and root fibres.
	800-1800mm	Sand with silt	**G**rey to light grey/white, fine to medium grained.
			No water table was encountered.
TP3	0-300mm	Sand with gravel	Brown/grey, fine to medium grained sand, fine to medium grained gravel, subrounded to sub-angular, roots and root fibres.
	300-1800mm	Sand with silt	Light grey/white, fine to medium grained, roots and root fibres.
			No water table was encountered.
TP4	0-600mm	Sand with silt	Dark grey to grey, fine to medium grained, roots and root fibres.
	600-1800mm	Sand with silt	Dark grey to grey, fine to medium grained.
	1800-1900mm	Sand with silt	Light grey/light brown, fine to medium grained with pockets of dark brown fine to medium grained, cemented SAND.
			No water table was encountered.
TP5	0-200mm	Sandy gravel	Grey/brown, fine to medium gravel, sub-rounded to sub-rounded, fine to medium grained sand, roots and root fibres.
	200-1200mm	Sand with silt	Light grey/white, fine to medium grained.
	1200-1800mm	Sand with silt	Light brown/yellow, fine to medium grained, mottled dark brown fine to medium grained, cemented SAND with silt.
			No water table was encountered.
TP6	0-1200mm	Sand with silt	light grey, fine to medium grained, roots and root fibres.
	1200-1800mm	Sand with silt	Light brown/yellow, fine to medium grained, mottled dark brown fine to medium grained, cemented SAND with silt.
			No water table was encountered.

Table 2: Soil Testing Results (GSG, 2018)

Test Pit	Depth (mm)	Soil Type	Soil Description
TP1 (2)	0-400mm 400-800mm 800-2000mm	Sand with silt Sand with silt Sand with silt	Dark grey, fine to medium grained. Roots and root fibres. Grey, fine to medium grained. Light grey to white, fine to medium grained. **No water table was encountered.**
TP2 (2)	0-1600mm 1600-2000mm	Sand with silt Sand with silt	Light grey/white, fine to medium grained. Light brown/grey, fine to medium grained. **No water table was encountered.**
TP3 (2)	0-400mm 400-1000mm 1000-2000mm	Sand with silt Sand with silt Sand with silt	Grey, fine to medium grained, roots and root fibres. Light grey, fine to medium grained. White fine to medium grained. **No water table was encountered.**
TP4 (2)	0-500mm 500-1000mm 1000-2000mm	Sand with silt Sand with silt Sand with silt	Grey, fine to medium grained, roots and root fibres. Light grey, fine to medium grained. Light grey/white, fine to medium grained. **No water table was encountered.**
TP5 (2)	0-300mm 300-800mm 800-2000mm	Sand with silt Sand with silt Sand with silt	Grey, fine to medium grained with roots and root fibres. Light grey/white, fine to medium grained. Light grey/white, fine to medium grained. **No water table was encountered.**
TP6 (2)	0-300mm 300-1700mm 1700-2000mm	Sand with silt Sand with silt Sand with silt	Grey, fine to medium grained, with roots and root fibres. Light grey, fine to medium grained. Brown/grey, fine to medium grained. **No water table was encountered.**

4.3 Soil Permeability

Silts and clay soils generally record poor permeability results whereas coarse sands generally record high permeability, as shown in Figure 8. Soil permeability for effluent disposal treatment needs to be rapid to moderate to allow adequate infiltration of effluent waters and prevent the backing up of the effluent disposal system whilst not being too rapid that leaching of contaminates through the soil occurs.

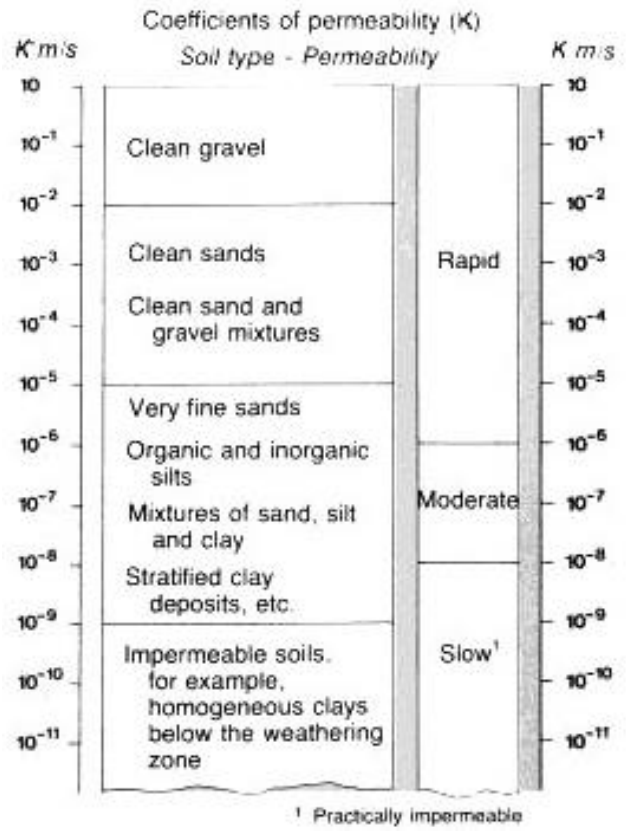


Figure 8: Generalised Permeability - Hydraulic Conductivity of soil types

Permeability testing was conducted on samples from TP1 (0-500mm) and TP6 (0-1200mm) as part of the 2016 soil investigation and TP3(2) (400-1000mm) and TP5(2) (800-2000mm) as part of the 2018 soil investigation. Soil permeability results are presented in Table 3.

Table 3: Permeability Results

Test Pit	Soil Profile Depth (mm)	Soil type	Permeability (m/s)
TP1	0-500	Sand with silt	2.2×10^{-6}
TP6	0-1200	Sand with silt	5.7×10^{-5}
TP3 (2)	400-1000	Sand with silt	4.5×10^{-6}
TP5 (2)	800-2000	Sand with silt	2.6×10^{-6}

Test results indicate that the sand with silt at the Subject Site has a moderate permeability. This rate of permeability is ideal for onsite effluent disposal. The sand with silt allows adequate infiltration of effluent waters, whilst not too fast to allow fixation of the nutrients to the soil and uptake of the nutrients by plants.

4.4 Phosphorus Retention Index

Phosphorous retention Index (PRI) is the ability of soils to absorb and treat nutrients within the soil (i.e. soil microbe disinfecting ability). Soils with a PRI less than 1 have a very poor ability to treat effluent waters, whilst soils with a PRI of >5 having a high ability to treat effluent waters (nutrients).

PRI testing was conducted by CSBP on the sand with silt layer from TP1 (0-500mm depth) and TP6 (0-1200mm depth) during the 2016 soil investigation. The test results indicate that the site soils have a very low ability of treating effluent waters and to fix nutrients within the soil. TP1 had a PRI of 0.1 and TP6 had a PRI of 0.7.

5 Site Suitability

The Subject Site is situated in an area that does not have deep or reticulated sewerage. The health and environmental requirements for wastewater treatment and disposal for developments not serviced by deep sewerage systems are contained in the *Government Sewerage Policy*, (DPLH, 2019a). The *Government Sewerage Policy* (DPLH, 2019a) states minimum requirements apply for all on-site sewage disposal systems.

Soil testing conducted by Landform Research (2008) and Great Southern Geotechnics (2016 and 2018) showed soils across the Subject Site were consistent and comprised predominantly of sand with silt with a moderate permeability. This soil type is suitable for onsite effluent disposal using a typical sub-surface disposal system (leached drains) or an irrigation system.

Groundwater was not encountered to a depth of 2 metres during the 2016 and 2018 soil investigation (GSG) and the 2008 investigation by Landform Research showed groundwater to be >6m BGL across the site therefore groundwater is not likely to have any impact on effluent disposal across the site.

The Subject Site has a gentle slope and does not exceed the minimum grade requirements (1:5) for disposal as outlined in Table 3 of the Draft Government Sewerage Policy (2019). It is recommended that the land application areas for onsite effluent disposal are adequately setback from the steep slope between the Subject Site and the Frenchman Bay foreshore to the north.

There are no waterways, water bodies or wetlands within the Subject Site. Vancouver and Small Springs are situated 65 and 40m, respectively, to the northwest of the Subject Site. Despite the springs being within 100m from the Subject Site boundary the onsite effluent disposal for the proposed development can be and shall be achieved outside of the 100m separation setback. A 100m setback from the coastline to all land application areas shall also apply, adequate land application area is achievable on the Subject Site >100m from the coastline.

There is one private production bore within the Subject Site, this bore will be decommissioned as part of the development. Any future bore installed shall be situated a minimum of 30m from effluent disposal land application areas, this is achievable within the Subject Site.

In summary the Subject Site and proposed development is deemed suitable for on-site effluent disposal given effluent disposal systems are installed consistent with (AS)1547-2012.

Table 4 outlines a summary of policy and compliance of the site to minimum requirements as outlined in the Government Sewerage Policy (DPLH, 2019a).

Table 4: Minimum requirements for all on-site wastewater disposal systems and design specific standards

Site Feature	Minimum Requirement	Requirement met
Separation from waterways	a wellhead protection zone or on Crown land within a reservoir protection zone; 100 metres of the high-water mark of a reservoir or 100 metres of any bore used for public drinking water supply where: — a wellhead protection zone or reservoir protection zone has not been assigned; or — where existing lots would be rendered undevelopable by the wellhead protection zone.	Yes The Subject Site is not located within the vicinity of a Priority Drinking Water Source Area (PDWSA) and associated wellheads. The nearest PDWSA is 1.4kms away being the South Coast Water Reserve and Limeburners Creek Catchment Area.
	30 metres of a private bore used for household/ drinking water purposes.	Yes There is one existing production bore on site, this bore will be decommissioned as part of development works. There are no other private production bores on site, any proposed production bores shall be located a minimum of 30m from the designated land application areas.
	100 metres of a waterway or significant wetland and not within a waterway foreshore area or wetland buffer. The separation distance should be measured outwards from the outer edge of riparian or wetland vegetation.	Yes The nearest waterway is Vancouver and Small Spring located approximately 65 and 40 metres from the Subject Site. The land application areas shall be located a minimum of 100m from the springs. Land application areas shall also be located 100m from the coastline.
	100 metres of a drainage system that discharges directly into a waterway or significant wetland without treatment.	Yes There are no additional drainage systems within 100m of the proposed development.
	Any area subject to inundation and/or flooding in a 10 per cent Annual Exceedance Probability (AEP) rainfall event.	Yes The Subject Site is situated between 14 and 28m AHD, with sufficient slope and is not subjected to flooding.
Separation from groundwater – outside of public drinking water source areas.	Where land is not within a public drinking water source area or a sewage sensitive area, the discharge point of the on-site sewage system should be located the following distances above the highest groundwater level: • for loams and heavy soils, at least 0.6 metres. • for gravels, at least one metre. • for sands, at least 1.5 metres. Where a nutrient retentive secondary treatment system is used, at least 0.6 metres.	Yes Site soil survey conducted by Landform Research in 2008 showed the highest known groundwater level is 6.8m BGL.

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Table 4 continued.

Site Feature	Minimum Requirement	Requirement met
Land Application Area	A land application area should be provided for all development in accordance with tables 2 and 3 of this schedule for the disposal of sewage.	Yes The proposed land application areas are shown in Figure 9 and have been calculated in accordance with the Government Sewerage Policy & AS/NZS 1547:2012. The land application areas are indicative only and should be confirmed upon final design of the development.
	The land application area includes the area restricted to the distribution of treated sewage only and should be kept free of any temporary or permanent structures.	Yes The proposed land application areas are a sufficient distance to areas that are utilized for activity or pedestrian traffic. The land application areas shall be placed in an area so that requirements are met. Site plan to be forwarded to CoA/DoH prior to approval.
	Activities within the land application area shall not interfere with the function of the current and future land application system and people should avoid potential contact with effluent residues. Unless allowed for in the design, the land application area) should: • not be built on or paved in a manner which precludes reasonable access; • not be subject to vehicular traffic (other than a pedestrian-controlled lawnmower); • not be subject to regular foot traffic such as pathways and clothes line areas; and • should be kept in a manner which enables servicing and maintenance of the disposal system.	Yes The proposed land application areas are a sufficient distance to areas that are utilized for activity or pedestrian traffic. The land application areas shall be placed in an area so that requirements are met. Site plan to be forwarded to CoA/DoH prior to approval.
Gradient of the land application area	Where slope exceeds one in five (1:5), the land application area should be engineered to prevent run-off from the land application area. Surface contours should be provided on the site plan.	Yes The proposed land application areas are situated on relatively flat land that does not exceed 1:5 gradient. Natural and finished gradients of land application areas shall not exceed 1:5 gradient. Site plan to be forwarded to CoA/DoH prior to approval.
Location of land application area within building envelope	Local government may approve the location of land application areas outside building envelopes where proposed location meets requirements outlined above.	Noted

6 Land Application Areas

Land application areas have been calculated for each accommodation type within the proposed development. Estimated land application areas for the proposed development are presented in Table 5 and shown in Figure 9.

Table 5: Estimated Land Application Areas for proposed development

Accommodation Type	Expected Maximum occupancy (No. of people at any given time)	Human waste hydraulic loading rates (L/person/day)	Estimated occupancy rate (%)	Conversion factor	Land Application Area (m^2)
Luxury holiday lodge consisting of 10-12 bedrooms	24	140	80	0.2	538
25 x single bedroom chalets	50	140	80	0.2	1,120
8 glamping tents	16	140	80	0.2	358
Signature café/restaurant with associated shop and reception	100	30	80	0.2	480
Day spa	8*	30	80	0.2	38
Manager's accommodation	2	150	100	0.2	60

*Assumed day spa visitors are also accommodation guests.

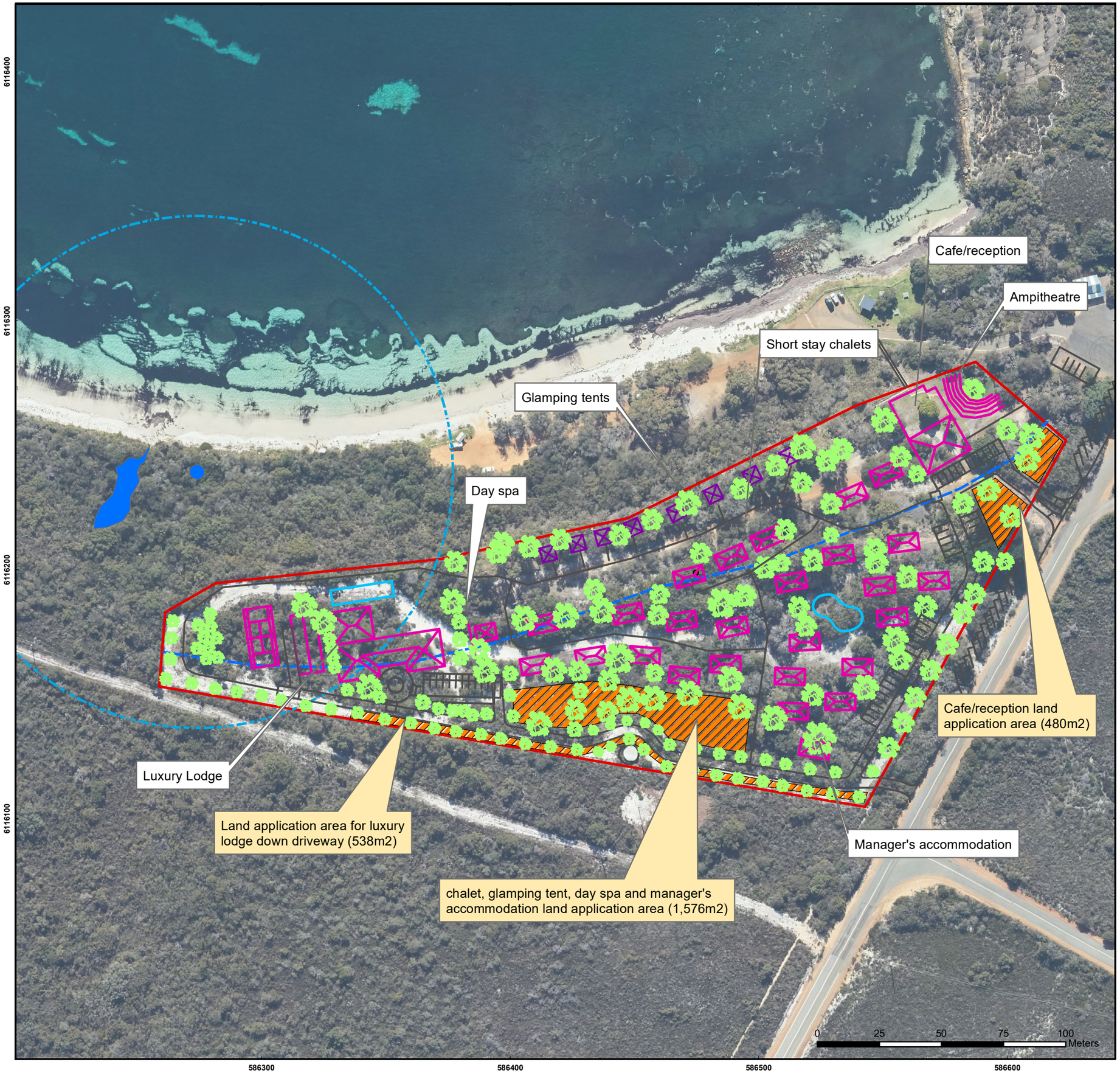
The location of the land application areas shown in Figure 9 are indicative only, the final location of the land application areas shall be confirmed during detailed design and shall be in accordance with the Government Sewerage Policy (DPLH, 2019a), and this Site Soil Evaluation and the effluent disposal system shall be installed in accordance with (AS)1547-2012.

The following assumptions were used to estimate the land application areas for the development:

- The human waste hydraulic loading rates (Table 5) used to calculate land application areas are derived from Regulation 29 and Schedule 9 of the Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974.
- The estimated occupancy rate used for the accommodation is 80% this takes into consideration that the holiday accommodation will not be at full capacity all the time, it is our understanding that this is a conservative value.
- The conversion factor used to estimate the land application area is derived from the Government Sewerage Policy (DPLH, 2019). This factor is based on the use of a secondary treatment system and the application of effluent water to Soil Category 1 – sand/gravel (as determined in Section 4: Soil Testing).

It is recommended a secondary treatment system be utilised for all effluent disposal systems installed as part of the proposed development due to the large scale of the development and its proximity to the Frenchman Bay foreshore area and Vancouver and Small Springs.

In summary on-site effluent disposal for the proposed development is achievable in accordance with the relevant guidelines with the use of a secondary treatment system. Land application area estimates will require revision given any proposed extensions or major changes to the development.

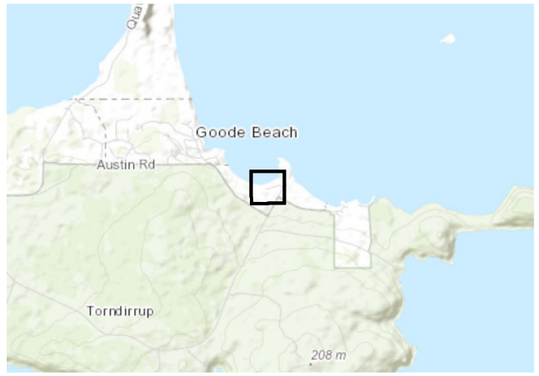


Albany Office:
29 Hercules Crescent
Albany, WA 6330
(08) 9842 1575

Denmark Office:
7/40 South Coast Highway
Denmark, WA 6333
(08) 9848 1309

Esperance Office:
2A/113 Dempster Street
Esperance, WA 6450

BIO DIVERSE SOLUTIONS



Overview Map Scale 1:100,000

Legend

- Subject Site
- Cadastre
- Vancouver and Small Springs
- 100m setback to springs
- 100m setback to coast line
- Indicative Land Application Area

Local Development Plan

- Buiding 1
- Building 2
- Glamping tents
- Car bays
- Carrage
- Pool
- Trees 1
- Trees 2

Scale
1:1,500 @ A3
GDA MGA 94 Zone 50

Data Sources
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT
Frenchman Bay Albany Pty Ltd
Lot 1 and 2 Frenchman Bay
Frenchman Bay, WA 6330

Indicative Land Application Areas

	QA Check	Drawn by
	KK	CC
STATUS: FINAL	FILE: MSC403	DATE: 22/03/2022

7 References

Australian Standard AS1547:2012 Onsite domestic wastewater management. Sai Global Licence to Bio Diverse Solutions, 2015.

Department of Health (2020) *Schedule 9 - Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974.*

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Department of Water and Environmental Regulation (2001) 1:250 000 *Hydrogeology Map Series*, Government of Western Australia.

Department of Water and Environmental Regulation (2001) *Public Drinking Water Source Areas (PDWSA) Mapping dataset*, Government of Western Australia. Accessed March 2022.

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Great Southern Geotechnics (2016) *Geotechnical Report Lot 1 and 2 Frenchman Bay Road Albany.* Unpublished report prepared for a Development Application.

Great Southern Geotechnics (2018) *Geotechnical Report Lot 1 and 2 Frenchman Bay Road Albany.* Unpublished report prepared for a Development Application.

Landform Research (2008) *Geotechnical Investigation Frenchman Bay, Albany.* Unpublished report prepared for a Development Application.

Appendix A

Site Soil Investigation – Great Southern Geotechnics (2016)

VERSION 1

OCTOBER 19, 2016

Great Southern GEOTECHNICS

GEOTECHNICAL INVESTIGATION

LOTS 1 & 2 FRENCHMAN BAY ROAD, ALBANY WA

PRESENTED BY: M.COFFEY

GREAT SOUTHERN GEOTECHNICS
5A 209 CHESTER PASS RD, ALBANY WA

ACN: 613 485 644 ABN: 77 613 485 644
Info@gsgeotechnics.com

Great Southern GEOTECHNICS

Explanatory Notes

COLOURS

BLACK - BROWN (bk)	BLUE (bl)	ORANGE (or)
BROWN (br)	BLUE – GREEN (bl/gr)	RED (rd)
GREY – BROWN (gy/br)	GREEN (gr)	RED – BROWN (rd/br)
GREY (gy)	YELLOW (yl)	PINK (pk)
BLUE – GREY (bl/gy)	YELLOW – BROWN (yl/br)	PURPLE (pr)

MOISTURE CONDITION OF SOIL

TERM	DESCRIPTION
Dry	Cohesive soils; hard and friable or powdery, well dry of plastic limit. Granular soils; cohesionless and free-running.
Moist	Soil feels cool, darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	Soil feels cool, darkened in colour. Cohesive soils usually weakened and free water forms on hands when handling. Granular soils tend to cohere and free water forms on hands when handling.

