

APPENDIX E
LAND CAPABILITY & ENVIRONMENTAL
ASSESSMENT REPORT

**Lot 1
Ocean Beach Road
Denmark
WA**

Land Capability & Environmental Assessment Report



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1. Executive Summary

Mark and Steve Allen commissioned Bio Diverse Solutions (Environmental Consultants) to undertake an Environmental and Land Capability Assessment at Lot 1 Ocean Beach Road, Denmark, in the Shire of Denmark, Western Australia (“the Subject Site”).

The Subject Site is on the western side of Ocean Beach Road, 10km south from the Denmark town site. The Subject Site measures 235 metres from north to south, 220 metres east to west at the widest location. It covers approximately 5 hectares (ha). The Subject Site is located west of Wilson Inlet.

This Environmental and Land Capability Assessment is a supporting document for planning to guide the proponent and decision makers for a tourist development. A Land Capability Assessment is required to inform the relevant regulatory authorities for the purposes of tourist development of the Subject Site.

The Scope of works undertaken by Bio Diverse Solutions included:

- Undertake a targeted flora survey of Subject Site to map vegetation types and identify any presence of Threatened Flora as Listed by Department of Parks and Wildlife (DPAW) (Priority or Declared Rare Flora (DRF));
- Undertake soil sampling to ascertain conditions on the Subject site (soil types, water table levels, soil assessment) to identify site suitability;
- Undertake Environmental Assessment of the Subject site to identify any limitations and give planning advise;
- Assess the Subject Site in terms of vicinity (i.e. buffer requirements etc) to the Wilson Inlet; and
- Prepare a Land Capability and Environmental Assessment Report, which includes all of the above environmental considerations.

The assessment process was undertaken by Bio Diverse Solutions and involved desktop analysis of climate, site history, vegetation, fauna, and geology of the Subject Site. Site assessment included flora survey and analysis of soil types to ascertain site suitability to assist in the planning of on-site effluent disposal, development areas and limitations mapping.

The Subject Site has currently two existing dwellings and a disused shed, with the remainder of the property being predominantly cleared paddock areas. The Land Capability Assessment compares the physical requirements for a particular land use with the qualities of the land. The analysis determines the ability of the land to sustain a particular land use without resulting in significant environmental degradation. The proposed land use for the Subject Site is a tourist development of the site, subject to rezoning to tourism.

The soil testing was undertaken in late winter conditions by Bio Diverse Solutions on the 5th September 2013. The soils are mostly deep sands encountered across the site. The Subject Site is located on a flat aspect with low slopes (the average slope for the site assessed to be between 0-<5°) across the site.

Soil testing occurred on the higher ground >4m contour with the south eastern portion waterlogged and not tested. The soil conditions are fairly uniform across the north and western portion of the site with the main difference being the level at which the groundwater enters the profile. At Test Pit 2 groundwater was intercepted at 510mm below Ground Level (BGL), with the remainder of the site between 1100-1800mm BGL. The soils are generally moderately draining due to the presence of some silt.

The Subject Site vegetation is also quite uniform and low in diversity. The majority of the site is *Agonis Flexuosa* Low Open Woodland. A targeted search for possible Threatened Flora Species was undertaken with no species located on site.

The mapping of land units revealed three Mapping Units:

- 1) Map Unit "A" (Sands):
- 2) Map Unit "B" (Sands in wet, waterlogged areas):

Map Unit A revealed a Land Capability Class Rating of **II - Areas with a High capability for the proposed activity or use.** Map Unit B revealed a Land Capability Class Rating of **IV – Areas with a low capability for the proposed activity or use.**

Some planning considerations are required for development, particularly a 100m buffer from the Wilson Inlet (environmentally sensitive areas) and fire hazard setbacks. Alternative treatment units with phosphate removing capability are proposed for on-site effluent disposal.

Native trees on the Subject Site should be retained as much as possible for purpose of amenity, however some may need to be removed for bushfire protection. Retaining trees where possible will assist in the stabilisation of the site, provide refuge for birds/reptiles and provide buffers to adjacent land uses.