PARTICLE SHAPES

ANGULAR	SUB-ANGULAR	SUB-ROUNDED	ROUNDED




PARTICLE SIZES

BOULDERS	COBBLES	COARSE GRAVEL	MEDIUM GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
>200mm	63-200mm	20-63mm	6-20mm	2.36-6mm	0.6-2.36mm	0.2-0.6mm	0.075-0.2mm	0.002-0.075mm	<0.002mm

GRAIN SIZE

SOIL TYPE (ABBREV.)	CLAY (CL)	SILT (SI)	← SAND (SA) →		← GRAVEL (GR) →			COBBLES (CO)
SIZE	< 2µm	2–75µm	Fine 0.075-0.2mm	Medium 0.2-0.6mm	Coarse 0.6-2.36mm	Fine 2.36-6mm	Medium 6-20mm	Coarse 20-63mm	63-200mm
SHAPE & TEXTURE	Shiny	Dull	← angular or subangular or subrounded or rounded →						
FIELD GUIDE	Not visible under 10x	Visible under 10x	Visible by eye	Visible at < 1m	Visible at < 3m	Visible at < 5m	Road gravel	Rail ballast	Beaching

Great Southern GEOTECHNICS

Explanatory Notes

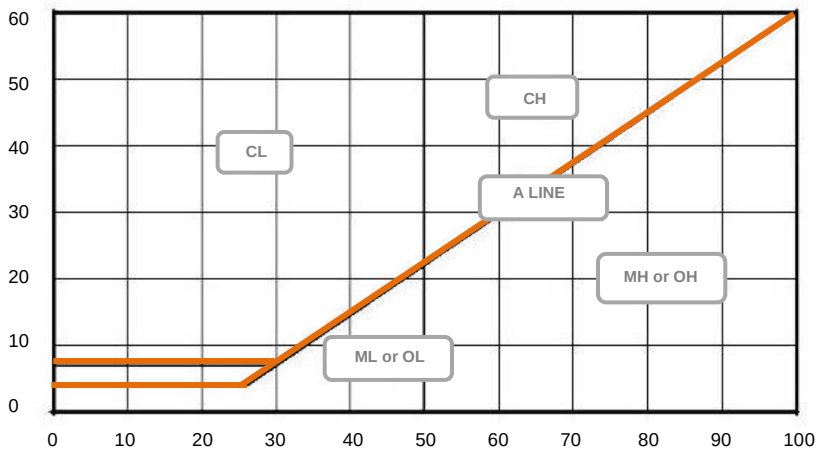
CLASSIFICATION CHART

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60mm and basing fractions on estimated mass)				GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% of material less than 63 mm is larger than 0.075 mm	GRAVELS More than 50% of coarse fraction is larger than 2.36mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	GP	Poorly Graded gravels and gravel-sand mixtures, little or no fines, uniform gravels
		GRAVELS WITH FINES (Appreciable amount of fines)	Dirty' materials with excess of non-plastic fines, zero to medium dry strength	GM	Silty gravels, gravel-sand-silt mixtures
			'Dirty' materials with excess of plastic fines, medium to high dry strength	GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction is smaller than 2.36mm	CLEAN SANDS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	SW	Well graded sands, gravelly sands, little or no fines
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength '	SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands
		SANDS WITH FINES (Appreciable amount of fines)	Dirty' materials with excess of non-plastic fines, zero to medium dry strength	SM	Silty sands, sand-silt mixtures
			'Dirty' materials with excess of plastic fines, medium to high dry strength	SC	Clayey sands, sand-clay mixtures

FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS <0.2mm					
		DRY STRENGTH	DILATANCY	TOUGHNESS		
	SILTS AND CLAYS Liquid limit less than 50	None to low	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with low plasticity. Silts of low to medium Liquid Limit.
		Medium to high	None to very slow	Medium	CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
		Low to medium	Slow	Low	OL	Organic silts and organic silt-clays of low to medium plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Low to medium	Slow to none	Low to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, silts of high Liquid Limit.
		High to very high	None	High	CH	Inorganic clays of high plasticity.
		Medium to high	None to very slow	Low to medium	OH	Organic clays of high plasticity
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture				Pt	Peat and other highly organic soils

PLASTICITY CHART

For laboratory classification of fine grained soils



Great Southern GEOTECHNICS

Explanatory Notes

PLASTICITY

DESCRIPTIVE TERM	OF LOW PLASTICITY	OF MEDIUM PLASTICITY	OF HIGH PLASTICITY
Range Of Liquid Limit (%)	≤ 35	> 35 ≤ 50	> 50

DESCRIPTION OF ORGANIC OR ARTIFICIAL MATERIALS

PREFERRED TERMS	SECONDARY DESCRIPTION
Organic Matter	Fibrous Peat/ Charcoal/ Wood Fragments/ Roots (greater than approximately 2mm diameter)/ Root Fibres (less than approximately 2mm diameter)
Waste Fill	Domestic Refuse/ Oil/ Bitumen/ Brickbats/ Concrete Rubble/ Fibrous Plaster/ Wood Pieces/ Wood Shavings/ Sawdust/ Iron Filings/ Drums/ Steel Bars/ Steel Scrap/ Bottles/ Broken Glass/ Leather

CONSISTENCY - Cohesive soils

TERM	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD
Symbol	VS	S	F	St	VSt	H
Undrained Shear Strength (kPa)	< 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
SPT (N) Blowcount	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	> 30
Field Guide	Exudes between the fingers when squeezed	Can be moulded by light finger pressure	Can be moulded by strong finger pressure	Cannot be moulded by fingers. Can be indented by thumb nail	Can be indented by thumb nail	Can be indented with difficulty with thumb nail

CONSISTENCY - Non-cohesive soils

TERM	VERY LOOSE	LOOSE	MEDIUM DENSE	DENSE	VERY DENSE	COMPACT
Symbol	VL	L	MD	D	VD	CO
SPT (N) Blowcount	0 - 4	4 - 10	10 - 30	30 - 50	50 - 100	> 50/150 mm
Density Index (%)	< 15	15 - 35	35 - 65	65 - 85	85 - 95	> 95
Field Guide	Ravels	Shovels easily	Shovelling very difficult	Pick required	Pick difficult	Cannot be picked

MINOR COMPONENTS

TERM	TRACE	WITH
% Minor Component Field Guide	Coarse grained soils: < 5% Fine grained soils: <15% Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary components	Coarse grained soils: 5 – 12% Fine grained soils: 15 – 30% Presence easily detectable by feel or eye, soil properties little different to general properties of primary component

Great Southern GEOTECHNICS

Explanatory Notes

GEOLOGICAL ORIGIN

	TYPE	DETAILS
TRANSPORTED SOILS	Aeolian Soils	Deposited by wind
	Alluvial Soils	Deposited by streams and rivers
	Colluvial Soils	Deposited on slopes
	Lacustrine Soils	Deposited by lakes
	Marine Soils	Deposited in ocean, bays, beaches and estuaries
FILL MATERIALS	Soil Fill	Describe soil type, UCS symbol and add 'FILL'
	Rock Fill	Rock type, degree of weathering, and word 'FILL'.
	Domestic Fill	Percent soil or rock, whether pretrucible or not.
	Industrial Fill	Percent soil, whether contaminated, particle size & type of waste product, i.e. brick, concrete, metal

STRENGTH OF ROCK MATERIAL

TERM	SYMBOL	IS(50)	(MPA)	FIELD GUIDE TO STRENGTH
Extremely Low	EL	≤0.03		Easily remoulded by hand to a material with soil properties.
Very Low	VL	>0.03	≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxle sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low	L	>0.1	≤0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	>0.3	≤1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	H	>1	≤3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	VH	>3	≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High	EH	>10		Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

ROCK MATERIAL WEATHERING CLASSIFICATION

TERM	SYMBOL	DEFINITION
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported
Extremely Weathered Rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water.
Distinctly Weathered Rock	DW	Rock strength usually changed by weathering. Rock may be highly discoloured, usually be ironstaining. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	FR	Rock shows no sign of decomposition or staining.

5a 209 Chester Pass Rd, Albany WA 6330
ACN: 613 485 644 ABN: 77 613 485 644

Test Pit Report

Email: Info@gsgeotechnics.com
Mobile: 040 790 3297

Great Southern GEOTECHNICS	Report No. 006/1	Job No. 006	Sheet 1 of 6
Client: Bio Diverese Solutions Project: Frenchman Bay Retreat Project No. N/a	Location / Road: Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay. Test Pit No. **TP1**		

Excavation Method : Excavation	Target Depth (mm) 1800mm	Sample No.	16G035
Equipment type: 301.4C Mini Hydraulic Excavator Bucket width 300mm	Date Commenced: 30/09/2016	GPS Reference	
Operator/Contractor: Great Southern Geotechnics	Date Completed: 30/09/2016	E	117˚56'57.66
Excavation Dimensions:	Logged By: M.Coffey	S	35˚5'34.35
Length 1.6 (m) Width 0.35 (m)	Checked By: M.Coffey	Elevation	-

Depth (mm) / Material Description SOIL TYPE, Placticity, Colour, Particle characteristics, Secondary and other minor components	Depth (m)	RL (m)	Graphic Log	Moist. Condition	Consistency/ Strength	Cementation	Weathering (Rock)	$Is_{(50)}$ (MPa)	Water Level	Classification Symbol	Sample/Test	Comments
0 - 500 **SAND with silt:** Dark grey to grey, fine to medium grained, roots and root fibres.	0.5			M							0.5	
500 - 1800 **SAND with silt**: Light grey to white, fine to medium grained.	1.0 1.5			M							1.0 1.5	water level not encountered
	2.0 2.5										2.0 2.5	

Materials Consistency/Strength

Cohesive	NonCohesive	Rock
VS - Very Soft	VL - Very Loose	EL - Extremely Low
S - Soft	L - Loose	VL - Very Low
F - Firm	MD - Medium Dense	L - Low
St - Stiff	D - Dense	M - Medium
VSt - Very Stiff	VD - Very Dense	H - High
H - Hard		VH - Very High
		EH - Extremely High

Sample / Test

Ux - Undist. Tube Sample
D - Disturbed Sample
R - Rock Sample
DCP - Dynamic Cone Pen.
P - Pocket Penetrometer
PSP - Perth Sand Penet.
Is (50) - Point load Index

Pit Terminated at: ✓ or × (mm) below ground level

Target Depth	✓	1800
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Water

▼ Water first Encountered

Cementation

IN - Indurated
PC - Poorly Cemented
MC - moderately Cemented
WC - Well Cemented

Method of Excavation

N - Natural Exposure
H - Hand
E - Existing Excavation
BH - Backhoe Bucket
BHE - Excavator
B - Bulldozer Blade

Weathering

RS - Residual Soil
XW - Extremely Weathered
DW - Distinctly Weathered
SW - Slightly Weathered
FRST - Fresh with Stained Surfaces
FR - Fresh

Moisture

D - Dry M - Moist W - Wet

General

N/A - Not Applicable
N/D - Not Determined
PASS - Potential Acid Sulfate Soils

5a 209 Chester Pass Rd, Albany WA 6330
ACN: 613 485 644 ABN: 77 613 485 644

Test Pit Report

Email: Info@gsgeotechnics.com
Mobile: 040 790 3297

Great Southern GEOTECHNICS	Report No. 006/1	Job No. 006	Sheet 2 of 6
Client: Bio Diverese Solutions Project: Frenchman Bay Retreat Project No. N/a	Location / Road: Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay. Test Pit No. **TP2**		

Excavation Method : Excavation	Target Depth (mm) 1800mm	Sample No.	16G036
Equipment type: 301.4C Mini Hydraulic Excavator Bucket width 300mm	Date Commenced: 30/09/2016	GPS Reference	
Operator/Contractor: Great Southern Geotechnics	Date Completed: 30/09/2016	E	117°56'56.12
Excavation Dimensions:	Logged By: M.Coffey	S	35°5'35.03
Length 1.6 (m) Width 0.35 (m)	Checked By: M.Coffey	Elevation	-

Depth (mm) / Material Description (SOIL TYPE, Placticity, Colour, Particle characteristics, Secondary and other minor components)	Depth (m)	RL (m)	Graphic Log	Moist. Condition	Consistency/ Strength	Cementation	Weathering (Rock)	Is(50) (MPa)	Water Level	Classification Symbol	Sample/Test	Comments
0 -300 **Sandy GRAVEL:** Brown, fine to medium gravel, sub-rounded to sub angular, fine to medium grained sand, roots and root fibres	0.5			M							0.5	
300 - 800 **SAND with silt:** Dark grey to grey, fine to medium grained, roots and root fibres.	1.0			M							1.0	Water level not encountered.
800 - 1800 **SAND with silt: G**rey to light grey/white, fine to medium grained.	1.5										1.5	
	2.0										2.0	
	2.5										2.5	

Materials Consistency/Strength		
Cohesive	**NonCohesive**	**Rock**
VS - Very Soft	VL - Very Loose	EL - Extremely Low
S - Soft	L - Loose	VL - Very Low
F - Firm	MD - Medium Dense	L - Low
St - Stiff	D - Dense	M - Medium
VSt - Very Stiff	VD - Very Dense	H - High
H - Hard		VH - Very High
		EH - Extremely High

Sample / Test
Ux - Undist. Tube Sample
D - Disturbed Sample
R - Rock Sample
DCP - Dynamic Cone Pen.
P - Pocket Penetrometer
PSP - Perth Sand Penet.
Is (50) - Point load Index

Pit Terminated at:	✓ or ×	(mm) below ground level
Target Depth	✓	1800
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Cementation	Method of Excavation	Weathering
IN - Indurated	N - Natural Exposure	RS - Residual Soil
PC - Poorly Cemented	H - Hand	XW - Extremely Weathered
MC - moderately Cemented	E - Existing Excavation	DW - Distinctly Weathered
WC - Well Cemented	BH - Backhoe Bucket	SW - Slightly Weathered
	BHE - Excavator	FRST - Fresh with Stained Surfaces
	B - Bulldozer Blade	FR - Fresh

Water

▼ Water first Encountered

Moisture

D - Dry M - Moist W - Wet

General

N/A - Not Applicable
N/D - Not Determined
PASS - Potential Acid Sulfate Soils

5a 209 Chester Pass Rd, Albany WA 6330
ACN: 613 485 644 ABN: 77 613 485 644

Test Pit Report

Email: Info@gsgeotechnics.com
Mobile: 040 790 3297

Great Southern GEOTECHNICS	Report No. 006/1	Job No. 006	Sheet 3 of 6
Client: Bio Diverese Solutions Project: Frenchman Bay Retreat Project No. N/a	Location / Road: Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay. Test Pit No. **TP3**		

Excavation Method : Excavation	Target Depth (mm) 1800mm	Sample No.	16G037
Equipment type: 301.4C Mini Hydraulic Excavator Bucket width 300mm	Date Commenced: 30/09/2016		GPS Reference
Operator/Contractor: Great Southern Geotechnics	Date Completed: 30/09/2016	E	117°56'54.99
Excavation Dimensions:	Logged By: M.Coffey	S	35°5'35.47
Length 1.6 (m) Width 0.35 (m)	Checked By: M.Coffey	Elevation	-

Depth (mm) / Material Description (SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components)	Depth (m)	RL (m)	Graphic Log	Moist. Condition	Consistency/ Strength	Cementation	Weathering (Rock)	$Is_{(50)}$ (MPa)	Water Level	Classification Symbol	Sample/Test	Comments
0 - 300 **SAND with gravel:** Brown/grey, fine to medium grained sand, fine to medium grained grave, .sub-rounded to sub-angular, roots and root fibres	0.5			M							0.5	Roots noted down to 1000mm
300 - 1800 **SAND with silt:** light grey to white, fine to medium grained, roots and root fibres	1.0			M							1.0	
	1.5										1.5	Water level not encountered
	2.0										2.0	
	2.5										2.5	

Materials Consistency/Strength			Sample / Test
Cohesive	**NonCohesive**	**Rock**	
VS - Very Soft	VL - Very Loose	EL - Extremely Low	Ux - Undist. Tube Sample
S - Soft	L - Loose	VL - Very Low	D - Disturbed Sample
F - Firm	MD - Medium Dense	L - Low	R - Rock Sample
St - Stiff	D - Dense	M - Medium	DCP - Dynamic Cone Pen.
VSt - Very Stiff	VD - Very Dense	H - High	P - Pocket Penetrometer
H - Hard		VH - Very High	PSP - Perth Sand Penet.
		EH - Extremely High	Is (50) - Point load Index

Pit Terminated at:	✓ or ×	(mm) below ground level
Target Depth	✓	1800
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Cementation	Method of Excavation	Weathering
IN - Indurated	N - Natural Exposure	RS - Residual Soil
PC - Poorly Cemented	H - Hand	XW - Extremely Weathered
MC - moderately Cemented	E - Existing Excavation	DW - Distinctly Weathered
WC - Well Cemented	BH - Backhoe Bucket	SW - Slightly Weathered
	BHE - Excavator	FRST - Fresh with Stained Surfaces
	B - Bulldozer Blade	FR - Fresh

Water

▼ Water first Encountered

Moisture

D - Dry M - Moist W - Wet

General

N/A - Not Applicable
N/D - Not Determined
PASS - Potential Acid Sulfate Soils

5a 209 Chester Pass Rd, Albany WA 6330
ACN: 613 485 644 ABN: 77 613 485 644

Test Pit Report

Email: Info@gsgeotechnics.com
Mobile: 040 790 3297

Great Southern GEOTECHNICS	Report No. 006/1	Job No. 006	Sheet 4 of 6

Client: Bio Diverese Solutions	Location / Road: Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay.		
Project: Frenchman Bay Retreat			
Project No. N/a	Test Pit No. **TP4**		
Excavation Method : Excavation	Target Depth (mm) 1800mm	Sample No.	16G038
Equipment type: 301.4C Mini Hydraulic Excavator	Date Commenced:	30/09/2016	GPS Reference
Bucket width 300mm	Date Completed:	30/09/2016	E 117˚56'53.81
Operator/Contractor: Great Southern Geotechnics	Logged By:	M.Coffey	S 35˚5'35.73
Excavation Dimensions:	Checked By:	M.Coffey	Elevation
Length 1.6 (m) Width 0.35 (m)			-

Depth (mm) / Material Description (SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components)	Depth (m)	RL (m)	Graphic Log	Moist. Condition	Consistency/ Strength	Cementation	Weathering (Rock)	$Is_{(50)}$ (MPa)	Water Level	Classification Symbol	Sample/Test	Comments
0 - 600 **SAND with silt:** Dark grey to grey, fine to medium grained, roots and root fibres.	0.5			M							0.5	
600 - 1800 **SAND with silt:** Dark grey to grey, fine to medium grained.	1.0 1.5			M							1.0 1.5	Water level not encountered
1800 - 1900 **SAND with silt:** Light grey/light brown, fine to medium grained with pockets of dark brown fine to medium grained, cemented SAND.	2.0 2.5			M		PC					2.0 2.5	

Materials Consistency/Strength			Sample / Test
Cohesive	**NonCohesive**	**Rock**	
VS - Very Soft	VL - Very Loose	EL - Extremely Low	Ux - Undist. Tube Sample
S - Soft	L - Loose	VL - Very Low	D - Disturbed Sample
F - Firm	MD - Medium Dense	L - Low	R - Rock Sample
St - Stiff	D - Dense	M - Medium	DCP - Dynamic Cone Pen.
VSt - Very Stiff	VD - Very Dense	H - High	P - Pocket Penetrometer
H - Hard		VH - Very High	PSP - Perth Sand Penet.
		EH - Extremely High	Is (50) - Point load Index

Pit Terminated at:	✓ or ×	(mm) below ground level
Target Depth	✓	1800
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Cementation	Method of Excavation	Weathering
IN - Indurated	N - Natural Exposure	RS - Residual Soil
PC - Poorly Cemented	H - Hand	XW - Extremely Weathered
MC - moderately Cemented	E - Existing Excavation	DW - Distinctly Weathered
WC - Well Cemented	BH - Backhoe Bucket	SW - Slightly Weathered
	BHE - Excavator	FRST - Fresh with Stained Surfaces
	B - Bulldozer Blade	FR - Fresh

Water

▼ Water first Encountered

Moisture

D - Dry M - Moist W - Wet

General

N/A - Not Applicable
N/D - Not Determined
PASS - Potential Acid Sulfate Soils

5a 209 Chester Pass Rd, Albany WA 6330
ACN: 613 485 644 ABN: 77 613 485 644

Test Pit Report

Email: Info@gsgeotechnics.com
Mobile: 040 790 3297

Great Southern GEOTECHNICS	Report No. 006/1	Job No. 006	Sheet 5 of 6

Client: Bio Diverese Solutions
Project: Frenchman Bay Retreat
Project No. N/a

Location / Road: Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay.

Test Pit No. **TP5**

Excavation Method : Excavation
Equipment type: 301.4C Mini Hydraulic Excavator
Bucket width 300mm
Operator/Contractor: Great Southern Geotechnics
Excavation Dimensions:
Length 1.6 (m) Width 0.35 (m)

Target Depth (mm) 1800mm

Sample No. 16G039

Date Commenced: 30/09/2016
Date Completed: 30/09/2016
Logged By: M.Coffey
Checked By: M.Coffey

GPS Reference
E 117˚56'52.42
S 35˚5'36.08
Elevation -

Depth (mm) / Material Description (SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components)	Depth (m)	RL (m)	Graphic Log	Moist. Condition	Consistency/ Strength	Cementation	Weathering (Rock)	$Is_{(50)}$ (MPa)	Water Level	Classification Symbol	Sample/Test	Comments
				M								
0 - 200 **Sandy GRAVEL:** Grey/brown, fine to medium gravel, sub-rounded to sub-rounded, fine to medium grained sand, roots and root fibres	0.5			M							0.5	Roots and root fibres noted down to 350mm
200 - 1200 **SAND with silt**: Light grey/white, fine to medium grained.	1.0										1.0	
1200 - 1800 **SAND with silt**: Light brown/yellow, fine to medium grained, mottled dark brown fine to medium grained, cemented SAND with silt.	1.5			M		PC					1.5	Water level not encountered
	2.0										2.0	
	2.5										2.5	

Materials Consistency/Strength

Cohesive	NonCohesive	Rock
VS - Very Soft	VL - Very Loose	EL - Extremely Low
S - Soft	L - Loose	VL - Very Low
F - Firm	MD - Medium Dense	L - Low
St - Stiff	D - Dense	M - Medium
VSt - Very Stiff	VD - Very Dense	H - High
H - Hard		VH - Very High
		EH - Extremely High

Sample / Test

Ux - Undist. Tube Sample
D - Disturbed Sample
R - Rock Sample
DCP - Dynamic Cone Pen.
P - Pocket Penetrometer
PSP - Perth Sand Penet.
Is (50) - Point load Index

Pit Terminated at: ✓ or × (mm) below ground level

	✓ or ×	(mm) below ground level
Target Depth	✓	1800
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Water
Water first Encountered

Cementation
IN - Indurated
PC - Poorly Cemented
MC - moderately Cemented
WC - Well Cemented

Method of Excavation
N - Natural Exposure
H - Hand
E - Existing Excavation
BH - Backhoe Bucket
BHE - Excavator
B - Bulldozer Blade

Weathering
RS - Residual Soil
XW - Extremely Weathered
DW - Distinctly Weathered
SW - Slightly Weathered
FRST - Fresh with Stained Surfaces
FR - Fresh

Moisture
D - Dry M - Moist W - Wet

General
N/A - Not Applicable
N/D - Not Determined
PASS - Potential Acid Sulfate Soils

5a 209 Chester Pass Rd, Albany WA 6330
ACN: 613 485 644 ABN: 77 613 485 644

Test Pit Report

Email: Info@gsgeotechnics.com
Mobile: 040 790 3297

Great Southern GEOTECHNICS	Report No. 006/1	Job No. 006	Sheet 6 of 6
Client: Bio Diverese Solutions Project: Frenchman Bay Retreat Project No. N/a	Location / Road: Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay. Test Pit No. **TP6**		

Excavation Method : Excavation	Target Depth (mm) 1800mm	Sample No.	16G040
Equipment type: 301.4C Mini Hydraulic Excavator Bucket width 300mm	Date Commenced: 30/09/2016		GPS Reference
Operator/Contractor: Great Southern Geotechnics	Date Completed: 30/09/2016		E 117°56'51.09
Excavation Dimensions:	Logged By: M.Coffey		S 35°5'36.63
Length 1.6 (m) Width 0.35 (m)	Checked By: M.Coffey		Elevation -

Depth (mm) / Material Description (SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components)	Depth (m)	RL (m)	Graphic Log	Moist. Condition	Consistency/ Strength	Cementation	Weathering (Rock)	Is(50) (MPa)	Water Level	Classification Symbol	Sample/Test	Comments
0 - 1200 **SAND with silt:** light grey, fine to medium grained, roots and root fibres	0.5 1.0			M							0.5 1.0	Roots and root fibres noted down to 500mm
1200 - 1800 **SAND with silt:** Light brown/yellow, fine to medium grained, mottled dark brown fine to medium grained, cemented SAND with silt.	1.5			M		PC					1.5	Water level not encountered
	2.0 2.5										2.0 2.5	

Materials Consistency/Strength			Sample / Test
Cohesive	**NonCohesive**	**Rock**	
VS - Very Soft	VL - Very Loose	EL - Extremely Low	Ux - Undist. Tube Sample
S - Soft	L - Loose	VL - Very Low	D - Disturbed Sample
F - Firm	MD - Medium Dense	L - Low	R - Rock Sample
St - Stiff	D - Dense	M - Medium	DCP - Dynamic Cone Pen.
VSt - Very Stiff	VD - Very Dense	H - High	P - Pocket Penetrometer
H - Hard		VH - Very High	PSP - Perth Sand Penet.
		EH - Extremely High	Is (50) - Point load Index

Pit Terminated at:	✓ or ×	(mm) below ground level
Target Depth	✓	1800
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Cementation	Method of Excavation	Weathering
IN - Indurated	N - Natural Exposure	RS - Residual Soil
PC - Poorly Cemented	H - Hand	XW - Extremely Weathered
MC - moderately Cemented	E - Existing Excavation	DW - Distinctly Weathered
WC - Well Cemented	BH - Backhoe Bucket	SW - Slightly Weathered
	BHE - Excavator	FRST - Fresh with Stained Surfaces
	B - Bulldozer Blade	FR - Fresh

Water

▼ Water first Encountered

Moisture

D - Dry M - Moist W - Wet

General

N/A - Not Applicable
N/D - Not Determined
PASS - Potential Acid Sulfate Soils

Fieldwork

The fieldwork was carried out on September 30, 2016 and comprised the following:
Six (6) test pits excavated with a 301.4C Mini Hydraulic Excavator using a 300mm wide bucket to depths of 1.8 m to visually assess subsurface conditions and obtain samples for laboratory testing.
The approximate test locations are shown on **Figure 2.**

301.4C Mini Hydraulic Excavator

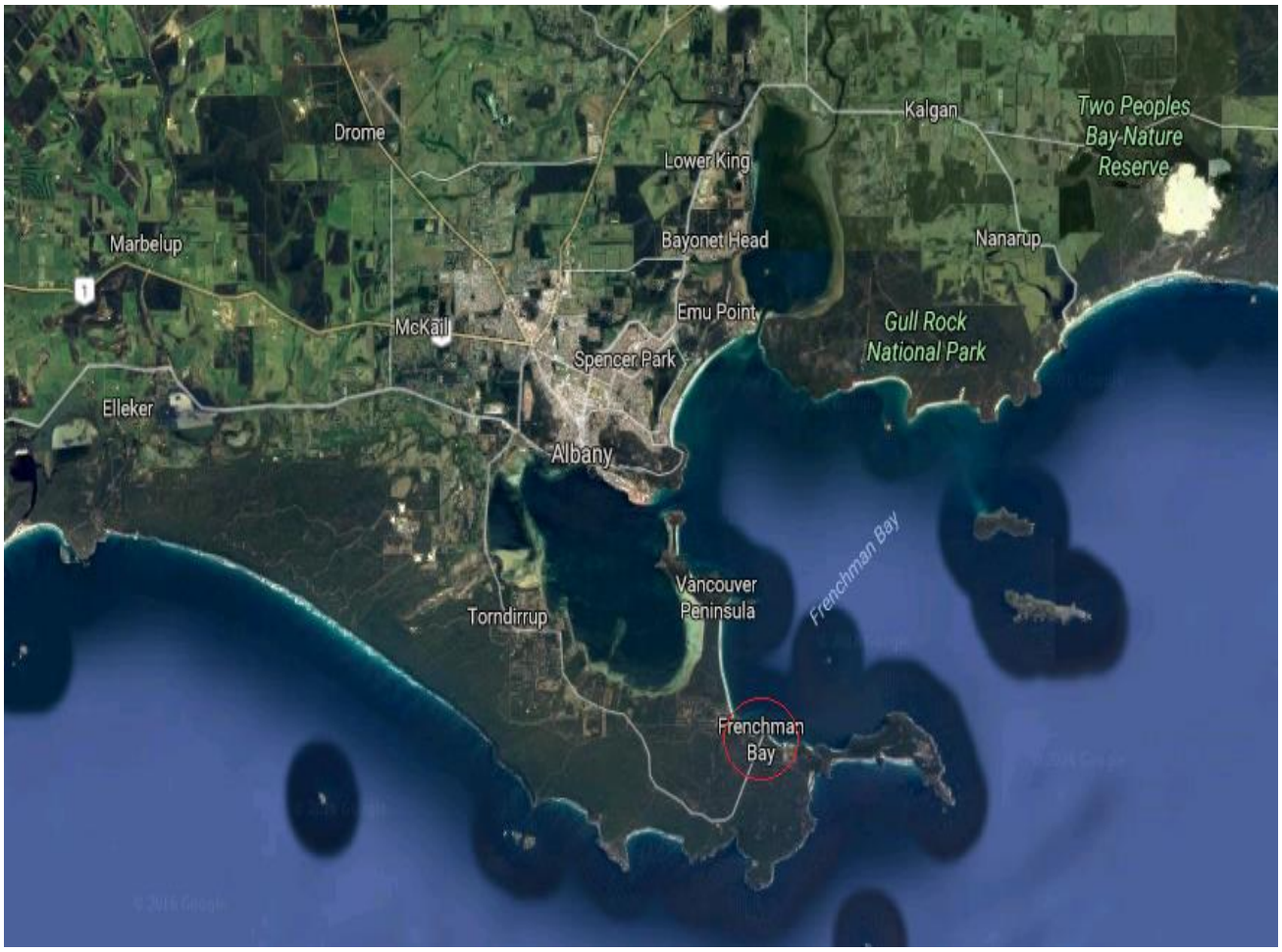


Figure 1 - Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay

Figure 2 - Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay

Great Southern GEOTECHNICS

Job No: 006 **Test Pit No:** **TP1 to TP6**
Client: Bio Diverese Solutions
Project: Proposed Frenchman Bay Retreat - Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay

Test Pit No. 1 Spoil

Test Pit No. 1 Excavation

Test Pit No. 2 Spoil

Test Pit No. 2 Excavation

Test Pit No. 3 Spoil

Test Pit No. 3 Excavation

Great Southern GEOTECHNICS

Job No: 006 **Test Pit No:** **TP3**

Client: Bio Diverese Solutions

Project: Proposed Frenchman Bay Retreat - Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay

Test Pit No. 4 Spoil

Test Pit No. 4 Excavation

Test Pit No. 5 Spoil

Test Pit No. 5 Excavation

Great Southern GEOTECHNICS

Job No: 006 **Test Pit No:** **TP5**

Client: Bio Diverese Solutions

Project: Proposed Frenchman Bay Retreat - Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay

Test Pit No. 6 Spoil

Test Pit No. 6 Excavation

Great Southern GEOTECHNICS

Job No: 006 **Test Pit No:** **TP6**

Client: Bio Diverese Solutions

Project: Proposed Frenchman Bay Retreat - Lots 1 & 2 Frenchman Bay Rd, Frenchman Bay

5a 209 Chester Pass Road, Albany WA 6330
ACN: 613 485 644 ABN: 77 613 485 644

Great Southern GEOTECHNICS

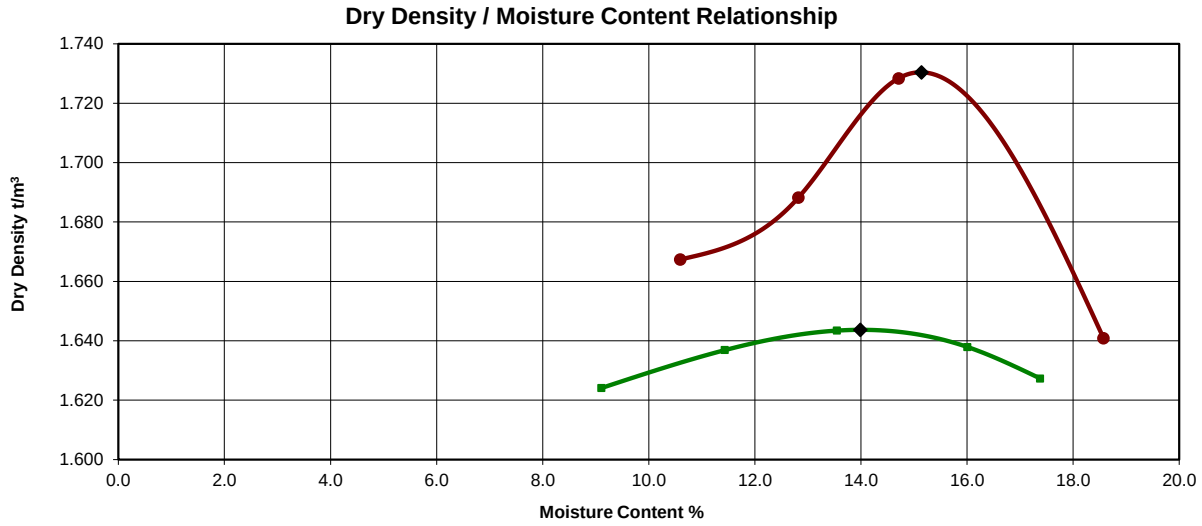
Email: Info@gsgeotechnics.com
Mobile: 040 790 3297

Dry Density/Moisture Content Relationship Test Report

Job No. 006
Client: Bio Diverese Solutions
Project: Lots 1 & 2 Frenchman Bay Road Albany WA

Report No. 006/1
Sheet 1 of 1

Sample No.	Sample Location	Field Description
16G041	Test Pit 1	SAND with silt
16G042	Test Pit 6	SAND with silt



Sample Number		16G041 ●	16G042 ●	●
Depth		0mm to 500mm	0mm to 1200mm	
Stabiliser Used				
Stabiliser Added %				
Curing Period	Water (Days)	0.00	0.00	
	Stabiliser (Hrs)			
Moisture Content Method used		AS 1289.2.1.1	AS 1289.2.1.1	
Sampling Method		AS 1289.1.2.1 Proc 6.5	AS 1289.1.2.1 Proc 6.5	
Date Sampled		30/09/2016	30/09/2016	
Date Received		30/09/2016	30/09/2016	
Date Tested		4/09/2016	4/09/2016	
Test Method		AS 1289.5.2.1	AS 1289.5.2.1	
Maximum Dry Density t/m^3		**1.73**	**1.64**	
Optimum Moisture Content %		**15.0**	**14.0**	
Adjusted Maximum Dry Density t/m3				
Adjusted Optimum Moisture Content %				
Percentage Retained %	37.5 mm	**0**	**0**	
Percentage Retained %	19.0 mm	**0**	**0**	

Comments: N/a

Distribution: Laboratory File / Kath Kinnear - Bio Diverse Solutions

Approved Signatory:

Name: M.Coffey
Function: Laboratory Manager
Date: 5/10/2016

Liquid Labs WA
Unit 4/96 Briggs Street
Welshpool, WA 6106
Perth Australia

Falling Head Permeability Report — Test Method: AS 1289.6.7.2

Client:	Great Southern Geotechnics	**Ticket No:**	S149
Project:	Lots 1 & 2 Frenchman Bay Road (Bio Diverse Solutions)	**Report No:**	LL16/538 _1
Location:	Albany, WA	**Sample No:**	LL16/538
Sample ID:	16G041 - TP1 0mm - 500mm	**Issue Date:**	17-October-2016

Sampling Procedure: Tested as Received

Laboratory Moisture Ratio (%)	97.5
Laboratory Density Ratio (%)	95.0
Compactive Effort	Modified
Hydraulic Gradient	N/A
Surcharge (kPa)	3
% Retained on 19mm Sieve	0
Coefficient of Permeability (m / sec)	2.2×10^{-6}

Client Address: 5a 209 Chester Pass Road, Albany WA 6330

Comments: MMDD/OMC supplied by client

Approved Signature:
Name: Matt van Herk
Function: Laboratory Manager
Date: 17-October-2016

Liquid Labs WA
Unit 4/96 Briggs Street
Welshpool, WA 6106
Perth Australia

Constant Head Permeability Report — Test Method: AS 1289.6.7.1

Client:	Great Southern Geotechnics	**Ticket No:**	S149
Project:	Lots 1 & 2 Frenchman Bay Road (Bio Diverse Solutions)	**Report No:**	LL16/539 _1
Location:	Albany, WA	**Sample No:**	LL16/539
Sample ID:	16G042 - TP6 0mm - 1200mm	**Issue Date:**	17-October-2016

Sampling Procedure: Tested as Received

Laboratory Moisture Ratio (%)	101.0
Laboratory Density Ratio (%)	95.0
Compactive Effort	Modified
Hydraulic Gradient	0.6
Surcharge (kPa)	3
% Retained on 19mm Sieve	0
Coefficient of Permeability (m / sec)	5.7×10^{-5}

Client Address: 5a 209 Chester Pass Road, Albany WA 6330

Comments: MMDD/OMC supplied by client

Approved Signature:
Name: Matt van Herk
Function: Laboratory Manager
Date: 17-October-2016

Customer Bio Diverse Solutions
Job Kathryn Kinnear
Date Rec'd 6/10/2016

Lots 1 & 2 Frenchman Bay Road, Albany WA

Lab Number	Name	Code	Customer	Depth (mm)	Phosphorus Retention Index
2TS16095	Pit 1	Job#2 - MSC125	Frenchman Bay Retreat	0-500	0.1
2TS16096	Pit 6	Job#2 - MSC125	Frenchman Bay Retreat	0-1200	0.7

Appendix B

Site Soil Investigation – Great Southern Geotechnics (2018)

VERSION 1

Report No 302/1

APRIL 11, 2018

Great Southern GEOTECHNICS

SITE INVESTIGATION

Bio Diverse Solutions

Lots 1 & 2 Frenchman Bay Rd, Albany WA 6330

PRESENTED BY: M.COFFEY

GREAT SOUTHERN GEOTECHNICS
5A 209 CHESTER PASS RD, ALBANY WA

ACN: 613 485 644 ABN: 77 613 485 644
Info@gsgeotechnics.com

1.0 INTRODUCTION

As authorised by Kathryn Kinnear of Bio Diverse Solutions, a site investigation for the proposed development at Lots 1 & 2 Frenchman Bay Rd, Albany WA 6330A 6324 was preformed on the 22nd of March, 2017.

2.0 GENERAL

This purpose of the investigation was to determine the following:

- Surface site conditions
- Subsurface soil profiles
- Depth of ground water tables .
- Permeability rates of soils encountered .

3.0 SITE INVESTIGATION

Site conditions and Test pit locations were recorded and are shown in Appendix 1

The field investigation consisted of six test pits excavated on-site to depths of up to 2.0m using a Kubota KX41-3V Mini Excavator with a 300mm wide Hydraulic open flight auger attachment.

All soil layers encountered were visually assessed and classified on-site

The subsurface soil profiles are shown on the Test pit logs located in Appendix 1

IMPORTANT NOTE: We have endeavoured to locate the test pits so that they are representative of the subsurface materials across the site. However, soil conditions may change dramatically over short distances and our investigations may not locate all soil variations across the site.

Great Southern GEOTECHNICS

Explanatory Notes

COLOURS

BLACK - BROWN (bk)	BLUE (bl)	ORANGE (or)
BROWN (br)	BLUE - GREEN (bl/gr)	RED (rd)
GREY - BROWN (gy/br)	GREEN (gr)	RED - BROWN (rd/br)
GREY (gy)	YELLOW (yl)	PINK (pk)
BLUE - GREY (bl/gy)	YELLOW - BROWN (yl/br)	PURPLE (pr)

MOISTURE CONDITION OF SOIL

TERM	DESCRIPTION
Dry	Cohesive soils; hard and friable or powdery, well dry of plastic limit. Granular soils; cohesionless and free-running.
Moist	Soil feels cool, darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	Soil feels cool, darkened in colour. Cohesive soils usually weakened and free water forms on hands when handling. Granular soils tend to cohere and free water forms on hands when handling.

PARTICLE SHAPES

ANGULAR	SUB-ANGULAR	SUB-ROUNDED	ROUNDED

PARTICLE SIZES

BOULDERS	COBBLES	COARSE GRAVEL	MEDIUM GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
>200mm	63-200mm	20-63mm	6-20mm	2.36-6mm	0.6-2.36mm	0.2-0.6mm	0.075-0.2mm	0.002-0.075mm	<0.002mm

GRAIN SIZE

SOIL TYPE (ABBREV.)	CLAY (CL)	SILT (SI)	← SAND (SA) →		← GRAVEL (GR) →			COBBLES (CO)
SIZE	< 2µm	2-75µm	Fine 0.075-0.2mm	Medium 0.2-0.6mm	Coarse 0.6-2.36mm	Fine 2.36-6mm	Medium 6-20mm	Coarse 20-63mm	63-200mm
SHAPE & TEXTURE	Shiny	Dull	← angular or subangular or subrounded or rounded →						
FIELD GUIDE	Not visible under 10x	Visible under 10x	Visible by eye	Visible at < 1m	Visible at < 3m	Visible at < 5m	Road gravel	Rail ballast	Beaching

Great Southern GEOTECHNICS

Explanatory Notes

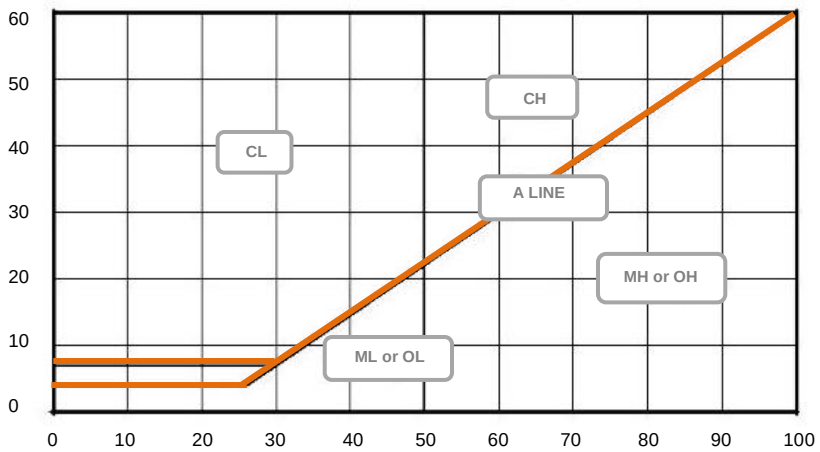
CLASSIFICATION CHART

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60mm and basing fractions on estimated mass)				GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% of material less than 63 mm is larger than 0.075 mm	GRAVELS More than 50% of coarse fraction is larger than 2.36mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	GP	Poorly Graded gravels and gravel-sand mixtures, little or no fines, uniform gravels
		GRAVELS WITH FINES (Appreciable amount of fines)	Dirty' materials with excess of non-plastic fines, zero to medium dry strength	GM	Silty gravels, gravel-sand-silt mixtures
			'Dirty' materials with excess of plastic fines, medium to high dry strength	GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction is smaller than 2.36mm	CLEAN SANDS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	SW	Well graded sands, gravelly sands, little or no fines
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength '	SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands
		SANDS WITH FINES (Appreciable amount of fines)	Dirty' materials with excess of non-plastic fines, zero to medium dry strength	SM	Silty sands, sand-silt mixtures
			'Dirty' materials with excess of plastic fines, medium to high dry strength	SC	Clayey sands, sand-clay mixtures

FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS <0.2mm					
		DRY STRENGTH	DILATANCY	TOUGHNESS		
	SILTS AND CLAYS Liquid limit less than 50	None to low	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with low plasticity. Silts of low to medium Liquid Limit.
		Medium to high	None to very slow	Medium	CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
		Low to medium	Slow	Low	OL	Organic silts and organic silt-clays of low to medium plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Low to medium	Slow to none	Low to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, silts of high Liquid Limit.
		High to very high	None	High	CH	Inorganic clays of high plasticity.
		Medium to high	None to very slow	Low to medium	OH	Organic clays of high plasticity
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture				Pt	Peat and other highly organic soils

PLASTICITY CHART

For laboratory classification of fine grained soils



Great Southern GEOTECHNICS

Explanatory Notes

PLASTICITY

DESCRIPTIVE TERM	OF LOW PLASTICITY	OF MEDIUM PLASTICITY	OF HIGH PLASTICITY
Range Of Liquid Limit (%)	≤ 35	> 35 ≤ 50	> 50

DESCRIPTION OF ORGANIC OR ARTIFICIAL MATERIALS

PREFERRED TERMS	SECONDARY DESCRIPTION
Organic Matter	Fibrous Peat/ Charcoal/ Wood Fragments/ Roots (greater than approximately 2mm diameter)/ Root Fibres (less than approximately 2mm diameter)
Waste Fill	Domestic Refuse/ Oil/ Bitumen/ Brickbats/ Concrete Rubble/ Fibrous Plaster/ Wood Pieces/ Wood Shavings/ Sawdust/ Iron Filings/ Drums/ Steel Bars/ Steel Scrap/ Bottles/ Broken Glass/ Leather

CONSISTENCY - Cohesive soils

TERM	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD
Symbol	VS	S	F	St	VSt	H
Undrained Shear Strength (kPa)	< 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
SPT (N) Blowcount	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	> 30
Field Guide	Exudes between the fingers when squeezed	Can be moulded by light finger pressure	Can be moulded by strong finger pressure	Cannot be moulded by fingers. Can be indented by thumb nail	Can be indented by thumb nail	Can be indented with difficulty with thumb nail

CONSISTENCY - Non-cohesive soils

TERM	VERY LOOSE	LOOSE	MEDIUM DENSE	DENSE	VERY DENSE	COMPACT
Symbol	VL	L	MD	D	VD	CO
SPT (N) Blowcount	0 - 4	4 - 10	10 - 30	30 - 50	50 - 100	> 50/150 mm
Density Index (%)	< 15	15 - 35	35 - 65	65 - 85	85 - 95	> 95
Field Guide	Ravels	Shovels easily	Shovelling very difficult	Pick required	Pick difficult	Cannot be picked

MINOR COMPONENTS

TERM	TRACE	WITH
% Minor Component Field Guide	Coarse grained soils: < 5% Fine grained soils: <15% Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary components	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30% Presence easily detectable by feel or eye, soil properties little different to general properties of primary component

Great Southern GEOTECHNICS

Explanatory Notes

GEOLOGICAL ORIGIN

	TYPE	DETAILS
TRANSPORTED SOILS	Aeolian Soils	Deposited by wind
	Alluvial Soils	Deposited by streams and rivers
	Colluvial Soils	Deposited on slopes
	Lacustrine Soils	Deposited by lakes
	Marine Soils	Deposited in ocean, bays, beaches and estuaries
FILL MATERIALS	Soil Fill	Describe soil type, UCS symbol and add 'FILL'
	Rock Fill	Rock type, degree of weathering, and word 'FILL'.
	Domestic Fill	Percent soil or rock, whether pretrucible or not.
	Industrial Fill	Percent soil, whether contaminated, particle size & type of waste product, i.e. brick, concrete, metal

STRENGTH OF ROCK MATERIAL

TERM	SYMBOL	IS(50)	(MPA)	FIELD GUIDE TO STRENGTH
Extremely Low	EL	≤0.03		Easily remoulded by hand to a material with soil properties.
Very Low	VL	>0.03	≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxle sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low	L	>0.1	≤0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	>0.3	≤1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	H	>1	≤3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	VH	>3	≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High	EH	>10		Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

ROCK MATERIAL WEATHERING CLASSIFICATION

TERM	SYMBOL	DEFINITION
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported
Extremely Weathered Rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water.
Distinctly Weathered Rock	DW	Rock strength usually changed by weathering. Rock may be highly discoloured, usually be ironstaining. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	FR	Rock shows no sign of decomposition or staining.