It is noted that this assessment does not include a detailed Fire Management Plan, Stormwater Management, engineering assessment or geotechnical assessment for structural footings/building construction and road pavement design. Bio Diverse Solutions recommends that these assessments would be required prior to commencement of building/ development. Although not undertaken, a Level 2 Flora Assessment or Fauna survey is not deemed necessary as the Subject Site has been severely altered and this risk of disturbing threatened species is low.

Bio Diverse Solutions conclude that if the listed "Planning and Management Recommendations" (Section 7.0) are implemented by the client, the Shire of Denmark could consider the Subject Site suitable for a scheme amendment for the purpose of rezoning the Subject Site to tourism. If the listed recommendations are undertaken, the proposed tourist development could be implemented sustainably and in an environmentally sound manner.

2. Introduction

Bio Diverse Solutions was commissioned to undertake a Land Capability and Environmental Assessment of the Subject Site for the purposes of a tourist development, requiring approval from the relevant regulatory bodies in relation to rezoning the land. The Land Capability Assessment is aligned to the State Planning Commission Land Capability Assessment for Local Rural Strategies (1989).

The Subject Site is on the Western side of Ocean Beach Road and approximately 10km south of Denmark town site in the Municipality of the Shire of Denmark. The Subject Site measures 235 metres from north to south, 220 metres east to west at the widest location. It covers approximately 5 hectares (ha). The Subject Site is located west of Wilson Inlet. Please refer to Location Mapping Appendix A.

2.1. Land Capability Assessment Method

Bio Diverse Solutions (Environmental Consultants) was commissioned to undertake a Land Capability and Environmental Assessment of Lot 1 Ocean Beach Road Denmark. The methodology for establishing the site suitability for the proposed use (Tourism) is similar for establishing rural residential use and the methodology as per the (previous) Department of Planning and Urban Development Department document "Rural Residential Development in the Perth Metropolitan Region" has been used to guide the site capability for this site in the absence in that document for the tourism land use definition.

To assess the capability of the land, the WAPC Land Capability Assessment does not have a tourism category, therefore the site has been assessed as "*Rural Residential with on-site effluent disposal*" (as per the State Planning Commission (1989) Land Capability Assessment definition not any other planning instrument) and is aligned to the Department of Agriculture and Food standards and State Planning Commission Land Capability Assessment for Local Rural Strategies (1989).

The Land Capability Assessment involves a number of inter-related stages including:

1. **Land Use Requirements** – Specifies and defines the proposed land use, list the land qualities and characteristics to determine each land quality.
2. **Land Resource Survey** – Divides the study area into mapping units which have measureable differences and may influence the land attributes and land capabilities.
3. **Land Capability Analysis** – For each mapping unit rate each individual land quality and determine overall capability to sustain the land use.

The land use that has been considered for this study area is defined as "*Rural Residential with on-site effluent disposal*, (as per the State Planning Commission (1989) Land Capability Assessment definition not any other planning instrument) as per the definition in the State Planning Commission, *Land Capability Assessment for Local Rural Strategies* (1989) document.

The Land Capability Assessment process (SPC, 1989) compares the physical requirements for a particular land use with the qualities of the land. This analysis determines the ability of the land to sustain a particular land use without resulting in significant environmental degradation.

This study was undertaken in late winter conditions in September 2013 and has included analysis of the soil and landform from soil survey, field vegetation survey and analysis, environmental assessment and laboratory analysis of soils.

2.2. Alignment to Legislation, Policy and Guidelines

In assessing the site, Bio Diverse Solutions has prepared this report aligned to the following legislation:

- State Planning Commission, Land Capability Assessment for Local Rural Strategies (1989);
- *Health Act (1911)* and draft *Health Act (2008)*;
- *Biosecurity and Agriculture Management Act 2007 (BAM Act)*;
- *Environmental Protection Act 1986*;
- *Environmental and Protection and Biodiversity Conservation Act 1999*;
- Environmental Protection Authority (EPA) (2005) *Environmental Guidance for Planning and Development* Draft Guidance Statement No 33 June 2005;
- *Environmental Protection (Clearing Native Vegetation) Regulations*;
- Environmental Weeds Strategy for Western Australia 1999;
- DER Acid Sulphate Soils Assessment Guidelines;
- *Wildlife Conservation Act 1950*;
- *Contaminated Sites Act 2003*;
- Draft Government Sewerage Policy – Consultation Draft 2011;
- *Country Area Water Supply Act 1947*; and
- *CALM Act 1980*; and
- Wilson Inlet Catchment Management Plan 2013-2022.