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Mobile: 0407 903 297

Appendix 1

Test Pit Logs

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Figure 1 - Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330

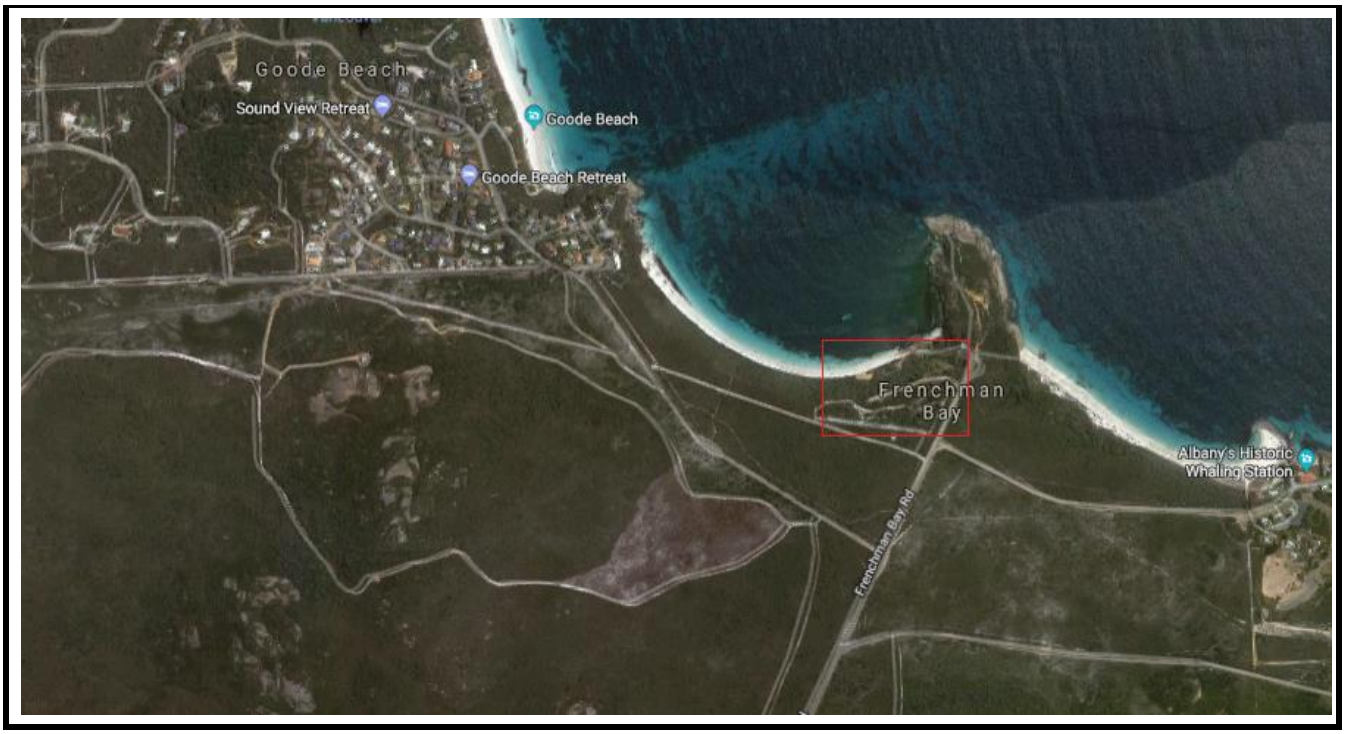
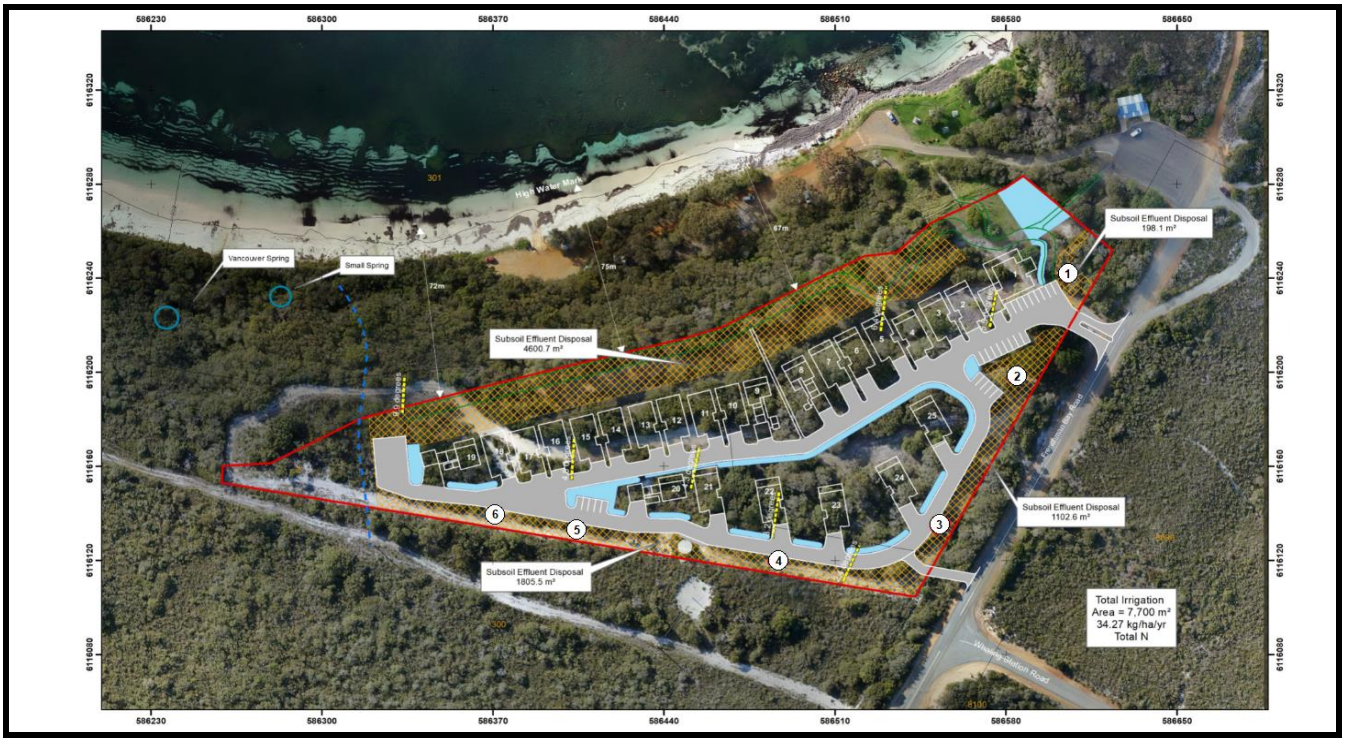


Figure 2 - Approximate Test Pit Locations



Job No:	302
Client:	Bio Diverse Solutions
Project:	Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

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GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Report No	Sheet 1 of 6
302	302/1	

Client: Bio Diverse Solutions
Project: Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330
Project No. N/A
Location: Proposed Building Envelope
Test Pit No.: **TP1** Sample No. **18G671**

Operator/Contractor: GSG
Equipment type: Kubota KX41-3V
Excavation Method : 300mm Auger
Position: 50 H 586602 6116250
Elevation: n/a

Date Commenced: 22.03.2018
Date Completed: 22.03.2018

Logged By: M.Coffey
Checked By: M.Coffey

Excavation Dimensions:
Depth 2.0 (m) Width 0.3 (m)

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
0 - 400	400	**(Topsoil) SAND with silt:** Dark grey, fine to medium. Roots & root fibres.	M	L		No water table encountered.		
400 - 800	400	**SAND with silt:** Grey, fine to medium.	M	L				
800 - 2000	1200	**SAND with silt:** Light grey to white, fine to medium.	M	L				

Comments

Pit Terminated at: ✓ or × (mm) below ground level

Target Depth	✓	2000
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Materials Consistency/Strength

Cohesive	Non-Cohesive
VS - Very Soft	VL - Very Loose
S - Soft	L - Loose
F - Firm	MD - Medium Dense
St - Stiff	D - Dense
VSt - Very Stiff	VD - Very Dense
H - Hard	CO - Compact

Rock

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Cementation

IN - Indurated
PC - Poorly Cemented
MC - moderately Cemented
WC - Well Cemented

Water
▼ Water first Encountered

Moisture
D - Dry M - Moist W - Wet

General
N/A - Not Applicable
N/D - Not Determined

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Test Pit No. 1 - Excavation

Test Pit No. 1 - Spoil

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No:	302	**Test Pit No:**	**TP1**
Client:	Bio Diverse Solutions		
Project:	Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330		

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GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Report No	Sheet 2 of 6
302	302/1	

Client: Bio Diverse Solutions
Project: Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330
Project No. N/A
Location: Proposed Building Envelope
Test Pit No.: **TP2** Sample No. **18G672**

Operator/Contractor: GSG
Equipment type: Kubota KX41-3V
Excavation Method : 300mm Auger
Position: 50 H 586582 6116174
Elevation: n/a

Date Commenced: 22.03.2018
Date Completed: 22.03.2018

Logged By: M.Coffey
Checked By: M.Coffey

Excavation Dimensions:
Depth 2.0 (m) Width 0.3 (m)

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
0 - 1600	1600	**SAND with silt:** Light grey/white, fine to medium.	D-M	L		No water table encountered.		
1600 - 2000	400	**SAND with silt:** Light brown/grey, fine to medium.	M	L	PC			

Comments

Pit Terminated at: ✓ or × (mm) below ground level

Target Depth	✓	2000
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Materials Consistency/Strength

Cohesive	Non-Cohesive
VS - Very Soft	VL - Very Loose
S - Soft	L - Loose
F - Firm	MD - Medium Dense
St - Stiff	D - Dense
VSt - Very Stiff	VD - Very Dense
H - Hard	CO - Compact

Rock

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Cementation

IN - Indurated
PC - Poorly Cemented
MC - moderately Cemented
WC - Well Cemented

Water
▼ Water first Encountered

Moisture
D - Dry M - Moist W - Wet

General
N/A - Not Applicable
N/D - Not Determined

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Test Pit No. 2 - Excavation

Test Pit No.2 - Spoil

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No:	302	**Test Pit No:**	**TP2**
Client:	Bio Diverse Solutions		
Project:	Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330		

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GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Report No	Sheet
302	302/1	3 of 6

Client: Bio Diverse Solutions
Project: Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330
Project No. N/A
Location: Proposed Building Envelope
Test Pit No.: **TP3** Sample No. **18G673**

Operator/Contractor: GSG
Equipment type: Kubota KX41-3V
Excavation Method : 300mm Auger
Position: 50 H 586542 6116110
Elevation: n/a

Date Commenced: 22.03.2018
Date Completed: 22.03.2018

Logged By: M.Coffey
Checked By: M.Coffey

Excavation Dimensions:
Depth 2.0 (m) Width 0.3 (m)

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
0 - 400	400	**(Topsoil) SAND with silt:** Grey, fine to medium. Roots & root fibres.	M	L		No water table encountered.		
400 - 1000	600	**SAND with silt:** Light grey, fine to medium.	M	L				PERM
1000 - 2000	1000	**SAND with silt:** White, fine to medium.	M	L				

Comments

Pit Terminated at: ✓ or × (mm) below ground level

Target Depth	✓	2000
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Materials Consistency/Strength

Cohesive	Non-Cohesive
VS - Very Soft	VL - Very Loose
S - Soft	L - Loose
F - Firm	MD - Medium Dense
St - Stiff	D - Dense
VSt - Very Stiff	VD - Very Dense
H - Hard	CO - Compact

Rock

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Cementation

IN - Indurated
PC - Poorly Cemented
MC - moderately Cemented
WC - Well Cemented

Water
▼ Water first Encountered

Moisture
D - Dry M - Moist W - Wet

General
N/A - Not Applicable
N/D - Not Determined

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Test Pit No. 3 - Excavation

Test Pit No. 3 - Spoil

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No:	302	**Test Pit No:**	**TP3**
Client:	Bio Diverse Solutions		
Project:	Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330		

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GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Report No	Sheet
302	302/1	4 of 6

Client: Bio Diverse Solutions
Project: Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330
Project No. N/A
Location: Proposed Building Envelope
Test Pit No.: **TP4** Sample No. **18G674**

Operator/Contractor: GSG
Equipment type: Kubota KX41-3V
Excavation Method : 300mm Auger
Position: 50 H 586479 6116121
Elevation: n/a

Date Commenced: 22.03.2018
Date Completed: 22.03.2018

Logged By: M.Coffey
Checked By: M.Coffey

Excavation Dimensions:
Depth 2.0 (m) Width 0.3 (m)

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
0 - 500	500	**(Topsoil) SAND with silt:** Grey, fine to medium. Roots & root fibres.	D	L		No water table encountered.		
500 - 1000	500	**SAND with silt:** Light grey, fine to medium.	D	L				
1000 - 2000	1000	**SAND with silt:** Light grey/white, fine to medium.	M	L				

Comments

Pit Terminated at: ✓ or × (mm) below ground level

Target Depth	✓	2000
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Materials Consistency/Strength

Cohesive	Non-Cohesive
VS - Very Soft	VL - Very Loose
S - Soft	L - Loose
F - Firm	MD - Medium Dense
St - Stiff	D - Dense
VSt - Very Stiff	VD - Very Dense
H - Hard	CO - Compact

Rock

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Cementation

IN - Indurated
PC - Poorly Cemented
MC - moderately Cemented
WC - Well Cemented

Water
▼ Water first Encountered

Moisture
D - Dry M - Moist W - Wet

General
N/A - Not Applicable
N/D - Not Determined

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Test Pit No. 4 - Excavation

Test Pit No. 4 - Spoil

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No:	302	**Test Pit No:**	**TP4**
Client:	Bio Diverse Solutions		
Project:	Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330		

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GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Report No	Sheet
302	302/1	5 of 6

Client: Bio Diverse Solutions
Project: Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330
Project No. N/A
Location: Proposed Building Envelope
Test Pit No.: **TP5** Sample No. **18G675**

Operator/Contractor: GSG
Equipment type: Kubota KX41-3V
Excavation Method : 300mm Auger
Position: 50 H 586373 6116140
Elevation: n/a

Date Commenced: 22.03.2018
Date Completed: 22.03.2018

Logged By: M.Coffey
Checked By: M.Coffey

Excavation Dimensions:
Depth 2.0 (m) Width 0.3 (m)

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
0 - 300	300	**(Topsoil) SAND with silt:** Grey, fine to medium. Roots & root fibres.	D	L		No water table encountered.		
300 - 800	500	**SAND with silt:** Light grey/white, fine to medium.	M	L				
800 - 2000	1200	**SAND with silt:** Light grey/yellow, fine to medium.	M	L	PC			PERM

Comments

Pit Terminated at: ✓ or × (mm) below ground level

Target Depth	✓	2000
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Materials Consistency/Strength

Cohesive	Non-Cohesive
VS - Very Soft	VL - Very Loose
S - Soft	L - Loose
F - Firm	MD - Medium Dense
St - Stiff	D - Dense
VSt - Very Stiff	VD - Very Dense
H - Hard	CO - Compact

Rock

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Cementation

IN - Indurated
PC - Poorly Cemented
MC - moderately Cemented
WC - Well Cemented

Water
▼ Water first Encountered

Moisture
D - Dry M - Moist W - Wet

General
N/A - Not Applicable
N/D - Not Determined

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Test Pit No. 5 - Excavation

Test Pit No. 5 - Spoil

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No:	302	**Test Pit No:**	**TP5**
Client:	Bio Diverse Solutions		
Project:	Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330		

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ACN: 613 485 644 ABN: 77 613 485 644

Email: Info@gsgeotechnics.com
Mobile: 0407 903 297

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Report No	Sheet 6 of 6
302	302/1	

Client: Bio Diverse Solutions
Project: Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330
Project No. N/A
Location: Proposed Building Envelope
Test Pit No.: **TP6** Sample No. **18G676**

Operator/Contractor: GSG
Equipment type: Kubota KX41-3V
Excavation Method : 300mm Auger
Position: 50 H 586309 6116153
Elevation: n/a

Date Commenced: 22.03.2018
Date Completed: 22.03.2018

Logged By: M.Coffey
Checked By: M.Coffey

Excavation Dimensions:
Depth 2.0 (m) Width 0.3 (m)

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
0 - 300	300	**(Topsoil) SAND with silt:** Grey, fine to medium. Roots & root fibres.	D	L		No water table encountered.		
300 - 1700	1400	**SAND with silt:** Light grey, fine to medium.	M	L				
1700 - 2000	300	**SAND with silt:** Brown/grey, fine to medium.	M	L-MD	PC			

Comments

Pit Terminated at: ✓ or × (mm) below ground level

Target Depth	✓	2000
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Materials Consistency/Strength

Cohesive	Non-Cohesive
VS - Very Soft	VL - Very Loose
S - Soft	L - Loose
F - Firm	MD - Medium Dense
St - Stiff	D - Dense
VSt - Very Stiff	VD - Very Dense
H - Hard	CO - Compact

Rock

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Cementation

IN - Indurated
PC - Poorly Cemented
MC - moderately Cemented
WC - Well Cemented

Water
▼ Water first Encountered

Moisture
D - Dry M - Moist W - Wet

General
N/A - Not Applicable
N/D - Not Determined

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Test Pit No. 6 - Excavation

Test Pit No. 6 - Spoil

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No:	302	**Test Pit No:**	**TP6**
Client:	Bio Diverse Solutions		
Project:	Lots 1 & 2 Fenchman Bay Rd, Albany WA 6330		

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Email: Info@gsgeotechnics.com
Mobile: 0407 903 297

Appendix 2

Test Results

GREAT SOUTHERN GEOTECHNICS

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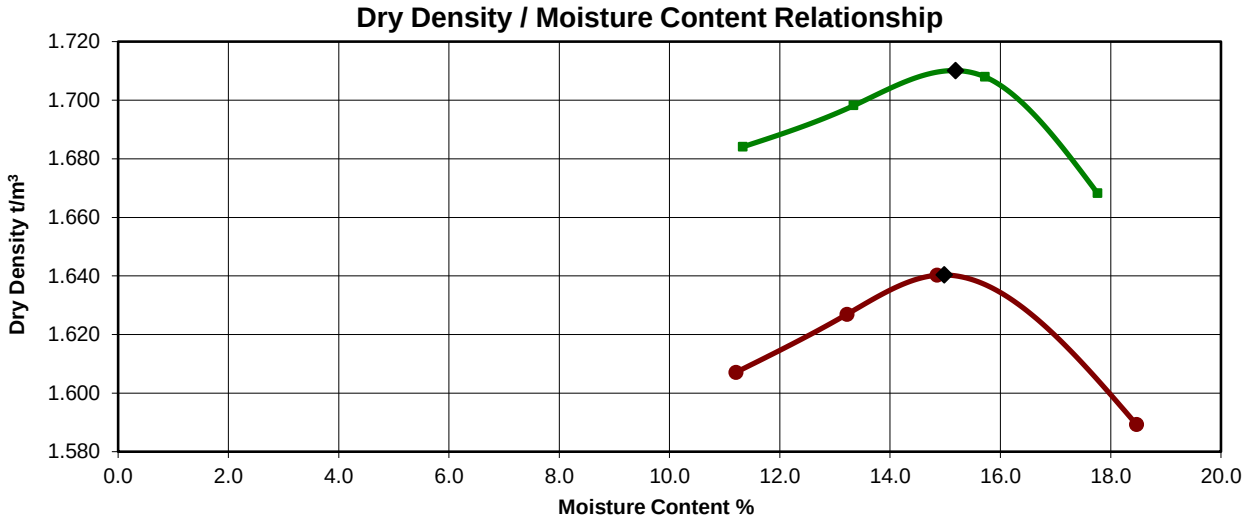
Dry Density / Moisture Content Relationship Test Report — Sheet 1 of 1

Report No. 302/1 **Job No.** 302

Client: Bio Diverese Solutions
Project: Lots 1 & 2 Frenchman Bay Road
Road: Frenchman Bay Road
Section N/A

Sample No.	Sample Location	Field Description
18G677	Test Pit 3	SAND
18G678	Test Pit 5	SAND



Sample Number		18G677	18G678	
Depth		400mm to 1000mm	800mm to 2000mm	
Stabiliser Used				
Stabiliser Added %				
Curing Period	Water (Days)	0.08	0.08	
	Stabiliser (Hrs)			
Moisture Content Method used		AS 1289.2.1.1	AS 1289.2.1.1	
Sampling Method		AS 1289.1.2.1 Proc 6.5	AS 1289.1.2.1 Proc 6.5	
Date Sampled		22.03.2018	22.03.2018	
Date Received		22.03.2018	22.03.2018	
Date Tested		24.03.2018	24.03.2018	
Test Method		AS 1289.5.2.1	AS 1289.5.2.1	
Maximum Dry Density t/m^3		**1.64**	**1.71**	
Optimum Moisture Content %		**15.0**	**15.0**	
Adjusted Maximum Dry Density t/m3				
Adjusted Optimum Moisture Content %				
Percentage Retained %	37.5 mm	**0**	**0**	
Percentage Retained %	19.0 mm	**0**	**0**	

Comments: N/a

Distribution: Laboratory File / Kathryn Kinnear

Approved Signatory:

Name: M.Coffey
Function: Laboratory Manager
Date: 11.04.2018

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CONSTRUCTION MATERIALS TESTING LABORATORY
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CONSTANT HEAD PERMEABILITY - TEST REPORT

In accordance with **AS 1289.6.7.1, 2.1.1, 5.1.1**

Client	**Bio Diverse Solutions**	Ticket No.	**S1555**
Client Address	**-**	Report No.	**LLS18/1362 _1_FHPERM**
Project	**Lots 1 & 2 Frenchman Bay Road**	Sample No.	**LLS18/1362**
Location	**Albany WA 6330**	Job No.	**Job No. 302**
Sample Identification	**Test Pit 3 - 400mm - 1000mm (18G677)**		
Sampling Method:	**Tested as Received**		

Constant Head Permeability

Laboratory Moisture Ratio (%)	99.0
Laboratory Density Ratio (%)	94.5
Compactive Effort	Modified
Hydraulic Gradient	0.6
Surcharge (kPa)	3
% Retained on 19mm Sieve	0
Coefficient of Permeability (m/sec)	**$4.5 \times 10^{(-6)}$**

Comments: *AS 1289.5.2.1 Compaction Values supplied by Great Southern Geotechnics*

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

Approved Signatory

Name	M. van Herk
Function	Laboratory Manager
Issue Date	11-April-2018

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CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

FALLING HEAD PERMEABILITY - TEST REPORT

In accordance with **AS 1289.6.7.2, 2.1.1, 5.1.1**

Client	**Bio Diverse Solutions**	Ticket No.	**S1555**
Client Address	**-**	Report No.	**LLS18/1362 _1_FHPERM**
Project	**Lots 1 & 2 Frenchman Bay Road**	Sample No.	**LLS18/1362**
Location	**Albany WA 6330**	Job No.	**Job No. 302**
Sample Identification	**Test Pit 5 - 800mm - 2000mm (18G678)**		
Sampling Method:	**Tested as Received**		

Falling Head Permeability

Laboratory Moisture Ratio (%)	99.5
Laboratory Density Ratio (%)	95.0
Compactive Effort	Modified
Hydraulic Gradient	0.6
Surcharge (kPa)	3
% Retained on 19mm Sieve	0
Coefficient of Permeability (m/sec)	**2.6×10^{-6}**

Comments: *AS 1289.5.2.1 Compaction Values supplied by Great Southern Geotechnics*

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-April-2018

APPENDIX 'E': BUSHFIRE MANAGEMENT PLAN

BAL CONTOUR PLAN & BUSHFIRE MANAGEMENT PLAN

BIO DIVERSE SOLUTIONS

Lot 1 and 2 Frenchman Bay Road

Frenchman Bay, WA 6330

Final V 3

12/04/2022

BUSHFIRE | ENVIRONMENTAL | WATER | GIS

Site Details					
Address:	Lot 1 & 2 Frenchman Bay Road				
Suburb:	Frenchman Bay	**State:**	W.A.	**Postcode**	6330
Local Government Area:	City of Albany				
Description of Building Works:	Proposed tourism development				
Stage of WAPC Planning	Local Development Plan				

BAL Contour Plan Details			
Report / Job Number:	MSC0403-002	**Report Version:**	Final v3
Assessment Date:	5 January 2022	**Report Date:**	12 April 2022
BPAD Practitioner	Kathryn Kinnear (Level 2)	**Accreditation No.**	BPAD 30794

Bio Diverse Solutions Australia Pty Ltd

Albany Office
29 Hercules Crescent
Albany WA 6330
(08) 9842 1575

Denmark Office
Unit 7, 40 South Coast Highway
Denmark WA 6333
(08) 9848 1309

Esperance Office
Unit 2A, 113 Dempster Street
Esperance WA 6450
(08) 9072 1382

www.biodiversesolutions.com.au
ABN 46 643 954 929

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1. Introduction

Bio Diverse Solutions (Bushfire Consultants) were commissioned to prepare a Bushfire Management Plan (BMP) to accompany a Local Development Plan to the City of Albany for the construction of holiday accommodation at Lots 1 and 2 Frenchman Bay Road, Frenchman Bay (the subject site), within the City of Albany (CoA).

The Bushfire Management Plan (BMP) is developed to assess the proposal to ensure it is consistent with the current and endorsed 'Guidelines for Planning in Bushfire Prone Areas Version 1.4 (WAPC, 2021), 'State Planning Policy 3.7' (WAPC, 2015). A previous BMP was prepared and approved through the CoA Development Approval process in 2018. In 2021 an updated version of the BMP report was produced to support a draft Local Development Plan (LDP). This version of the report updates the LDP plan and the current version of the WAPC guidelines (Vers 1.4, WAPC, 2021). Components of the previous approved BMP (2018) has been re-used in this plan to demonstrate the compliance to the performance-based assessment of the tourism/vulnerable land use components of the LDP.

This BMP has been developed to guide the planning of the LDP and subsequent development of the site and will be revised as required with updated information as available. Specifically, the implementation table (Section 6) of this document has outlined where and when updated information is required by the proponent to demonstrate compliance to this BMP report. (Note: A peer review to a L3 Bushfire Partitioner as per FPAA PN03 is occurring during the referrals process).

1.1 Location

The Subject Site is defined as Lot 1 and 2 Frenchman Bay Road, Frenchman Bay, within the municipality of the City of Albany (CoA). It is located approximately 21km southeast of the Albany CBD. The site is bound by Frenchman Bay Road to the east, Frenchman Bay beach to the north and CoA reserve to the south and west. The location of the Subject Site is shown on Figure 1.

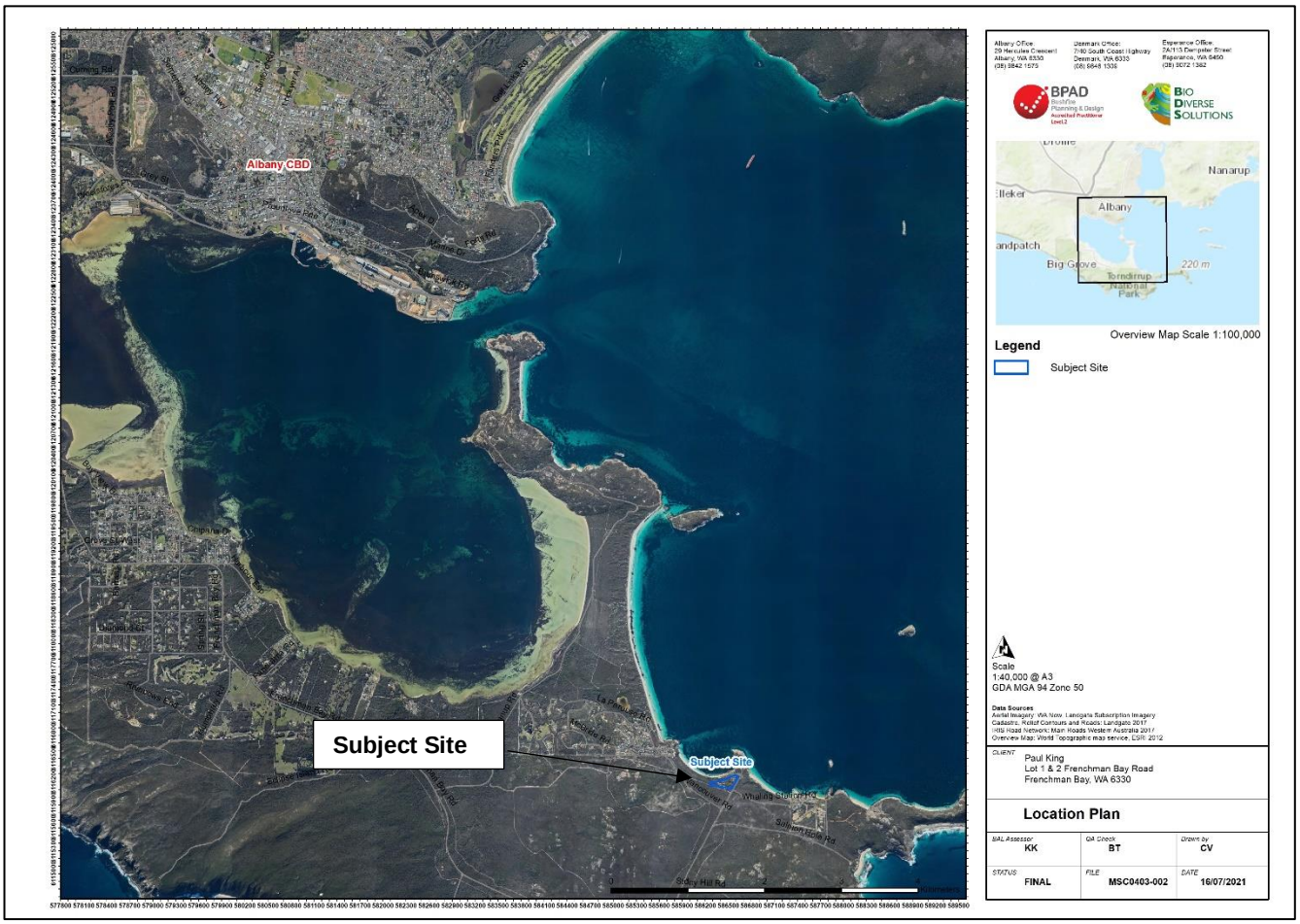


Figure 1: Location Mapping of the subject site.

1.2 Development Proposal

In September 2015, the CoA approved a Local Development Plan (LDP) for Lots 1 and 2 Frenchman Bay Road, which are designated as Special Use Site No. 13 under the provisions of the City of Albany's Local Planning Scheme No. 1. The Special Use site provides for the development of Holiday accommodation, Caravan Park, Caretaker's Dwelling and a shop and is identified as an important Local Strategic Tourist site in Council's Local Tourism Planning Strategy. Following approval of the LDP, a development application was lodged with the Southern Joint Development Assessment Panel in December 2017 and approved in June 2018. The developer subsequently resolved not to proceed with the development and the property has been acquired by Frenchman Bay Albany Pty Ltd.

Frenchman Bay Albany Pty Ltd propose an alternative development to what was previously proposed. They propose separating the site into three components consisting of:

- A luxury holiday lodge with 10-12 bedrooms (occupancy approx. 24 people);
- Up to 25 single bedroom holiday chalets (occupancy approx. 50 people);
- Eight glamping tents (occupancy approx. 16 people);
- Day spa (patrons of village);
- Manager's accommodation (occupancy approx. 2 people); and
- A signature café/restaurant with associated kiosk/shop and reception office (occupancy approx. 100 people).

The proposed LDP is shown in Figure 2.

Figure 2: Local development plan

The LDP is proposed to be developed in stages comprising of:

Stage 1: Luxury holiday lodge with 10-12 bedrooms, Swimming pool and tennis court and maintenance shed; and
Stage 2: Balance of development, subject to further due diligence and design.

It is noted that each stage will still require planning approval from the City of Albany. This BMP is to guide the LDP and subsequent development stages of the site. At this stage of planning some detail of the BMP are yet to be resolved and may require further review and consultation. The subject site is zoned as Special Residential under the City of Albany Local Planning Scheme (No. 1). The publicly released Bushfire Prone Area Mapping (OBRM, 2021) shows that the subject site is located within a Bushfire Prone Area (within 100m of >1ha of bushfire prone vegetation) and as such is subject to a planning assessment of the bushfire risks. Bushfire Prone Area Mapping (OBRM, 2019) is shown in Figure 3.

Figure 3: Map of Bushfire Prone Areas and relevance to subject site (OBRM, 2021).

1.3 Statutory Framework

This document and the recommendations contained within are aligned to the following policy and guidelines:

- *Planning and Development Act 2005*;
- *Planning and Development (Local Planning Scheme) Regulations 2015;*
- State Planning Policy (SPP) 3.7 Planning in Bushfire Prone Areas 2015 (WAPC, 2015);
- Guidelines for Planning in Bushfire Prone Areas (WAPC, 2021, vers 1.4);
- *Building Act 2011;*
- *Building Regulations 2012;*
- Building code of Australia (National Construction Code) (NCC, n.d.);
- *Fire and Emergency Services Act 1998*.
- AS3959-2018 “Construction of Buildings in Bushfire Prone Areas” current and endorsed standards;

- *Bushfires Act 1954*; and
- City of Albany Fire Management Notice (CoA, 2021).

2 Environmental Considerations

2.1 Native Vegetation – Modification and Clearing

The Subject Site lies within the WAR – Warren Region Interim Bio-geographic Regional Area (IBRA). Hearn *et al.* (2002) describes the Warren IBRA region as; 'Dissected undulating country of the Leeuwin Complex, Southern Perth Basin (Blackwood Plateau), South-West intrusions of the Yilgarn Craton and western parts of the Albany Orogen with loamy soils supporting Karri forest, laterites supporting Jarrah-Marri forest, leached sandy soils in depressions and plains supporting low Jarrah woodlands and paperbark/sedge swamps, and Holocene marine dunes with *Agonis flexuosa* and Banksia woodlands and heaths.' The vegetation has been mapped on a broad scale by J.S. Beard (Shepherd et al 2002) in the 1970's, where a system was devised for state-wide mapping and vegetation classification based on geographic, geological, soil, climate structure, life form and vegetation characteristics (Sandiford and Barrett 2010). A GIS search of J.S. Beards (DPIRD, 2017) vegetation classification places the Subject Site within one System and Vegetation Association (DPIRD_006, 2017):

- **System Association Name:** Torndirrup
- **Vegetation Association Number:** 423
- **Vegetation Description:** Shrublands; Acacia scrub-heath (unknown spp.)

To the north, south and west is City of Albany Reserve 7374. The Subject Site is located 212m away from an Environmentally Sensitive Area (ESA) being; Torndirrup National Park. A general habitat and vegetation survey was conducted over the Subject Site and adjoining foreshore area on the 28th April 2017 in association with the Habitat and Tree Retention Survey (Bio Diverse Solutions, 2017). A total of 51 species were recorded from the survey area, of which 37 or 72.5% were native (14 weed species recorded). The survey found the area is predominately covered by peppermint woodland, with variations in species composition across the site. There was also found to be coastal heath present along the northern, western and southern boundaries of the Subject Site and open grassland within the eastern extent of the foreshore reserve, extending into the north-east extent of the Subject Site, and a small area along the southern boundary. The open grassland area remains largely cleared from the previous Caravan Park facility. Refer to Section 5.2 of this report for further information on future low fuel management and standards. Vegetation within the site will be managed in a low threat state as per the WAPC Asset Protection Zone (APZ) Schedule 1 Standards (refer to Appendix B). This low fuel zone will be managed in perpetuity as per the current maintenance regime over the park with additional requirements as outlined in Section 6 of this report.

2.2 Review of the Environmental Data Sets (Landgate SLIP)

A review of the environmental data sets (Landgate SLIP) as identified in the Department of Planning Lands and Heritage BMP Template for a complex development application, does not identify that any regulated (restricted) vegetation will be affected by the proposal, see Table 1 Environment Dataset Review.

Table 1: Environmental Dataset Review.

CCW	Impact on Proposal	Comment
CCW and buffers	No	
RAMSAR wetlands	No	
Threatened and priority flora	No	A flora survey been undertaken of the site;
Threatened Ecological Communities	No	
Bush Forever areas 2000	No	
Clearing regulations –ESA	No	
Swan Bioplan Regionally Significant Natural Areas 2010	N/A	
Conservation Covenants WA	No	

2.3 Revegetation or Landscaping

Revegetation is not proposed for this development, a Landscaping masterplan is recommended as part of this BMP to guide the LDP development.

3 Bushfire Assessment Results

The bushfire assessment for this site has followed the Bushfire Attack Level (BAL) Assessment and WAPC Planning in Bushfire Prone Areas Guidelines (Vers 1.4, 2021).

3.1 Assessment Inputs

Bushfire Assessment inputs for the site has been calculated using the Method 1 BAL Assessment procedure as outlined in AS3959-2018. This incorporates the following factors:

- WA adopted Fire Danger Index (FDI), being FDI 80;
- Vegetation Classes;
- Effective Slope under classified vegetation; and
- Distance between proposed development site and classified vegetation.

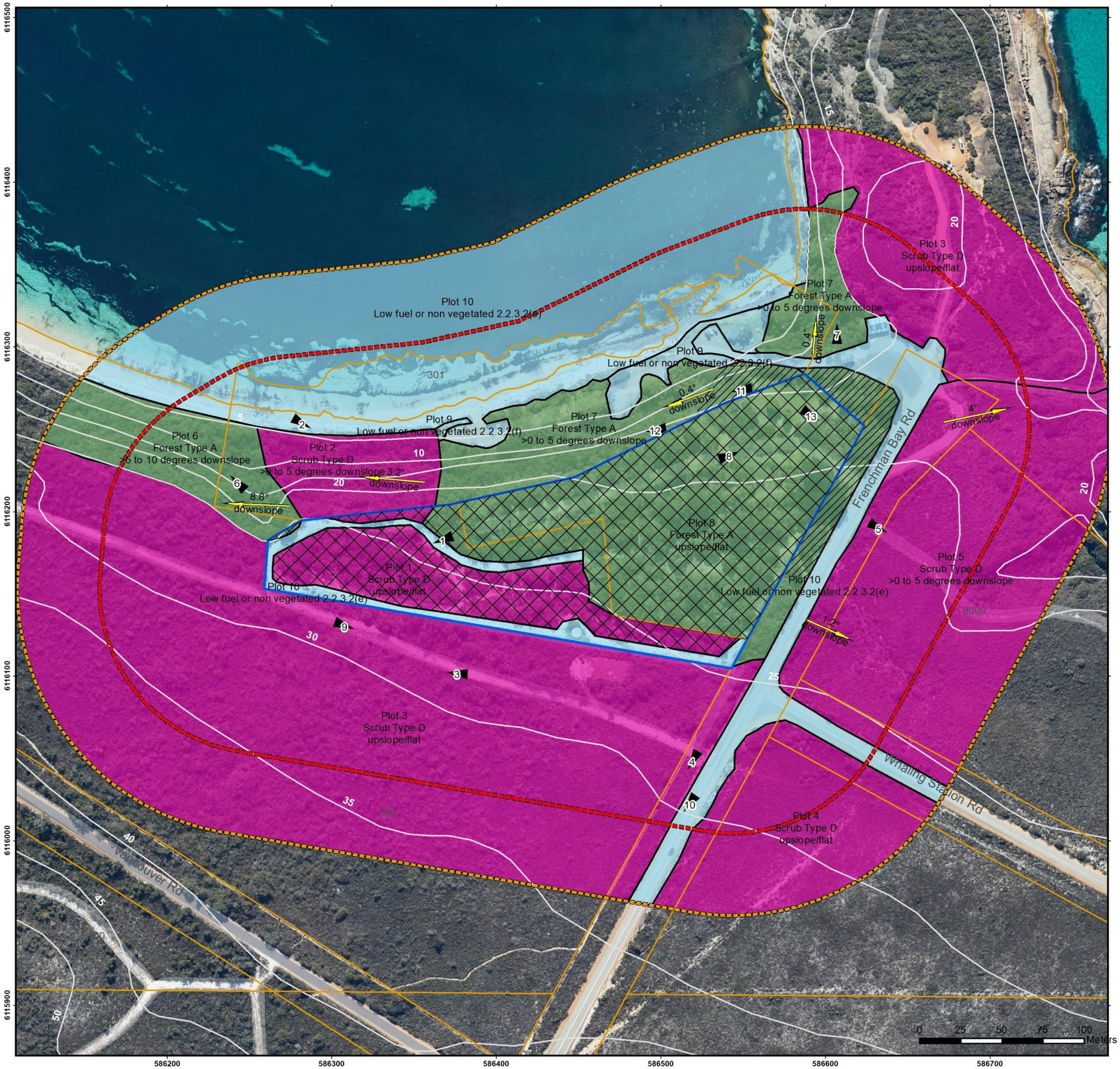
3.1.1 Vegetation Classification

Site assessment occurred on the 9th September 2020 and reviewed in 2021 by Principal Bushfire Consultant of Bio Diverse Solutions, Kathryn Kinnear (BPAD 30794). All vegetation within 150m of the site / proposed development was classified in accordance with Clause 2.2.3 of AS 3959-2018. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level is identified in the following pages and shown on the Vegetation Classes Maps.

A summary of the Plot data assessed as per Clause 2.2.3 of AS 3959-2018 is provided below in Table 1 below, detailed plot data is provided in Appendix A.

Table 2: Vegetation Classification Table (in accordance with AS 3959-2018) of the subject site.

Plot number	Vegetation Type (Table 2.3)	Slope (Table 2.4.3)
1	Scrub Type D	Upslope/flat
2	Scrub Type D	Downslope >0-5 degrees
3	Scrub Type D	Upslope/flat
4	Scrub Type D	Upslope/flat
5	Scrub Type D	Downslope >0-5 degrees
6	Forest Type A	Downslope >5-10 degrees
7	Forest Type A	Downslope >0-5 degrees
8	Forest Type A	Upslope/flat
9	Excluded 2.2.3.2 (f)	N/A
10	Excluded 2.2.3.2 (e)	N/A



Albany Office:
29 Hercules Crescent
Albany, WA 6330
(08) 9842 1575

Denmark Office:
7/40 South Coast Highway
Denmark, WA 6333
(08) 9848 1309

Esperance Office:
2A/113 Dempster Street
Esperance, WA 6450
(08) 9072 1382

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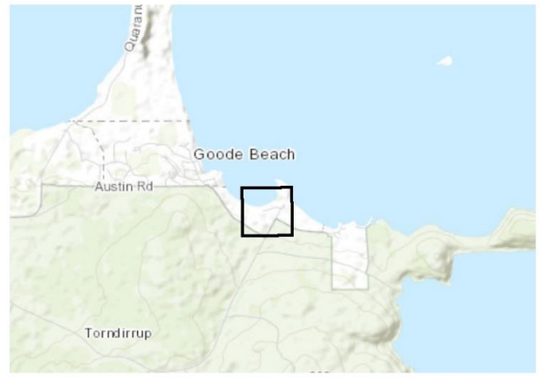
BIO DIVERSE SOLUTIONS



Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Cadastre
- 5m Contours
- Slopes Degrees
- Photo Point
- Fuel reduce to AS3959 exc 2.2.3.2(f)
- Future Low Fuel
- Vegetation/Plot Boundary

Vegetation

- Forest Type A
- Scrub Type D
- Low fuel or non vegetated 2.2.3.2

Scale
1:2,250 @ A3
GDA MGA 94 Zone 50

Data Sources
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT
Paul King
Lot 1 & 2 Frenchman Bay Road
Frenchman Bay, WA 6330

Vegetation Classes

BAL Assessor	QA Check	Drawn by
KK	BT	CV
STATUS	**FILE**	**DATE**
FINAL	MSC0403-002	03/08/2021

3.2 Assessment Outputs

A Method 1 BAL calculation (in the form of BAL contours) has been completed for the proposed subdivision in accordance with AS3959-2018 methodology. The BAL rating gives an indication of the level of bushfire attack (i.e., the radiant heat flux) that may be received by proposed buildings and subsequently informs the standard of building construction required to increase building tolerance to potentially withstand such impacts in line with the assessed BAL.

The assessed BAL ratings for the subdivision are depicted as BAL contours, as shown on Figure 5 and Table 3.

Table 3: AS3959 Determined BAL rating for the proposed staged development on the site

Stage	Building	Vegetation Classification	Effective Slope	Separation (m)	BAL Allocation
1	(A – Single Storey and Two Storey) 10-12 Bedroom lodge	Scrub Type D (Plot 3)	Upslope/flat	13m	BAL-29
	(B) Maintenance Shed/Caretaker	Scrub Type D (Plot 3)	Upslope/flat	13m	BAL – 29
2	(E) Day Spa	Forest Type A (Plot 7)	Downslope >0-5 degrees	30m	BAL – 29
	(C) 25 Single Bedroom chalets	Forest Type A (Plot 7)	Downslope >0-5 degrees	28m	BAL – 29
	(F) Manager's Accommodation	Forest Type A (Plot 8)	Upslope/flat	22m	BAL – 29
	8 Glamping Tents	Forest Type A (Plot 7)	Downslope >0-5 degrees	1-4m	BAL – FZ
3	(D) Reception, Kiosk/Shop and Café	Forest Type A (Plot 7)	Downslope >0-5 degrees	32m	BAL – 29

Assumptions/comments on BAL Contour Plan:

- Method 1 (AS3959-2018) Simplified procedure was used for vegetation classification and BAL Assessment process;
- The BAL Contour Plan was prepared by an Accredited Level 2 Bushfire Planning Practitioner (BPAD30794);
- The BAL Contour Map (Figure 5) has been prepared in accordance with Department of Planning (WAPC) Guidelines for Planning in Bushfire Prone Areas (Version 1.4; WAPC, 2021;
- The vegetation within the subject site has been excluded as this vegetation will be modified to a low threat state, trees >50cm DBH can remain however are managed in a fuel reduced state;
- The assumptions contained within the BAL Contour Plan is based on plan of LDP as supplied by the client (Figure 2); and
- Subject site is located in a Bushfire Prone Area, see Figure 3 (OBRM, 2019).