2.3. Desktop Assessment

Desktop assessment was undertaken of government databases and associated literature. A desktop review of the Subject Site within and adjacent to the site was undertaken. This assessment was conducted to various levels, ranging from state-wide to area specific information. The following searches were conducted as part of this report:

- Interim Biogeographic Regionalisation of Australia (IBRA) – identifies, at a regional level, the vegetation communities and land systems present within Australia;
- Land Systems – Further detailed information on the vegetation communities and land systems;
- DER (formerly DEC) ASS Risk Mapping;
- Department of Indigenous Affairs - Aboriginal Heritage Database
- Department of Water – 250K Hydrogeological Mapping and Public Drinking Water Source Areas datasets, 2001;
- Department of Agriculture and Food WA (DAFWA) – Declared weeds database;
- Pre-European vegetation mapping dataset (DEC 2005) based on the project AJM Hopkins, GR Beeston, JM Harvey (2000);
- Beard's Vegetation Classification dataset, 1:3,000,000 digital representation of Beard's vegetation map of the state of Western Australia.

2.4. Site survey

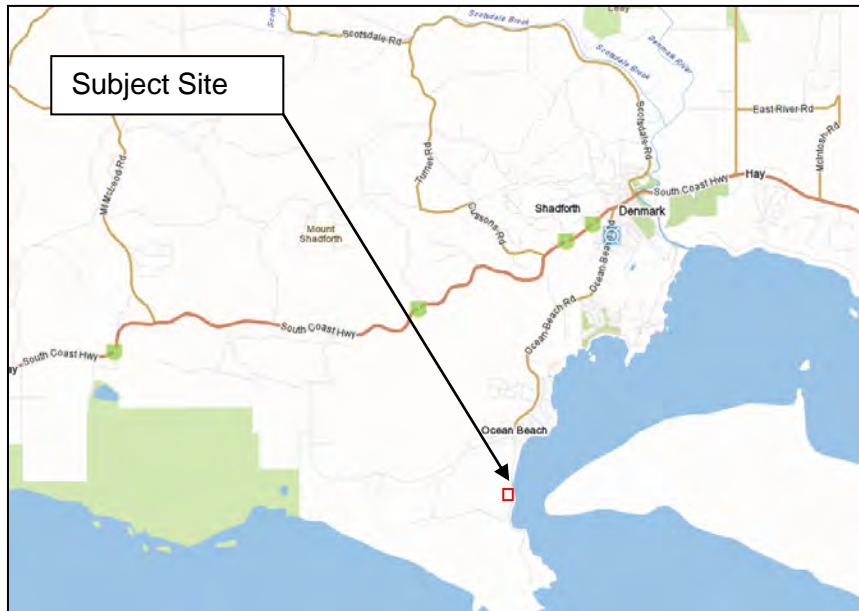
Level 1 targeted Flora and Vegetation Survey has been undertaken on the whole of the property with targeted searches for Threatened Flora adjacent to any proposed disturbance areas. Flora searches were undertaken in spring on 5th September 2013 by Kathryn Kinnear, (Environmental Consultant, Bio Diverse Solutions).

Soil sampling was undertaken on the Subject Site by Kathryn Kinnear, (Environment Consultant, Bio Diverse Solutions) on 5th September 2013 and sent to laboratories (CSBP Soil Laboratory and Coffey) for technical analysis.

3. Site Details

The Subject Site is on the western side of Ocean Beach Road, 5km south from the Denmark town site. The Subject Site measures 235 metres from north to south, 220 metres east to west at the widest location. It covers approximately 5 hectares (ha). The Subject Site is located west of Wilson Inlet. Please refer to Figure 1 below and Location Mapping Appendix A.

Figure 1 – Subject Site Locality



The Subject Site is in close proximity to the Wilson Inlet. To the south is the Ocean Beach Caravan Park and Chalets. Other Rural and Residential lots border the Subject Site to the east north of the site.