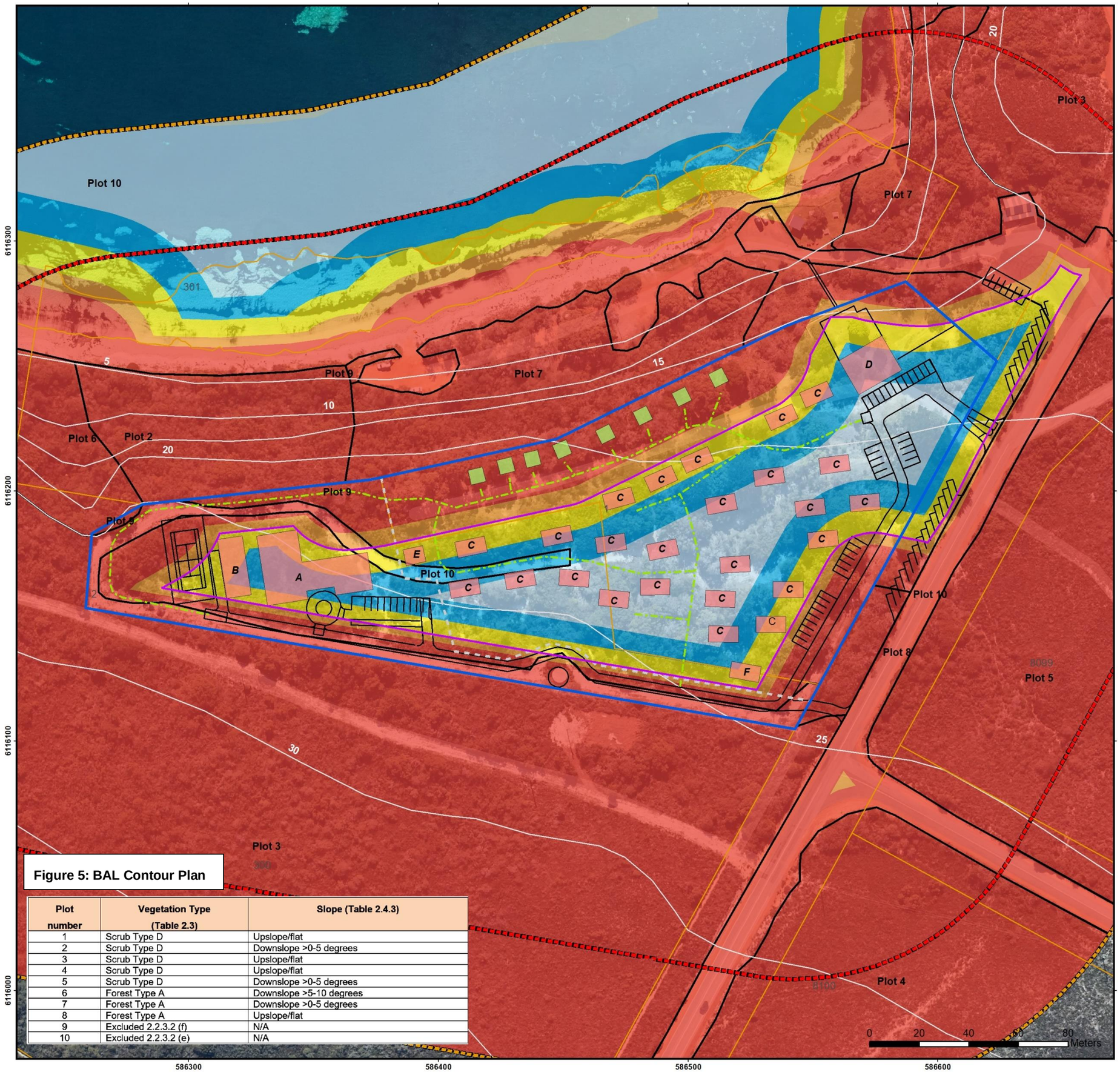


Figure 5: BAL Contour Plan

Plot number	Vegetation Type (Table 2.3)	Slope (Table 2.4.3)
1	Scrub Type D	Upslope/flat
2	Scrub Type D	Downslope >0-5 degrees
3	Scrub Type D	Upslope/flat
4	Scrub Type D	Upslope/flat
5	Scrub Type D	Downslope >0-5 degrees
6	Forest Type A	Downslope >5-10 degrees
7	Forest Type A	Downslope >0-5 degrees
8	Forest Type A	Upslope/flat
9	Excluded 2.2.3.2 (f)	N/A
10	Excluded 2.2.3.2 (e)	N/A

Albany Office:
29 Hercules Crescent
Albany, WA 6330
(08) 9842 1575

Denmark Office:
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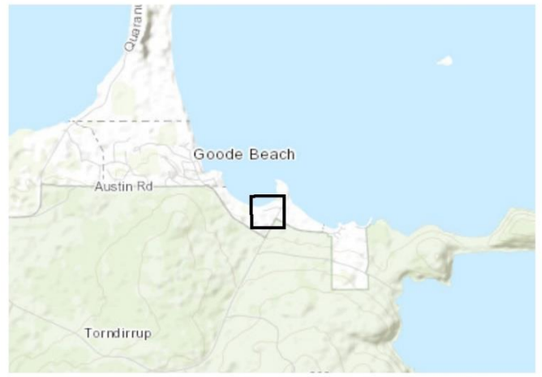


Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Cadastre
- 5m Contours
- Proposed Buildings
- Proposed Glamping Tents
- Lane Way / Fire Access
- Internal Roads and Other Hardstand Areas
- Proposed Lot Boundary
- Developable Area (BAL-29)
- Vegetation/Plot Boundary

BAL Contours

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5
- BAL-LOW

Scale
1:1,500 @ A3
GDA MGA 94 Zone 50

Data Sources
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT
Paul King
Lot 1 & 2 Frenchman Bay Road
Frenchman Bay, WA 6330

BAL Contour Plan

BAL Assessor	*QA Check*	*Drawn by*
KPK	BMT	BRM
STATUS	*FILE*	*DATE*
FINAL	MSC0403-002	5/04/2022

4 Identification of Bushfire Hazard Issues

4.1 Bushfire Hazard Level

The identified bushfire risks associated with the subject site is the continuous vegetation to the west, north (limited), east and south of the subject site. This area presents as predominantly Forest Type A and Scrub Type D which are defined as Extreme Bushfire Hazard Level (BHL). Under hot, dry and unstable conditions (Severe to Catastrophic bushfire weather) the subject site is most at risk from bushfire from these directions. Surrounding the subject site to the north is the Southern Ocean and a small sliver of vegetation fringing the City of Albany (CoA) recreation site of Frenchman Bay. The vegetation is less than 100m wide and presents limited fire run potential from this direction. Internal to the site will be low fuel areas with trees remaining for amenity and conservation of habitat trees.

All of the new habitable buildings associated with the development application to the CoA are located in BAL-29, BAL-19 and BAL-12.5 zones (Figure 5). All new buildings will be constructed in accordance with AS3959-2018 and subject to building approval and are located in BAL-29 to BAL-12.5 zones. It is noted that only Class 1, 2, 3 and decks associated with 10A are required to be built to BAL under the *Building Act 2011*. Buildings classified under the Building Code of Australia (BCA) Class 4-9 are not required to build to AS3959 however will need to be constructed according to the fire requirements in Part 2 of the BCA. It is also noted that the tent style structures on the north foreshore zone are noted to be “tolerable losses” under the WAPC guidelines and do not need to build to AS3959 and can be located in BAL FZ and BAL-40 zones.

4.2 Landscape Risk

Analysis of the vegetation types and corresponding bushfire fuels (to AS3959-2018) outlines the contiguous vegetation to the west, southwest, south, north, east and northwest which correspondingly has the highest risk of fire run into the subject site. Forest Type A and Scrub Type D are classified as Extreme BHL and present extreme risks to the subject site.

4.3 Access

The proposed development area and existing CoA recreation site to the north is accessed from Frenchman Bay Road, along with the existing public road network provides safe access to the west and (subsequently) north to Albany city centre along the Torndirrup Peninsula. Frenchman Bay Road, (formed public road) terminates at the CoA recreation site to the north. As such, the development proposal does not meet the requirement of two access routes under the WAPC guidelines (2021). Two accesses into and out of the LDP provide for emergency access to Frenchman Bay Road in the east.

The development cannot meet the Acceptable Solution as Frenchman Bay Road is effectively a long cul-de-sac which is a legacy issue to the siting of the project and cannot be overcome. The tourism venture proposed cannot overcome the issue, this BMP present two options to meet a performance-based assessment (one previously approved by the decision maker (DM) in 2018). No-through roads or dead-end roads are to be avoided in bushfire prone areas; this cannot be avoided as the land is already approved for tourism under the Albany LPS and associated approved schemes.

To assist meeting the provision of access, Eco Logical Australia (Level 3 Bushfire Practitioners) prepared a Bushfire Emergency Evacuation Plan in 2018 (prepared by Level 3 Accredited Bushfire Practitioners, refer to Section 5.2.6 of this report and Appendix C) which assists to meet compliance to this element of the bushfire protection criteria and applies the acceptable solutions in the WAPC guidelines (WAPC, 2021). This was for 200 people on site and was approved by the DM at the time (JDAP). This option may still be viable, however also there is the possibility of community refuge in the Goode Beach/Frenchman Bay area. Refer to Section 4.4 for more detail.

As the development is staged (Stage 1 is the maintenance shed, pool, tennis courts and Lodge) then there would be sufficient time to investigate this refuge option further. Refer to Section 5.2.4 of this report whereby a Bushfire Emergency Evacuation Plan (BEEP) was prepared by ELA in the original Development Application in 2018 (and approved). This BEEP will be updated and reviewed prior to planning approval and occupation to ensure all relevant persons and responsibilities are designated. It is also noted further due diligence and planning is required for the

Cafe/kiosk area, to re-enforce the requirement of a detailed and more defined BEEP at Development Approval stages.

The internal driveways/road layout has a cul-de-sacs within the development due to the low key "back to nature" style of the development. The glamping tents and cabins in the north have linking lane ways/fire service access through to the driveway/road network roads to ensure there is two-way access to Frenchman Bay Road available at all times. The linking Fire Service Access Ways occurs along the west and northern sections to assist connectivity on the site and fire appliances accessing the vegetation outside of the development footprint. All access is to meet the minimum technical standards of the WAPC guidelines as outlined in Table 5 of this report. The internal access is shown below in Figure 6 – Access Plan.

Figure 6: Internal Access Plan

4.4 Building Bushfire Resilience in the Great Southern (BRIGS)

In 2020 work was undertaken within the City of Albany for the Western Australian and Commonwealth governments National Partnership Agreement for Natural Disaster Resilience that delivers the Natural Disaster Resilience Program (NDRP). An application was submitted to the NDRP to fund the three local governments (Shire of Denmark, City of Albany and Shire of Plantagenet) to enhance the evacuation planning and bushfire risk mitigation strategies through applying a scientific and methodological approach to extreme-risk communities. Details on the methodologies applied for each precinct are documented in the overarching report –Bushfire Resilience in the Great Southern, report prepared for the Natural Disaster Resilience Program (2019).

The BRIGS project, delivered under the 2018-19 NDRP, found that access in/out of the Goode Beach precinct and water supply through the reticulated network, would be severely impacted from bushfire. The management of bushfire fuels, strategic water and a community refuge area/neighbourhood safer place were identified within the scope of the project. A copy of the recommendations for possible community refuge areas (three options presented) by ELA is shown in Figure 7. As the development is staged (Stage 1 is the maintenance shed and Lodge) then there would be sufficient time to investigate this refuge option further. Also refer to Section 5.2.4 of this report

whereby a Bushfire Emergency Evacuation Plan (BEEP) was prepared (and approved) by ELA in the original Development Application in 2018. This BEEP will be updated and reviewed prior to planning approval and occupation to ensure all relevant persons and responsibilities are designated. It is also noted further due diligence and planning is required for the Cafe/kiosk area, again re-enforcing the requirement of detailed and more defined BEEP at Development Approval stages. Consultation with LEMC, CoA and DFES is continuing by the bushfire practitioner on the viability of a community refuge in the Goode Beach/Frenchman Bay area March-May 2022). As the development is staged (Stage 1 is the maintenance shed, pool, tennis courts and Lodge) then there would be sufficient time to investigate this refuge option further.

Figure 7: ELA Figure 14 Goode Beach Precinct Report (BRIGS, 2020)

4.5 Water Supply

The development will be provided with reticulated scheme water in accordance with the specifications of the relevant water supply authority (Water Corporation WA (WCWA) and DFES requirements. This will be detailed in the detailed engineering drawings and be subject to approval from WCWA and DFES at development condition stages, meeting the Acceptable Solution. Fire hydrant (street) outlets are required, these must be installed to WCWA standards installed in accordance with the Water Corporation's No 63 Water Reticulation Standard and are to be identified by standard pole and/or road markings and installed by the Developer.

In the event of a power failure during a bushfire in the area, it is recommended that the southern tank is retained (already present on southern boundary) as a standalone firefighting supply for the purposes of firefighting water supply. The strategic tank supply is estimated to be 200,000L in size and will have two camlock storz fittings, for fire services rapid access. Refilling the tank will be the scheme reticulated system. It is the responsibility of the site caretaker to ensure this is maintained at capacity at all times. Also see Section 5.2.3 of this report Schedule 2 strategic water supply.

The commercial buildings will be subject to detailed hydraulic design by a qualified consultant and requirements and specification to the BCA will be subject to approval from the City of Albany at building construction stages.

..

5 Assessment against the Bushfire Protection Criteria

5.1 Compliance Table

The Guidelines for Planning in Bushfire Prone Areas (WAPC, 2021, Vers 1.4) outlines bushfire protection criteria which subdivision and development proposals are assessed for compliance. The bushfire protection criteria (Appendix 4, WAPC, 2021, Vers 1.4) are performance-based criteria utilised to assess bushfire risk management measures and they outline four elements, being:

- Element 1: Location;
- Element 2: Siting and Design of Development;
- Element 3: Vehicle Access; and
- Element 4: Water.
- Element 5: Vulnerable Tourism Land Uses

The subject site and the LDP/future development proposal will be assessed to, and are required to meet the "Acceptable Solutions" of each element of the bushfire mitigation measures (WAPC, 2021, vers 1.4). The proposal will be assessed against 'Element 5' of the bushfire protection criteria (Table 4) applicable to ***'Other short-term accommodation – including motel, serviced apartments, tourist development (includes cabins and chalets), holiday accommodation and caravan park (which incorporates caravan parks)'.***

Note: A Performance based assessment has been provided to address Access, provision of additional information that meets the acceptable solutions is provided. **.**

Table 4: Bushfire protection criteria applicable to the subject site

Element	Acceptable Solution	Applicable or not Yes/No	Proposal meets Acceptable Solution
Element 5.7 - Siting and design	A5.7a	Yes	Compliant The LDP has all buildings/facilities in APZ areas that will upon completion be subject to a BAL rating of BAL-29 or lower. BAL-19, BAL-12.5 or BAL-LOW will apply to future buildings (excepting the glamping huts see 5.7b below) on the subject site as demonstrated in the BAL Contour Plan Figure 5. This includes all buildings in all classes of the BCA, noting only Class 1, 2 and 3 and 10a structures associated with Class 1, 2 and 3 buildings. It is recommended that the class building outside of the requirements (i.e. non habitable sheds, day spa and café) are built to BAL or the BCA and NCC as deemed appropriate by a building surveyor. Noting if the café is to be used as a last resort this will have additional building requirements to the ABCB handbook. See Section 5.2.6. Proposal meets Acceptable Solution A5.7a.
	A5.7b	Yes	Compliant The LDP identifies “glamping huts” in BAL FZ located along the northern area of the plan. These structures are identified as BAL FZ in the plan and are noted to be a “tolerable” risk and sited in areas >29kW/m2. A tolerable risk as defined by the WAPC guidelines is not something to be ignored, however will be reviewed in line with the evacuation procedures and any site closures as designated through the BEEP. Refer to Section 5.2.6 which outlines evacuation well in advance of bushfire and site closures. It is also recommended that soft and hard landscaping treatments at the interface of this CoA Reserve will be important, and attention to fencing (See Section 5.2.4) and other landscaping in these areas should be documented into a Landscaping Masterplan prior to Development Approval. Proposal meets Acceptable Solution A5.7b.
	A5.7c	Yes	Compliant An APZ for the site can be provided in accordance with Element 2 – Siting and Design. The APZ for these buildings is to be 27m to meet BAL-29 requirements. Refer to Vegetation Classes Mapping Figure 4. The APZ utilises the future low fuel areas of the internal site and fronting the Frenchman Bay Access Road and the existing recreation site. Any landscaping/replanting is to conform to WAPC APZ standards (WAPC, 2021, vers 1.4). Refer to the standard Appendix B and further information Section 5.2.2 of this report. Proposal meets Acceptable Solution A5.7c.
	A5.7d	Yes	Compliant As outlined in sections above a Landscape Masterplan is to be developed and reviewed by the Bushfire Practitioner which confirms the APZ and the elements in the site conform to this BMP. This is noted in the Implementation Table Section 6 of this report and is to be provided prior to DA and before any staged planning approval to guide the staged development of the site in site and hard landscaping features. Upon development of Landscaping Masterplan the proposal meets Acceptable Solution A5.8d.

Table 4 cont.

Element	Acceptable Solution	Applicable or not Yes/No	Proposal meets Acceptable Solution
A5.7 – siting and design cont.	A5.7e	Yes	Compliant As outlined in sections above a Landscape Masterplan is to be developed and reviewed by the Bushfire Practitioner which confirms the linking footpaths through the site. If on-site shelter is proposed through the subsequent staged development then footpaths are to clearly link to the on-site refuge (proposed café). This is noted in the Implementation Table Section 6 of this report and is to be provided prior to DA and before any staged planning approval to guide the staged development of the site. Upon development of Landscaping Masterplan the proposal meets Acceptable Solution A5.7e.
	A5.7f	Yes	Compliant In 2020 the BRIGS Goode Beach Precinct outlined 3 “community refuge” options for the Goode Beach Precinct, with one of these at the Whale World facility to the east of this site. If community refuge for the area is proposed this would greatly assist in the safety of the existing Goode Beach area and this proposed development. In the event that this is not a viable option during the staged development then the Café area is proposed to the last resort refuge area, refer to the original BEEP Appendix C and the summary of the BEEP in section 5.2.6. If onsite refuge is proposed then a method 2 BAL assessment to achieve 10kW/m^2 will be required of the Café and assessment of the building size as per AS 5.7g below. Consultation with LEMC, CoA and DFES is continuing by the bushfire practitioner on the viability of a community refuge in the Goode Beach/Frenchman Bay area March-May 2022). Upon development of Landscaping Masterplan the proposal meets Acceptable Solution A5.7f.
	A5.7g	Yes	Compliant If onsite refuge is proposed then a method 2 BAL assessment to achieve 10kW/m^2 will be required of the Café and assessment of the building size and location in accordance with the NCC and the ABCB Handbook: Design and construction of Community Bushfire Refuges (2014). Also refer to the BEEP previously prepared by ELA section 5.2.6 and Appendix C of this report. Upon development of the Café to the ABCB Handbook (if required) the proposal meets Acceptable Solution A5.7e.
A5.8.1 Vehicular access for all proposals	A5.8.1a	Yes	Compliant The trafficable carriageway of the proposed new internal roads is to be 6m (subject to detailed civil engineering design). Two access points are provided for on the LDP onto Frenchman Bay Road meeting the requirements of 5.8.1a. The internal driveways/road layout has a cul-de-sacs within the development this is due to the low key “back to nature” style of the development. The glamping tents and cabins in the north have linking lane ways/fire service access through to the driveway/road network roads to ensure there is two-way access to Frenchman Bay Road available at all times. The linking Fire Service Access Ways occurs along the west and northern sections to assist connectivity on the site and fire appliances accessing the vegetation outside of the development footprint. Any staged development is to incorporate the two access points and linking internal access network to Frenchman Bay Road. Proposal meets Acceptable Solution A5.8.1a.

Table 4 cont.

Element	Acceptable Solution	Applicable or not Yes/No	Proposal meets Acceptable Solution
A5.8.1 Vehicular access for all proposals	A5.8.1b	Yes	Compliant The internal driveway/road network is to meet the minimum requirements of the WAPC guidelines and as outlined in Table 5 of this report. These are to be detailed in civil engineering designs and approved by the CoA at any staged development. Any staged development is to incorporate the two access points and linking internal network to Frenchman Bay Road. Turnaround areas are to meet the WAPC requirements of Figure 7 of this report. Proposal meets Acceptable Solution A5.8.1a.
	A5.8.1c	Yes	Compliant Signage is to be provided within the site advising of where access routes travel and to exit points to Frenchman Bay Road. Signage in public spaces it to also reflect actions to take in the event of a bushfire. To be developed with the updated BEEP and prior to Development Approval. Proposal meets Acceptable Solution A5.8.1c
P5viii	A 5.8.2	Not able to achieve compliance to AS Performance based assessment	A performance-based assessment of the proposal through the provision of BEEP (approved by the DM) has been supplied. Although prepared for a previous development (2018) the numbers of the previous Development Approval were similar (200 people), whereas this development is proposing 212 people. The internal linking service and driveway access as demonstrated above has 2 access points and the ability for the site to be evacuated in an emergency through the principles of the BEEP, See Section 5.2.6 and Appendix C. As outlined in previous sections above if a community refuge is proposed in the Goode Beach Precinct then two destinations may be achieved which also meets the intent of a safe destination. As the development is greater than 100 persons then A5.8.2 (outside of a built up area cannot meet the Acceptable solutions. The risk of bushfire is accepted and the provision of elements in this BMP (and specifically detailed in Section 5.2 of this report) have addressed and responded to the level of risk in the allocation of BAL, management of the landscaping and internal access and the provision of an Bushfire Emergency Evacuation Plan. Proposal meets the intent of a performance-based assessment with an updated BEEP prior to DA and provision of either a community safer place in the local area or an onsite refuge at the Café. Proposal meets intent of performance based assessment P5viii.
A5.9 Provision of water	A5.9a Identification of future water supply	Yes	Compliant. A reticulated water supply is currently not available to the site. Water is proposed to be reticulated in the long term via extension of the reticulated system to the site. Provision of strategic water (see Section 5.9b) is also proposed to support the risk of bushfire and loss of water pressure or water in an extreme event. Proposal meets Acceptable Solution A5.9a.
	A5.9b Provision of water for firefighting supply	Yes	Compliant. Additional strategic water is proposed, retaining the existing site tank along the southern boundary (see LDP Figure 2). Strategic water is to meet the requirements as outlined in Schedule 2 of the WAPC guidelines and Section 5.2.3 of this report. Proposal meets Acceptable Solution A5.9b.

Further to the provisions of Element A5.8.1 in Table 4 above, the following vehicular access standards Table 5 and Figure 7 are to apply to turn around areas and are to be scheduled in the civil engineering plans and approved via the City of Albany.

Table 5 – Vehicle Access requirements

Technical requirements	1. Public Roads	2. Emergency Access Ways[1]	3. Fire Service Access Ways [1]	4. Private Driveways[2]
Minimum trafficable surface (m)	6*	6*	6	6
Minimum Horizontal clearance (m)	N/A	6	6	6
Minimum Vertical clearance (m)	4.5			
Minimum weight capacity (t)	15			
Maximum grade unsealed road[3]	As outlined in the IPWEA Subdivision guidelines.	1 in 10 (10%)		
Maximum grade sealed road[3]		1:7 (14.3%)		
Maximum average grade sealed road		1 in 10 (10%)		
Curves minimum inner radius (m)		8.5		

Notes:

[1] To have crossfalls between 3 and 6%.

[2] Where driveways and battle-axe legs are not required to comply with widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision.

[3] Dips must have no more than a 1 in 8 (12.5%- 7.1 degrees) entry and exit angle.

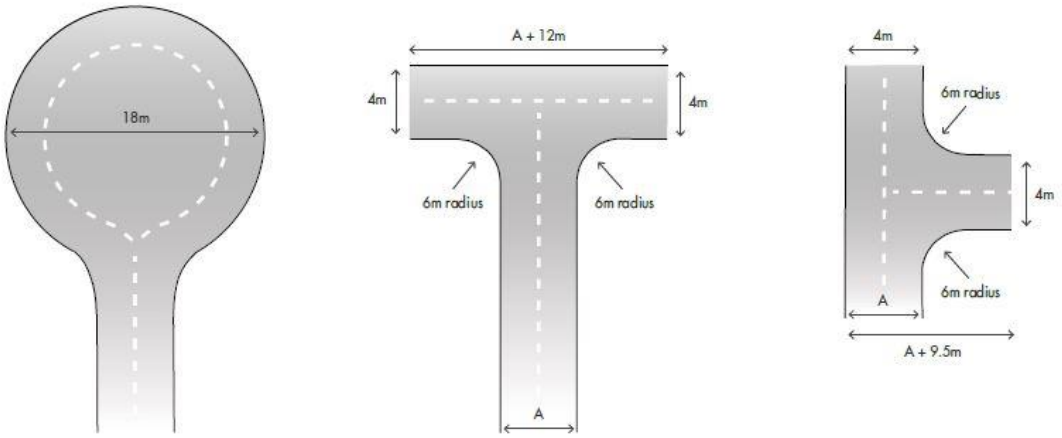


Figure 7: Turn Around Standards (WAPC, 2021)

5.2 Other Bushfire Mitigation Measures

The bushfire risk assessment (Section 4.0) has outlined the extreme bushfire risks for the site the future development of new facilities. The following section outlines additional measures to assist in mitigating the bushfire risk for the proposed development.

5.2.1 Minimise Ignition Sources

There is little control of offsite ignition sources, however the following is recommended to be undertaken by the developer while in ownership of the land and during construction periods.

Prior to the bushfire season (October) the following activities are undertaken:

- Mowing, slashing and brush cutting (noting illegal to do so on designated total fire ban days);
- Maintenance of road access into and out of the site; and
- Sub-contractors are aware of their obligations through contractual requirements.

During the summer bushfire season (1st December to 30th April inclusive as designated in the CoA fire management notice) maintenance activities internal to the site should be planned and risk assessed prior to commencement. This includes but not limited to:

- Mowing, slashing and brush cutting (noting illegal to do so on designated total fire ban days);
- Welding, grinding and hot works (not undertaken on designated total fire ban days);
- Temporary waste disposal areas and green waste dumps – ensure piles are not exceeding 1.5m high and have bare mineral earth surrounding (min of 10m); and
- A water tender (min of 200L) fast attack unit is on site during the fire season (any site construction activities).

The Site Construction manager in consultation with developer are responsible for safety in during the bushfire season and are to ensure safety of the site and adjacent properties at all times from potential ignition sources.

5.2.2 Fuel Reduction and APZ Management

Ongoing fuel reduction by landowners to ensure their allocated BAL applies through mechanical slashing and mowing will be required to be undertaken regularly to ensure all internal grasses are maintained. Buildings are to be inspected regularly for build-up of wind-borne debris and leaf accumulation in gutters and at penetrations to buildings (doors, windows, etc). The site manage/ owner is to be responsible for implementation of the maintenance schedule to maintain the BAL and general bushfire preparedness which should generally reflect the following actions, refer to Table 6.

Table 6: Maintenance schedule

Frequency	*Activity*
Weekly **(during fire season operations and prior to event)**	Check all buildings for wind borne debris build up and remove.
	Check waste materials collected from site are correctly sorted and stored (i.e. green waste, refuelling in designated areas only).
	Check personal safety equipment before each use.
	Check dust filters on equipment.
	Visually check vehicles and equipment for leaks or potential oil spills, check on fuel storage areas (if applicable).
	Check signage, gates and access gates are unlocked and accessible on emergency cues points.
	Check gutters are free from vegetation or overhand.
	Trimming and removing dead plants or leaf litter.
	Pruning climbing vegetation (such as vines) on a trellis, to ensure it does not connect to a building, particularly near windows and doors.
	Removing vegetation in close proximity to a water tank to ensure it is not touching the sides of a tank.
	Check fire firefighting water tanks are full and serviceable.
	Check outdoor objects around buildings (see list below).
	Raking and cleaning underfloor spaces (if applicable).
Monthly	Mowing, slashing and maintaining grasses, more frequent during spring and Autumn growth periods.
	Whipper snipper/grass cutter around all buildings.
	Ensure all Fire Service Access tracks are traversable and no erosion or washouts.
	Check no combustible materials are store near buildings or penetrations of buildings (windows, doors, etc.) includes, but not limited to – gas bottles, fences, stored combustible material, vines, plants etc.
Yearly **(prior to bushfire season)**	Undertake any fuel reduction burning (if applicable).
	Maintain firebreaks and fire service access tracks, check gates can easily be opened and closed.
	Check locks are in working order, check gates which are not to be locked (i.e., for emergency access) are not locked.
	Check water tank cam lock (Storz) valves are working and in good order (i.e., open and shut).
	Check hardstand areas are clear and traversable adjacent to firefighting storage tanks.
	Ensure weeds or woody material is not encroaching into the APZ area around buildings (20m minimum), attend to any dead material through trimming and pruning, raking and removing to green waste.
	Any material from pre fire season preparation is either disposed to green waste or burn in piles away for the buildings with a 10m mineral earth break around the pile.

Prior to a bushfire event best practice recommends that objects within the APZ are moved away from the building prior to any bushfire event. Objects may include, but are not limited to:

- Door mats
- Outdoor furniture
- Potted plants
- Shade sails or umbrellas
- Plastic garbage bins
- Firewood stacks
- Flammable sculptures
- Playground equipment and children's toys.

These should always be considered in the proximity to buildings and stored appropriately when not in attendance at site. Consider any replanting or landscaping refer to the Country Fire Authority's Landscaping for Bushfire: Garden Design and Plant Selection (CFA, 2012) – Plant Selection Key or aim for plants within the APZ that have the following characteristics:

- Grow in a predicted structure, shape and height.
- Are open and loose branching with leaves that are thinly spread.
- Have a coarse texture and low surface-area-to-volume ratio.
- Will not drop large amounts of leaves or limbs, that require regular maintenance.
- Have wide, flat, and thick or succulent leaves.
- Trees that have bark attached tightly to their trunk or have smooth bark.
- Have low amounts of oils, waxes, and resins (which will often have a strong scent when crushed).
- Do not produce or hold large amounts of fine dead material in their crowns.
- Will not become a weed in the area.

Also refer to Schedule 1, Appendix B of this report.

5.2.3 Strategic Water Sources for Bushfire

Strategic, standalone water sources for bushfire and structure fires is recommended within the site (not mandatory). Strategic water is supplied for bushfire in addition to water required for drinking and domestic water purposes. A minimum of 20,000L/habitable building is recommended for additional safety if the power and/or scheme water sources fail in a bushfire event. The following standards are to apply for strategic water sources as per Schedule 2 of the WAPC guidelines (WAPC, 2021, vers 1.4), to be implemented for this site:

Above ground tanks: should be constructed of a non-combustible material, and may need to comply with AS/NZ 35001:2018. Fittings for above ground tanks are to be in accordance with the following standards:

- Commercial land uses: 125mm Storz fitting; or
- Strategic water tanks: 50mm or 100mm male camlock coupling with full flow valve;
- Combined water tanks: 50mm male camlock coupling with full flow valve or a domestic fitting, being a standard house hold tap that enables an occupant to access the water supply with domestic hoses or buckets for extinguishing minor fire.

Below ground tanks: should have a 200mm dia access hole to allow tankers or emergency service vehicles to refill direct from the tank with the outlet clearly marked on the top. The tank may need to comply with AS/NZ 35001:2018.

Tank outlets: where an outlet is provided for an emergency service then an unobstructed, hardened surface is to be provided within 4m of the water supply. Refer to figure 6 below outlining the location of a tank to a hardstand area.

Pipe fittings: all above-ground exposed water supply pipes and fittings should be metal. Fittings should be located away from the source of the bushfire attack.

Water tank location: Tanks are to be located with a consideration to surrounding vegetation and should avoid locations where the tanks is situated near or under vegetation or where vegetation might grow or overhand the tank. Refer to Figure 8 below.

Figure 8: A good and a bad example of landscaping around a water tank and relation to hardstand areas. (WAPC, 2021)

5.2.4 Barrier Fencing

In November 2010, the Australian Bushfire CRC issued a "Fire Note" (Bushfire CRC, 2010), which outlined the potential for residential fencing systems to act as a barrier against radiant heat, burning debris and flame impingement during bushfire. The research aimed to observe, record, measure and compare the performance of commercial fencing of Colourbond steel and timber (treated softwood and hardwood).

The findings of the research found that:

"*.. Colourbond steel fencing panels do not ignite and contribute significant heat release during cone calorimeter exposure"* (exposure to heat)

".. Colourbond steel (fencing) had the best performance as a non-combustible material. It maintained structural; integrity as a heat barrier under all experimental exposure conditions, and it did not spread flame laterally and contribute to fire intensity during exposure"

It is also noted that non-combustible fences are recommended by WAPC (2021, Vers 1.4), through APZ standards: Fences and sheds within the APZ are constructed using non-combustible materials e.g., colourbond iron, brick, limestone, metal post and wire. The developer will be encouraged to build Colourbond or non-combustible fences where applicable.

5.2.5 Evaporative Air Conditioners

Evaporative air conditioning units can catch fire as a result of embers from bushfires entering the unit. These embers can then spread quickly through the home causing rapid destruction. It can be difficult for fire-fighters to put out a fire in the roof spaces of homes.

It is also recommended that the proponent:

- Ensure that suitable external ember screens are placed on roof top mounted evaporative air conditioners compliant with AS3959-2018 (current and endorsed standards) and that the screens are checked annually; and
- Maintain evaporative air conditioners regularly as per DFES recommendations, refer to the DFES website for further details: http://www.dfes.wa.gov.au

5.2.6 Bushfire Emergency Evacuation Plan (BEEP)

Access into the site is restricted to a one-way access along Frenchman Bay Road. This access is also within Extreme bushfire hazards with the likelihood of the road being closed rated as "High". The Bushfire Emergency Evacuation Plan (BEEP) (Appendix C) has been prepared by Eco Logical Australia Level 3 BPAD Bushfire Practitioners and is to be made available to all visitors/residents/lodgers at all times. The BEEP is guided by the following overarching principles:

- All clients are notified at time of deposit/confirmation of stay that Frenchman Bay Retreat is located in a bushfire prone area and may be subject to closure and/or re-schedule of stay if weather conditions are Catastrophic Fire Danger Rating (FDR) , see Figure 9.
- The key to the evacuation plan is - off-site evacuation is always safer and the priority. It is also dependant that adequate time is available to complete it safely. Confirm with Lead Agency (DFES or other Emergency Service) prior to evacuating and follow all directions.
- Evacuation of the site to Albany ALAC centre or another off site activated undertaken prior to a bushfire event occurring.
- Evacuation well in advance of a fire's predicted arrival time is safer than remaining on-site.
- Off-site evacuation is to occur by driving directly to Albany Leisure and Aquatics Centre (ALAC) on Barker Road (this has been previously used as an evacuation centre for the town).
- Preparedness of all guests and staff during the bushfire danger period (1st November to 30th April) on bushfire evacuation procedures.
- Evacuation plan is a poster style to be displayed in guest's rooms and in reception.
- Evacuation and management triggers are provided for specific actions for both managers and guests for the site.
- Site closures on Catastrophic FDR days.
- Provides for staged construction.

It is noted that the current BEEP provides for "on-site refuge" in the previous Café/caretakers building for 200 people. Since the development of this BEEP the "Bushfire Resilience in the Great Southern"(BRIGS) (Bio Diverse Solutions, 2020) project has identified options of 3 neighbourhood safer place or a community refuge areas (see Figure 7.). If a neighbourhood safer place or a community refuge areas is located at the historic Whaling Station to the east, it is recommended that the BEEP is updated to reflect this change and that community safety is undertaken for the whole of the area in a more holistic way and documented with Local Emergency Management Committees (LEMC). If a community refuge area cannot be sourced as per the BRIGS recommendations then an updated Method 2 BAL calculation will be required on the café to confirm the application of as onsite refuge.

The BEEP outlines evacuation of any lodgers evacuate to Albany Leisure and Aquatic Centre (ALAC) via road. The ALAC is an evacuation point consistent with CoA Local Emergency Management Committee (LEMC) planning.

The BEEP is to be included into the facilities emergency response procedures and guides the procedures that occupants and staff at the site are to follow in a bushfire emergency. The BEEP prepared by Eco Logical Australia is a two page poster which is designed as a quick ready reckoner.

The BEEP will be updated prior to the next stages of Development Approval (currently LDP) occupation of the site to include specific details required for the implementation (i.e. contact numbers of the site office and caretaker).

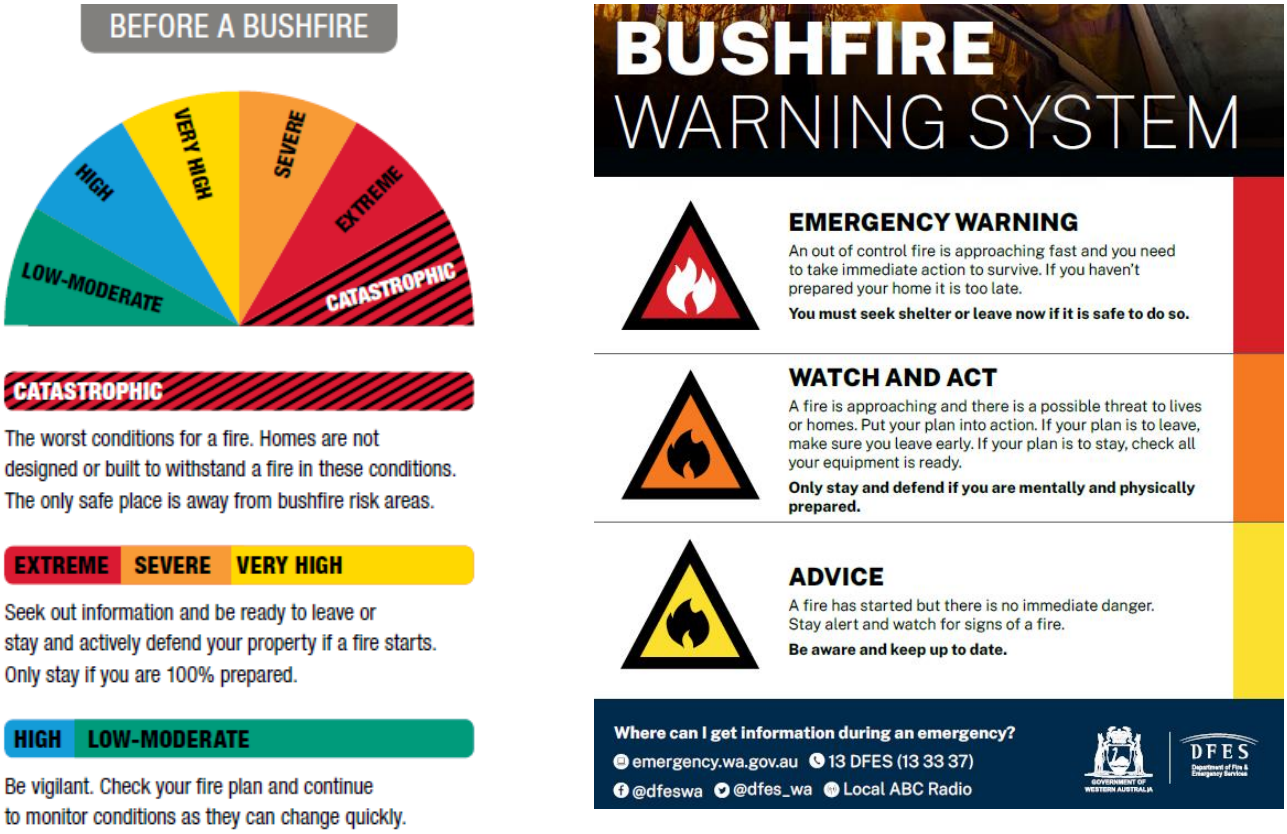


Figure 9: DFES Warning Systems (DFES, 2022).

6 Implementation Actions

The responsibilities of the developer(s), Landowners and local government are shown in Table 6, 7 and 8.

6.1 Developer's Responsibility

It is recommended the developer be responsible for the following:

Table 7: Implementation actions land owner/developer.

Developer		
No	**Implementation Action**	**DA Clearance**
1	Where a building has been identified as requiring an increased construction standard (i.e. BAL/AS3959) ensure that the design and construction of any building is compliant with the requirements of AS3959 (current and endorsed standards).	✓
2	Establish/maintain APZ's to the standard stated in this BMP, see Schedule 1 Standards for APZ's (See Appendix B).	
3	Ensure reticulated water is suppled in accordance with the Water Corporation's No 63 Water Reticulation Standard (WC, 2016) and hydrants are to be identified by standard pole and/or road markings.	✓
4	Update the BEEP prior to occupation of the tourist components of the site. If onsite refuge is to be utilised then an update of the Method 2 BAL assessment is required.	**Prior to DA**
5	All internal driveway's to be designated/ installed for access into the development to the minimum technical standards as required by WAPC. To be demonstrated to CoA at planning approval stages.	✓
6	The subject site is to be compliant with the relevant local government's annual firebreak notice issued under s33 of the *Bushfires Act 1954*.	✓
7	Ensuring that suitable external ember screens are placed on roof top mounted evaporative air conditioners compliant with AS3959-2018 (current and endorsed standards) and that the screens are checked annually.	✓
8	The commercial buildings will be subject to detailed hydraulic design by a qualified consultant and requirements and specification to the BCA will be subject to approval from the City of Albany at building construction stages.	✓
9	Ensure land/building owners are aware of the BAL Contour Plan and the applicable BAL to their property through provision of BAL Contour Plan. Update the BAL contour plan and provide certification of BAL Contour prior to lodgement of titles (post construction).	✓
10	Ensure the Fire Service Access Ways are constructed at Stage 1 to provide for access around the site, minimum construction standards as per Table 5.	✓
11	The soft and hard landscaping treatments such as linking footpaths, fencing and other soft and hard landscaping treatments should be documented into a Landscaping Masterplan prior to Development Approval.	**Prior to DA**
12	If the café is to be designated as a refuge, then any architectural designs are to respond and be built in accordance with the NCC and the ABCB (2014) *Handbook: Design and construction of Community Bushfire Refuges*.	**Prior to DA**
13	Signage is to be provided within the site advising of where access routes travel and to exit points to Frenchman Bay Road. Signage in public spaces it to also reflect actions to take in the event of a bushfire. To be developed with the updated BEEP and prior to Development Approval.	**Prior to DA**
14	An update and review of this BMP is required if any aspect of design changes in the subsequent stages and to document the updated BEEP and refuge strategies for the site.	**Prior to DA**

6.2 Local Government Responsibility

It is recommended the local government be responsible for the following:

Table 8: Implementation actions, City of Albany

SoD		
No	**Implementation Action**	**Clearance sage**
1	Request BAL certification at Building Approval stages on any proposed habitable buildings. Buildings to be located in BAL-29, BAL-19 and BAL-12.5 zones.). Certified BAL on specific buildings as required for buildings approval.	**Building approval**
2	All internal driveways to be designated/ installed for access into the site to the minimum technical standards as required by WAPC and outlined in Table 5 of this document. To be demonstrated to CoA at Planning approval/building approval stages.	**Development Approval**
3	Ensure reticulated water is suppled in accordance with the Water Corporation's No. 63 Water Reticulation Standard (WC, 2016) and hydrants are to be identified by standard pole and/or road markings.	**Development Approval**
4	Monitor landowner compliance with the Bushfire Management Plan and the annual CoA Fire Management Notice (CoA, 2020).	**Ongoing**
5.	Request a Landscaping Masterplan prior to Development Approval.	**Prior to DA**
6	If the café is to be designated as a refuge, then any architectural designs are to respond and be built in accordance with the NCC and the ABCB (2014) *Handbook: Design and construction of Community Bushfire Refuges*.	**Prior to DA**
7	Signage is to be provided within the site advising of where access routes travel and to exit points to Frenchman Bay Road. Signage in public spaces it to also reflect actions to take in the event of a bushfire. To be developed with the updated BEEP and prior to Development Approval.	**Prior to DA**
8	An update and review of this BMP is required if any aspect of design changes in the subsequent stages and to document the updated BEEP and refuge strategies for the site.	**Prior to DA**

7 Disclaimer

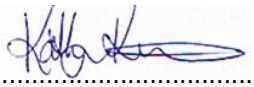
The recommendations and measures contained in this assessment report are based on the information available at the time of writing following the instructions of the regulatory authorities and following the requirements of the Australian Standards 3959-2018 – Building in Bushfire Prone Areas, WAPC State Planning Policy 3.7 (WAPC, 2015), WAPC Guidelines for Planning in Bushfire Prone Areas (WAPC, 2021, vers 1.4), and applying best practise as described by Fire Protection Association Australia. These are considered the minimum standards required to balance the protection of the dwellings and occupants with the aesthetic and environmental conditions required by local, state and federal government authorities. They DO NOT guarantee that a building will not be destroyed or damaged by a bushfire, people injured, or fatalities occur either at the site or while evacuating. All surveys and forecasts, projections and recommendations made in this assessment report and associated with this proposed development are made in good faith on the basis of the information available to the fire protection consultant at the time of assessment. The achievement of the level of implementation of fire precautions will depend amongst other things on actions of the landowner or occupiers of the land, over which the bushfire consultant has no control. Notwithstanding anything contained within, the consultant/s will not, except as the law may require, be liable for any loss or other consequences (whether or not due to negligence of the bushfire consultant) arising out of the services rendered by the consultant.

AS3959-2018 disclaimer: It should be borne in mind that the measures contained within this Standard (AS3959-2018) cannot guarantee that a building will survive a bushfire event on every occasion. This is substantially due to the unpredictable nature and behaviour of fire and extreme weather condition.

Building to AS3959-2018 is a standard primarily concerned with improving the ability of buildings in designated bushfire prone areas to better withstand attack from bushfire thus giving a measure of protection to the building occupants (until the fire front passes) as well as to the building itself (AS3959, 2018).

8 Certification

I hereby certify that I have undertaken the assessment of the above site and determined the Bushfire Attack Level (s) stated in this document have been prepared in accordance with the requirements of AS 3959-2018 and the Guidelines for Planning in Bushfire Prone Areas (WAPC, 2021, Vers 1.4).

SIGNED, ASSESSOR:  DATE: 11/04/2022

Kathryn Kinnear, Bio Diverse Solutions

Accredited Level 2 Bushfire Practitioner (Accreditation No: BPAD30794)

(Note: A peer review to a L3 Bushfire Partitioner as per FPAA PN03 is occurring during the referrals process)

9 Revision Record

Revision	Prepared By	Summary	Reviewed By	Date
Draft Id 5/04/2022	Kathryn Kinnear	Internal QA review	Mary Holt	5/04/2022
Draft Id 6/04/2022	Kathryn Kinnear	Internal Technical review	Jason Benson	7/04/2022
Draft Id 8/04/2022	Kathryn Kinnear	Issued to client	Nick Ayton	8/04/2022
Final Id Vers 3.0 11/04/2022	Kathryn Kinnear	Updated from client review, final issued to client		11/04/2022

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11 Appendices

Appendix: A: Vegetation Classifications to AS3959-2018

Appendix: B: Schedule 1 - WAPC Asset Protection Zone (APZ) standards to apply

Appendix C: ELA Bushfire Emergency Evacuation Plan (2018)

Appendix A

Vegetation Classification to AS3959-2018

Vegetation classification to AS3959-2018

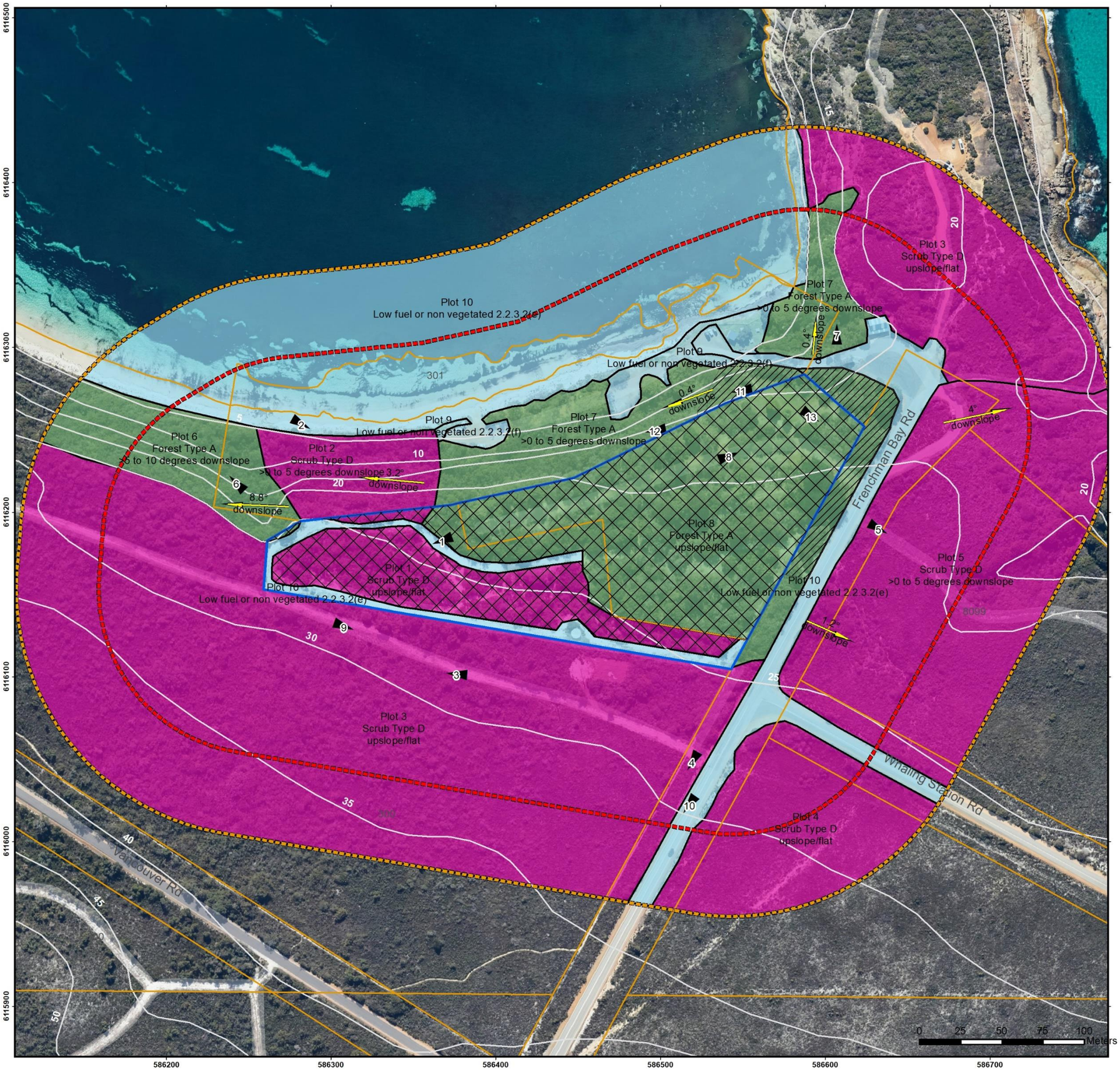
Site Details			
Address:	Lot 1 & 2 Frenchman Bay Road		
Suburb:	Frenchman Bay	**State:**	W.A.
Local Government Area:	City of Albany		
Stage of WAPC Planning	Subdivision Application		

BMP Plan Details			
Report / Job Number:	MSC0403	**Report Version:**	Final
Assessment Date:	11 February 2020	**Report Date:**	3 August 2021
BPAD Practitioner	Kathryn Kinnear	**Accreditation No.**	BPAD 30794

Vegetation Classification

Site assessment occurred on the 11th February 2020 and reviewed in 2021 by Kathryn Kinnear (BPAD 30794). All vegetation within 150m of the site / proposed development was classified in accordance with Clause 2.2.3 of AS 3959-2018. Each distinguishable vegetation plot with the potential to determine the Bushfire Attack Level (BAL) is identified in the following pages and shown on the Vegetation Classes Map Page 3.