This Land Capability Assessment relates to the Subject Site as per the requirements of 'Rural Residential with on site effluent disposal' as defined in the State Planning Commission, Land Capability Assessment for Local Rural Strategies (1989).

3.1. Current site land use

The Subject Site is currently has 2 existing buildings and an old disused shed located in the north of the property. The lot was previously used for grazing (cattle) from the previous owners (pre-2008) and possibly potato farming pre 1990's in the lower wetter areas (*Pers Comms M. Allen September 2013*).Please refer to Photographs 1 and 2 below.



Photograph 1 – View of the existing house north central of the Subject Site.



Photograph 2 – View of old shed in north west of Subject Site.

The Subject Site is one lot of Peppermint trees (*Agonis flexuosa*) and paddock grasses on the western two thirds of the site and low lying wetland on the eastern side adjacent to the Wilson Inlet.

3.2. Zoning and Proposed Development

The site is currently zoned rural in TPS No3 and identified in the Local Planning Strategy as “General Agriculture”. It is proposed that a more appropriate land use is for tourism purposes and “Tourist Zone” is proposed.

Please refer to Development Plan Appendix A.

Access is restricted to the Subject Site along a driveway in the north off Ocean Beach Road, please refer to Photographs 3 and 4 below.



Photograph 3 – View of existing driveway access off Ocean Beach Road to the north.



Photograph 4 – View of Ocean Beach Road to the west of the Subject Site.

3.3. Adjacent Land uses

The Subject Site is located within rural/rural residential interfaces and has a tourist caravan park/chalets adjacent to the south of the property, refer to Photograph 5 below. Wilson Inlet is directly to the east (Photograph 6) and the Southern Ocean (Surf life saving club and recreational beach sites) are within walking distance south of the Subject Site.



Photograph 5 – View of Chalets/Caravan park to the south of the Subject Site.



Photograph 6 – View of Wilson Inlet to the west of the Subject Site.

3.4. Historical land use

The Subject Site has been historically used for agriculture/farming activities such as grazing and possibly growing potatoes in the lower south east of the site (intensive horticulture)(*Pers comms* M. Allen, 2013). Analysis of Landgate aerial photography available for the site (2001-2011) indicates there has been no other land use for the site.

The Wilson Inlet is adjacent to the Subject Site, please refer to Photograph 6. Historical uses of the Inlet and surrounding catchment include farming, fishing, the historic railway line, guesthouses and holiday parks. Commercial fishing was occurring in the estuaries adjacent to Denmark/Albany in the early 1890s. In the early 1900s J.D. Smith and brothers began operating as professional fishermen on the Wilson Inlet (WICC, 2013).

3.5. Aboriginal Heritage

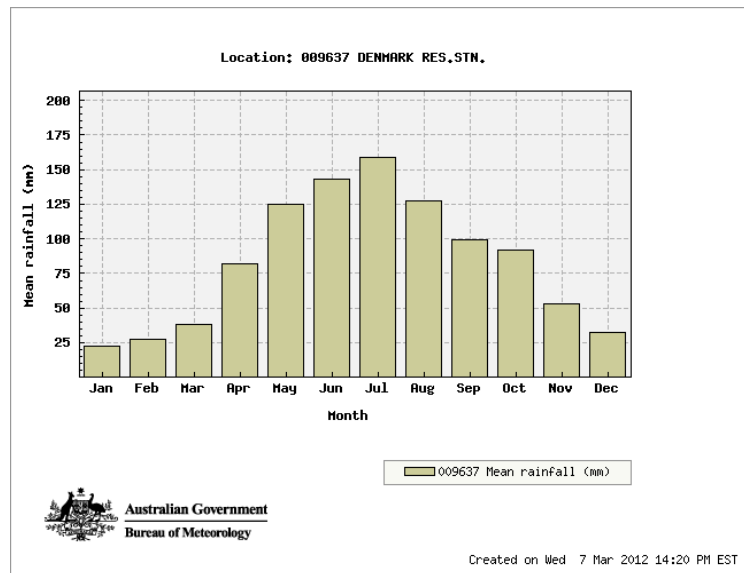
A search of the Department of Indigenous Affairs (DIA) database revealed that there are no Aboriginal Heritage sites located within the Subject Site. The Wilson to the east of the Subject Site were highly significant hunting and gathering areas for Aboriginal communities of south-western Australia. (DEC, 2009). This area still holds a strong significance for the indigenous people of the south – west. There is a Aboriginal Heritage Site adjacent to the Subject Site (150m to the north) The development is not anticipated to affect this site. Please refer to the Aboriginal Heritage Site Report at Appendix B.

3.6. Climate

Denmark's long-term median annual rainfall is approximately 995.9mm though there can be considerable variation in the total rainfall from year to year. Annual rainfall has ranged from on average, approximately 72 per cent of the annual rainfall occurs between May and October. Although cold fronts are responsible for much of the recorded rainfall total, a moist onshore flow can occur in any season and bring showers or drizzle. Denmark records rainfall on average 138.3 days annually (BOM, 2012).

July is the wettest month, with the wettest month recorded in August 1955 of 292.6, rain occurs on two days out of every three during an average winter. The driest month is January with a mean of 22.3 mm and in winter the average is 158.9mm (July). Please refer to Figure 2 below - Mean Rainfall Denmark (BOM 2012).

Figure 2 – Mean Rainfall Denmark Station (BOM)



(Source BoM Website, 2012)

3.6.1. Temperature

Average maximum temperatures peak in January and February in Denmark, with monthly means of 25.9°C although temperatures above 35°C sometimes occur when hot, dry northerly winds arrive from the interior of WA. Overnight minima also peak in January and February at a mild 13°C, on average.

Winter daily maximum temperatures average approximately 16.1°C, while the average minimum is approximately 6.9°C in July and August. Daily minimum temperatures below 5°C can be expected about once or twice a month in winter, but Denmark daily temperature records between 1907 and 1965 show no occasion where the temperature fell to zero. Please refer to Figure 3 and Figure 4 illustrating Average Temperatures Denmark (BOM 2012).

Figure: 3 Mean maximum temperature

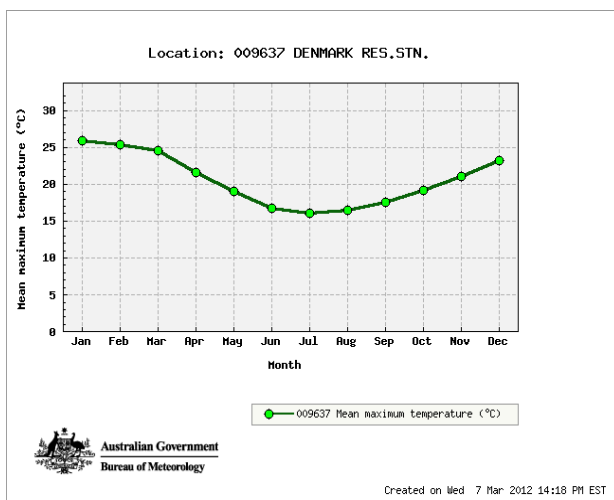
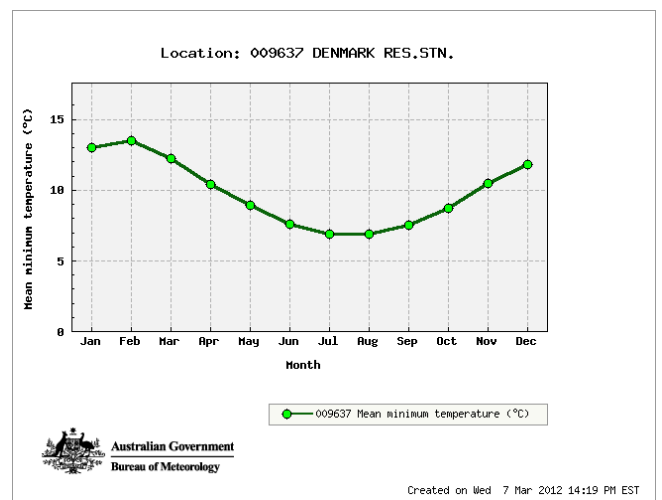


Figure 4: Mean minimum temperature



3.6.2. Wind

The dominant wind direction in summer is from the north west and afternoon sea breezes occur from the south west/south east. During winter, southwest winds prevail and northwest storm events occur (BOM, 2012). Although fronts and depressions may bring strong to gale force winds, winter winds are more variable and generally lighter than those of summer. Please refer to Figure 5 and 6.