Plot number	Vegetation Type (Table 2.3)	Slope (Table 2.4.3)
1	Scrub Type D	Upslope/flat
2	Scrub Type D	Downslope >0-5 degrees
3	Scrub Type D	Upslope/flat
4	Scrub Type D	Upslope/flat
5	Scrub Type D	Downslope >0-5 degrees
6	Forest Type A	Downslope >5-10 degrees
7	Forest Type A	Downslope >0-5 degrees
8	Forest Type A	Upslope/flat
9	Excluded 2.2.3.2 (f)	N/A
10	Excluded 2.2.3.2 (e)	N/A



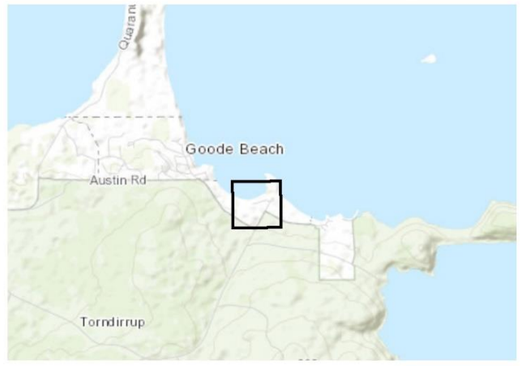
Albany Office:
29 Hercules Crescent
Albany, WA 6330
(08) 9842 1575

Denmark Office:
7/40 South Coast Highway
Denmark, WA 6333
(08) 9848 1309

Esperance Office:
2A/113 Dempster Street
Esperance, WA 6450
(08) 9072 1382

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

BIO DIVERSE SOLUTIONS



Overview Map Scale 1:100,000

Legend

- Subject Site
- 100m Assessment Boundary
- 150m Assessment Boundary
- Cadastre
- 5m Contours
- Slopes Degrees
- Photo Point
- Fuel reduce to AS3959 exc 2.2.3.2(f)
- Future Low Fuel
- Vegetation/Plot Boundary

Vegetation

- Forest Type A
- Scrub Type D
- Low fuel or non vegetated 2.2.3.2

Scale
1:2,250 @ A3
GDA MGA 94 Zone 50

Data Sources
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT
Paul King
Lot 1 & 2 Frenchman Bay Road
Frenchman Bay, WA 6330

Vegetation Classes

BAL Assessor	QA Check	Drawn by
KK	BT	CV
STATUS	**FILE**	**DATE**
FINAL	MSC0403-002	03/08/2021

Plot	1	Classification or Exclusion Clause	Scrub Type D
			**Location:** Within the Subject Site, making up the southern portion of the site. **Separation Distance:** 0m. **Description:** Coastal scrub and some stunted Jarrah. **Average vegetation height:** 3.5m general not exceeding 4m, with isolated Jarrah reaching 5m. **Vegetation Coverage:** >30%. **Available fuel loading:** 25 t/ha. **Effective slope:** Upslope.
Photo Id 1: View looking at Plot 1 in a westerly direction from within the plot.			
Plot	**2**	**Classification or Exclusion Clause**	**Scrub Type D**
			**Location:** Adjacent to the north-west boundary of the site, with a small portion of the plot within the Subject Site. **Separation Distance:** 0m. **Description:** Coastal scrub. **Average vegetation height:** 3.5m with isolated trees reaching 4m. **Vegetation Coverage:** >30%. **Available fuel loading:** 25 t/ha. **Effective slope:** >0 to 5 degrees downslope.
Photo Id 2: View looking along beach edge of Plot 2 in easterly direction.			

Plot	3	Classification or Exclusion Clause	Scrub Type D
			**Location:** In two locations, one to the south and west of the Subject Site and the other to the north-east. **Description:** Low coastal scrub of stunted Jarrah, banksia and Tea tree. **Average vegetation height:** 3.5m with occasional taller jarrah at 5m. **Vegetation Coverage:** >30%. **Available fuel loading:** 25 t/ha. **Effective slope:** Upslope.

Photo Id 3: View looking toward the west from western boundary of the Subject Site

Plot	4	Classification or Exclusion Clause	Scrub Type D
			**Location:** To the south of the Subject Site adjoining Frenchman Bay Road on the northern and southern side of road. **Separation Distance:** 0 to 40m. **Description:** Low coastal shrubs and herbs. Open heathland. **Average vegetation height:** 1.2m. **Vegetation Coverage:** >30%. **Available fuel loading:** 25 t/ha. **Effective slope:** Upslope.

Photo Id 4: View looking south along Frenchman Bay Road.

Plot	5	Classification or Exclusion Clause	Scrub Type D
			**Location:** To the east of the Subject Site on the eastern side of Frenchman Bay Rd. **Separation Distance:** 26m. **Dominant species & description:** Low coastal shrubs. **Average vegetation height:** 1.2m. **Vegetation Coverage:** >30%. **Available fuel loading:** 25 t/ha. **Effective slope:** >0 to 5 degrees downslope.

Photo Id 5: View looking east across plot 5 from the eastern edge of Frenchman Bay Road.

Plot	6	Classification or Exclusion Clause	Forest Type A
			**Location:** Located directly to the north-west of the Subject Site. **Separation Distance:** 24m. **Description:** Tall coastal scrub interspersed with Jarrah and Peppermint trees. Multilayered; bracken, woody scrubs mid-storey and smaller herbs and shrubs as understorey. **Average vegetation height:** 7m. **Vegetation Coverage:** >30 – 70%. **Available fuel loading:** 25 - 35t/ha. **Effective slope:** >5 to 10 degrees downslope.

Photo Id 6: View looking west through Plot 6 from inside the plot.

Plot	7	Classification or Exclusion Clause	Forest Type A
			**Location:** Two plots to the north of the Subject Site. Plots are separated by a beach access road. **Separation Distance:** 0 to 14m. **Description:** Jarrah and peppermint trees, eastern part of plot recently burnt. Not multilayered, grasses and bracken to 0.5m. **Average vegetation height:** 7m. **Vegetation Coverage: >30-70% foliage cover**. **Available fuel loading:** 245 - 35t/ha. **Effective slope:** >0 to 5 degrees downslope. Note: areas of this Plot will be fuel reduced to AS3959 Exclusion 2.2.3.2 (f)
Photo Id 7: View north through Plot 7 to beach and picnic area.			

Plot	8	Classification or Exclusion Clause	Forest Type A
			**Location:** Located within the Subject Site in previous disturbed areas of the caravan park site. Also, along Frenchman Bay road reserve. **Separation Distance:** 0m. **Description:** Peppermint trees and tall coastal vegetation. Not multilayered, grasses and bracken to 0.5m understorey. **Average vegetation height:** 6m-8m **Vegetation Coverage:** <30-70% foliage cover **Available fuel loading:** 25 - 35t/ha. **Effective slope:** Upslope/flat. Note: areas of this Plot will be fuel reduced to AS3959 Exclusion 2.2.3.2 (f).
Photo Id 8: View looking within plot from southern edge of beach access road.			
Plot	**9**	**Classification or Exclusion Clause**	**Low fuel or non-vegetated areas exclusion 2.2.3.2 (f)**
			**Location:** Foreshore area to the north of the Subject Site in Frenchman Bay recreation site. **Description:** Managed lawns and gardens and other low-threat vegetation. Includes maintained beach picnic area etc. Excluded as per AS3959 exclusion clause 2.2.3.2 (f). **Available fuel loading:** <2 t/ha.
Photo Id 9: View looking towards recreation site to the north of the subject site.			

Plot	10	Classification or Exclusion Clause	Low fuel or non-vegetated areas exclusion 2.2.3.2 (e)
			**Location:** Frenchman Bay beach and the Southern Ocean to the north of the Subject Site. Adjacent roads include Frenchman Bay Road, Whaling Station Road and the firebreak track within the Subject Site. **Description:** Roads, driveways, tracks, water bodies, bare beach areas, buildings and other non-vegetated areas. As per exclusion clause 2.2.3.2 (e) of AS3959-2018.
Photo Id 10: View looking south along Frenchman Bay Road.			

COMMENTS ON VEGETATION CLASSIFCATIONS:

- Distances from vegetation were made based on surface fuels to edge of lot (subject site) boundary;
- Effective slopes were measured in the field using a Nikon Forestry Pro and represented on the respective plots;
- Method 1 (AS3959-2018) Simplified procedure was used for vegetation classification Assessment process;
- All vegetation was classified within the subject site and within 150m of the lot boundaries to AS3959 Table 2.3; and
- The perimeter of the vegetation was measured using field GPS and notations on field GIS maps.

CERTIFICATION

I hereby certify that I have undertaken the assessment of the above site and determined the Bushfire Attack Level stated above in accordance with the requirements of AS 3959-2018.

SIGNED, ASSESSOR: ..... DATE: 3/08/2021

Kathryn Kinnear , Bio Diverse Solutions
Accredited Level 2 BAL Assessor (Accreditation No: BPAD30794)

REVISION RECORD

Revision	Prepared By	Summary	Reviewed By	Date
Draft Id 16/07/2021	Kathryn Kinnear	Internal Review	Bianca Theyer	16/07/2021
Final Id 16/07/2021	Kathryn Kinnear	Final Issued to Client		3/08/2021

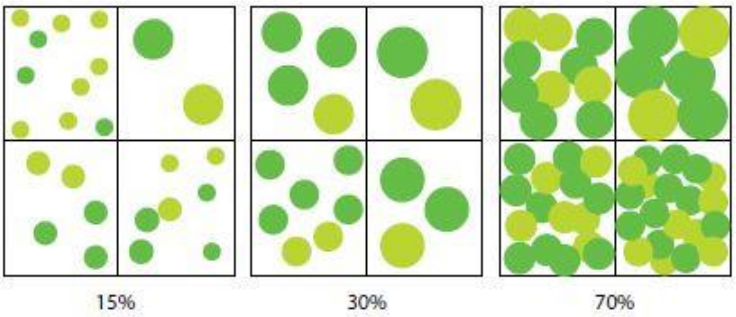
Appendix B

Schedule 1 WAPC Asset Protection Zone (APZ) standards to apply

Schedule 1

Standards for an Asset Protection Zone (APZ)

(WAPC, 2021)

Fences within the APZ	• Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (Combustible, dead vegetation matter <6 millimetres in thickness)	• Should be managed and removed on a regular basis to maintain a low threat state. • Should be maintained at <2 tonnes per hectare (on average). • Mulches should be non-combustible such as stone, gravel or crushed mineral earth or wood mulch >6 millimetres in thickness.
Trees* (>6 metres in height)	• Trunks at maturity should be a minimum distance of six metres from all elevations of the building. • Branches at maturity should not touch or overhang a building or powerline. • Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. • Canopy cover within the APZ should be <15 per cent of the total APZ area. • Tree canopies at maturity should be at least five metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ. **Figure 19:** Tree canopy cover – ranging from 15 to 70 per cent at maturity 
Shrub* and scrub* (0.5 metres to six metres in height). Shrub and scrub >6 metres in height are to be treated as trees.	• Should not be located under trees or within three metres of buildings. • Should not be planted in clumps >5 square metres in area. • Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground covers* (<0.5 metres in height. Ground covers >0.5 metres in height are to be treated as shrubs)	• Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above. • Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.

Grass	• Grass should be maintained at a height of 100 millimetres or less, at all times. • Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
Defendable space	• Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
LP Gas Cylinders	• Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building. • The pressure relief valve should point away from the house. • No flammable material within six metres from the front of the valve. • Must sit on a firm, level and non-combustible base and be secured to a solid structure.

** Plant flammability, landscaping design and maintenance should be considered – refer to explanatory notes*

Appendix C

ELA (2018)

Bushfire Emergency Evacuation Plan (BEEP)

1. Location details

Facility type:

- Short-term accommodation in Rural Area

Location:

- Lots 1 and 2 Frenchman Bay Road, Albany, Western Australia

Infrastructure:

- 25 accommodation units, including café and caretaker's residence

Occupation / Visitation (number of people):

- Maximum visitors: **200 (**based on 150 residential guests/caretaker, and 50 café patrons)

Access:

- Frenchman Bay Road (one formal and one emergency access route), internal paths and tracks within site.

Fire Weather Forecast Area:

- South West Land Division Fire District
- Stirling Coast

2. Communications

Mobile:

- Mobile reception is available – however, mobile communications can become unreliable during bushfire/emergency events due to the volume of usage

Landline / NBN:

- The resort will have a landline available for emergency use

Radio:

- ABC: Albany - Local Radio (630 AM), Southern Agricultural – News Radio (92.1 FM)

Internet Sites:

- Preparing your Property – DFES Link
- Emergency WA – www.emergency.wa.gov.au
- DFES on Facebook - www.facebook.com/dfeswa
- DFES on Twitter - www.twitter.com/dfes_wa
- National Bushfires app - www.bushfireblankets.com/bushfire-app.html

3. Contacts

Fire reporting	000	
Resort Manager	TBC	TBC TBC
DFES (Emergency Information)	13 33 37	
SES (Emergency Assistance)	132 500	
WA Police	000	
WA Ambulance	000	
Bureau of Meteorology (BoM) Recorded Information	1300 659 213	

4. Evacuation preparedness

- All guests must be briefed during the Bushfire Danger Period on the bushfire evacuation procedures with updated advice provided when the Fire Danger Rating (FDR) exceeds Very High or a fire warning is issued by Emergency Services (currently DFES) for the locality.
- This Evacuation Plan is to be displayed in guest's rooms, reception and communal areas.

BUSHFIRE PREPAREDNESS MATRIX

ACTION	LOW/ MOD	HIGH	VERY HIGH	SEVERE	EXTREME	CATASTROPHIC
Resort Manager to perform daily check (after 4 pm) on the DFES and BoM websites to determine the Fire Danger Rating (FDR) for the following day and weekly prediction. Update resort visitors if there is a likelihood of the site being closed to visitors due to FDR.						
Resort Manager to monitor Emergency WA / or DFES website or ABC Radio or 'National Bushfires' app for fire incidents		Min. 1 pm	Min. 1pm, 3pm	Min. 11am, 1pm, 3pm	Min. 11am, 1pm, 3pm (or more frequently if fire event in locality)	Resort Closed to visitors
Complete building preparedness checks			By 10 am	By 8 am	By 8 am	

5. Evacuation triggers

A decision to evacuate off-site or to the nominated bushfire shelter (shelter-in-place; the café/caretakers building) is to be determined by:

- Instructions from Police, DFES, other Emergency Services or Resort Manager
- the Bushfire Evacuation Matrix (overleaf)
- A warning regarding a known bushfire in the locality (see Bushfire Evacuation Matrix overleaf)

SEE EVACUATION DECISION MATRIX (OVERLEAF)

6. Evacuation Procedures

Every bushfire attack is different. The response to each must therefore be specific and be in response to bushfire warnings

Bushfire Warning Notification

- Emergency WA website, SMS or the 'National Bushfires' App (for smartphones) will provide initial notification of a fire and evacuation instructions.
- DFES, Police (or other incident personnel) may also attempt to notify visitors (on site).
- The Resort Manager is also responsible to ensure any visitors are aware of a fire warning has been issued.

Off-site evacuation

- Off-site evacuation is always safer, provided adequate time is available to complete safely. Confirm with Lead Agency (DFES or other Emergency Service) prior to evacuating and follow all directions.
- Off-site evacuation is to occur by driving private vehicles directly to Albany Leisure and Aquatics Centre (ALAC) on Barker Road (this has previously been used as an evacuation centre for the town). The ALAC is an evacuation point consistent with City of Albany Local Emergency Management Committee (LEMC) planning. Obtain further advice from media warnings once safely in Albany.
- Evacuation well in advance of a fire's predicted arrival time is safer than remaining on-site.

On-site evacuation

- Evacuating to the nominated on-site refuge may be required where it is not possible to evacuate to Albany safely.
- This nominated building (**café/caretakers building**) has been constructed to a BAL-29 standard, is situated in an area subject to a radiant heat flux of <10kW/m^2, and will provide for a greater level of protection than remaining outdoors.

Staging works

- Due to staging works, the café/caretakers building (i.e. on-site refuge) will not be available pre-Stage 3a, and will be subject to a separate Development Approval. Until the café/caretakers building is constructed, a temporary site sales office will be located in the café/caretaker's garage area/location and constructed to BAL-29. The site sales office will be moved once the café/caretakers building is established and operational and can be used as the on-site refuge.

  The temporary on-site refuge will contain an office/sales area and a conference room which is commensurate with the maximum number of potential residents on site. For example, by the end of stage 3 construction and prior to Stage 4 the temporary site sales office will contain 85m^2 of useable space to cater for 84 residents (i.e. 14 units @6 persons) in the event it is required as an on-site refuge.

7. Visitor welfare during shelter-in-place

- This will be provided by the Resort Manager. Serious medical needs will require emergency response via 000.

8. Building Preparedness Checks

- Include such tasks as ensuring reduced fuel loads around buildings, routine house maintenance is up to date including cleaning of gutters, fire breaks are in place, and static water supply is available.
- Detailed information and checklists are available on the DFES website including the 'The Homeowner's Bushfire Survival Manual' and the '*Prepare Act Survive Booklet*' published by DFES:

https://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/BushfireManualsandGuides/DFES_Bushfire-Homeowners_Survival_Manual.pdf

https://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/BushfireManualsandGuides/DFES_Bushfire-Prepare_Act_Survive_Booklet.pdf

9. Notes on Fire Danger Rating and Total Fire Ban Declaration

- The Fire Danger Rating (FDR) gives an indication of the potential consequences of a fire, if a fire was to start.
- The rating is based on predicted conditions such as the forecast temperature, humidity, wind and dryness of the landscape.
- The higher the fire danger rating, the more dangerous the conditions.
- During the Bushfire Danger Period (1st November – 30th April) the forecast FDR for the following day is typically released around 4pm but can be changed as weather conditions unfold.
- Both predicted and current FDR are available from the DFES and BoM websites.

A 'Total Fire Ban' (known as TFB) is a separate declaration (i.e. a particular day or part thereof may have both 'Severe' FDR and a TFB.

10. What to do if caught in a bushfire

The following provide current guidelines* on what to do if caught in a bushfire in a building or on foot. Each requires a different response involving critical decisions for your survival.

What to do if caught in a bushfire IN A BUILDING

Outside your building

- Ensure you drink plenty of water so you do not dehydrate
- Block your downpipes, (a sock full of sand/soil will help) and fill your gutters with water
- Move flammable items such as outdoor furniture, doormats,
- Gas cylinders should have the valve facing away from the building
- Do not stand on the roof with a hose. In bush fires, often more people are injured by falling from roofs than suffering burns
- Patrol the outside of the building, putting out any embers and spot fires that may start. An ember or spark can reach your home hours before the fire front arrives
- Just before the fire arrives, wet down timber decks and gardens close to the building
- Move any firefighting equipment to a place where it will not get burnt.

Inside your building

- Continue to drink water so you do not dehydrate
- Close doors, windows, vents, blinds and curtains to prevent flames, smoke and embers from entering
- Put tape across the inside of the windows so they stay in place if they break
- Shut off gas at the meter or bottle
- Move furniture away from the windows to prevent any embers that enter the building from igniting
- Fill sinks, bath and buckets with water for putting out any fires that may start inside
- Place wet towels around window and door edges to stop smoke and embers from entering
- Put a ladder next to the access hole to the roof space so you can check for spot fires.

During the fire

- When the fire arrives, go inside to protect you from the radiant heat
- Ensure you have torches ready as it is likely to become completely dark and you will not be able to see
- Patrol the inside of the building, including the roof space for sparks and embers
- Remember – if your life is at risk, call Triple Zero (000) immediately.

After the fire

- Once the fire has passed, you may need to patrol the property for hours. Go outside and put out any part of the building which is alight.
- An ember or spark from a fire can impact on a house many hours after the main fire front has passed and small spot fires can quickly get out of control.

What to do if caught in a bushfire ON FOOT

- Try to move on to bare or burnt ground at least 100 m from where fire is likely to burn, if this is not feasible find the largest bare or burnt ground possible
- Do not run uphill or away from the fire unless you know a safe refuge is able to be reached before the fire arrives. Try and position yourself downhill of the on-coming fire.
- Move across the slope out of the path of the fire front and work your way downslope towards the back of the fire or onto burnt ground.
- Do not attempt to run through flames unless you can see clearly behind them. This generally means that the flames are less than 1 metre high and less than 1 to 2 metres deep at the back or on the flanks of the fire.
- Lulls in the fire often result in the flames in these parts being low enough to step or run through to the burnt ground beyond.
- When conditions become severe use every possible means to protect yourself from radiation. On bare ground cover yourself, use wheel ruts, depressions, large rocks or logs to give protection.
- Take refuge in ponds, running streams or culverts, but behind solid objects such a rock
- Remain calm and do not run blindly from the fire. If you become exhausted you are much more prone to heat stroke and you may easily overlook a safe refuge. Consider an alternative course of action.

* adapted from NSW RFS bushfire training modules.

BUSHFIRE RESPONSE AND EVACUATION PLAN - Frenchman Bay Retreat: Lots 1 & 2 Frenchman Bay Road, Albany

586,200 586,400 586,600 586,800 587,000 587,200

6,116,400 6,116,200 6,116,000 6,115,800

Maintained APZ to achieve radiant heat flux < 10 kW/m²

Café

Frenchman Bay Rd

Whaling Station Rd

To Offsite Refuge (25 km)
(See inset map)

The Albany Leisure and Aquatic Centre
52-70 Barker Rd, Centennial Park
Distance: 25 km

Chester Pass Rd South
North Rd
Hanrahan Rd
Princess Royal Dr
Lower Denmark Rd
Denmark Rd

0 1 2 4 Kilometres

RISK STATUS	LOW/ MOD	HIGH	VERY HIGH	SEVERE	EXTREME	CATASTROPHIC
Fire predicted to impact site or egress	Evacuate to the Albany township if safe (seek advice from DFES / Emergency Services) or if instructed to do so*3 Allow for at least 2-4 hours for evacuation					
Time to fire impact is <time available to evacuate*2	If safe to do so; move directly to the nominated on-site refuge*1					
Fires exist in region but no risk to site			• Guests booked for the following 3 days alerted to possible Resort closure. • Brief guests of emergency service advice and maintain regular communications with them	• **Obtain emergency service advice on whether to close the Resort and evacuate guests off-site or shelter in place.**		• Close Resort for forecast period
No fires	Maintain appropriate monitoring as per Bushfire Preparedness Matrix					

*1 Relocate – ONLY if safe to do so e.g. flames are not visible or nearby dense smoke is not blown directly toward you. If you risk being caught on foot or in your car prior to reaching the on-site refuge, stay inside the accommodation dwelling.
*2 NB: time to relocate is the estimated time for all occupants/guests to pack up and drive to the Albany township PLUS adding extra precautionary time based upon the FDR. Check with emergency service warnings before evacuating. Leaving at least 24 hours prior to the predicted arrival of the fire may be required.
*3 Evacuation safety is dependent on factors such as Fire Danger Rating, wind strength and direction, and the proximity and direction of the fire. Follow advice of emergency service broadcast fire warnings or telephone them. Do not evacuate to Albany unless this can be completed many hours before the potential fire arrival. Advice from DFES or other Emergency Service should be sought before evacuating.

Accommodation block
Primary Egress
Secondary Egress
Off-site Refuge (Albany Leisure and Aquatic Centre)
On-site Refuge (Café)
Temporary on-site Refuge (Site Office) – to be used during staging works
Maintained APZ

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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Prepared by: LT Date: 13/04/2018