Evaporation in the summer months is high with a January average of 240mm (8mm a day). The monthly evaporation decreases to 66mm in June (2mm a day). Daily evaporation can vary significantly from over 15mm on a hot windy summer day to almost negligible on a cold wet winter day.

Figure 5 – Summer (Jan) wind rose BoM

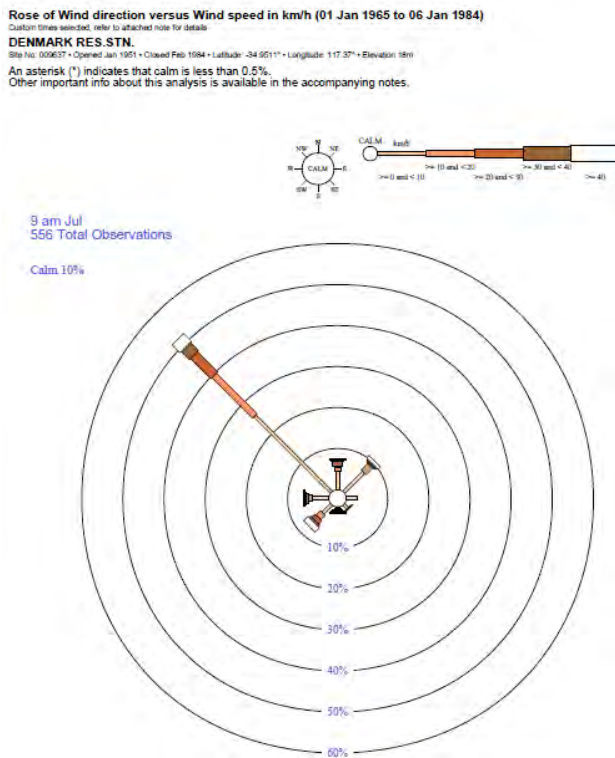
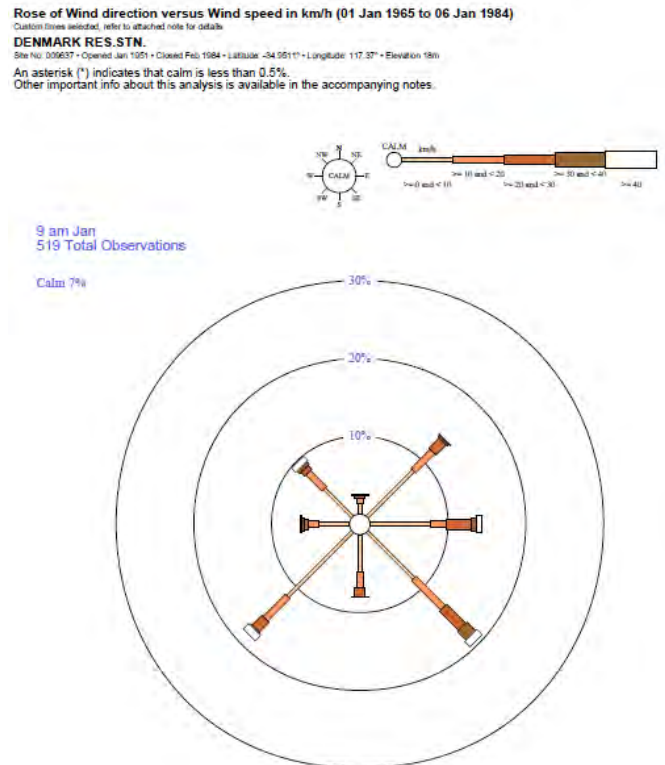


Figure 6 – Winter (July) wind rose BoM



(BOM, 2012).

3.7. Prevalent Fire Weather

Fire weather is characterised by mid-level disturbances across the south west of Western Australia, bringing unstable atmospheric conditions (thunder and lightning) from the north or north-west wind directions. This is characteristic of “Extreme” Fire Weather conditions to the area with hot dry conditions prior to storm events. Risk of lightning strikes, spark ignition, arson and other causes of fire give rise to wild fires under these conditions.

Prevalent winds which most wildfire events occur in the region are from the north-west, east and north-east direction. Conditions tend to be dry with low relative humidity. High winds and excess fuels can lead to hazardous conditions for residents. Strong easterly and south westerly winds exist at the subject site during dry summer periods. These circumstances place residential housing under the most risk from wildfire events.

3.8. Climate Change

Climate change is expected to impact on the future rainfall pattern of the area. It is recognised that the average rainfall has already declined by 20%-30% over the past few decades

and that the long term impact of climate change may lead to a shift in rainfall, as well as dryer climatic conditions for the region. The long term changes are predicted to impact on the flora, fauna and water availability for the region.

The Climate Commission (Climate Commission 2010) estimates that:

“...Rainfall patterns in Western Australia have changed over the last 40 years. There is significant evidence that climate change has contributed to the marked drying trend in the southwest of the state.”

The construction of the proposed tourist development could be affected by sea-level rise, from increased intensity rainfall events or extended drying periods. It is recommended that a setback of 100m occurs from the Wilson Inlet occur to allow precautionary principles with building placement, fire breaks, on-site effluent disposal and other structural designs. This will ensure that any flooding or high rainfall periods do not affect infrastructure proposed and that any watershed from the development from increased intensity rainfall events can be managed onsite with effective planning.

3.9. Geology

The greater part of the Wilson Inlet catchment lies in the Albany/Frazer geological province with its Precambrian granitic overlain by Quaternary sands and laterite (Mitchell 2008). Soils around the Wilson Inlet and its catchment consist of a variety of silts, sand, clays and gravel. The primary soil types being yellowish brown sandy and gravelly duplex soils (South Coast NRM, 2011).

The catchment is characterised by undulating lateritic plains and poorly drained flats, hilly terrain with rock outcrops and deeply incised valleys where the waterways have exposed the weathered profile and underlying bedrock (Collins & Fowlie 1981; Kern 1992; Bari et al. 2004). The Inlet is situated on a narrow coastal plain about 10km wide, with coastal dunes to the south and an undulating, hilly plain to the north leading up to the plateau of the upper catchment. West of the Inlet there are moderate hills while to the east, the land is dominated by stagnant, low lying flats and plains.

Australian Geoscience Mapping and Department of Water 250K Hydrogeological mapping places the Subject Site from the Quaternary/Cainozoic/Phanerozoic Time period:

(Qe): Estuarine and lagoonal deposits – clay silt and sand; and

(Qa) Alluvium, minor colluvium-gravel, sand, silt and clay

The aquifer is described as *Surficial aquifer - local aquifer, possible sedimentary aquifer beneath, minor groundwater resource* (GSWA, 1984).

4. Site Assessment

Site assessment was undertaken by Bio Diverse Solutions of the Subject Site on the 5th September 2013 of site soils, remnant vegetation, fauna and other landscape values (Appendix C). Laboratory testing of soils was undertaken by CSBP Soil Laboratory and Coffey Laboratories (Appendix D).

4.1. Topography and Slope

The Subject Site is located on a flat aspect in along the Wilson Inlet foreshore with the average slope for the site assessed to be between approximately 0 to <5° across the site. The northern western edge of the site is at approximately 15m AHD, and the contours gently decrease in a south easterly direction to Ocean Beach Road in the west to <5m AHD.

4.2. Site Soils

Site soil testing was undertaken in late winter conditions (September 2013) by Bio Diverse Solutions. The soil sampling strategy focussed on the proposed disturbed areas with the lower weta areas inaccessible due to inundation (and not deemed to be disturbed through the development process). Site soil testing confirmed the site to be one soil category – Deep sands. Please refer to the Soil Profile Sampling record sheets at Appendix C.

4.2.1. Deep sands

This soil type was encountered over the sampling area in the western two thirds of the site. All of the six Test pits generally had an A Horizon of dark grey organic matter (top soil) ranging from 0-250mm Below Ground Level (BGL), with dark grey sand from 250-650mm BGL grading to grey/brown coarse sand at 650-1100mm BGL. The B Horizon consisted of generally grey to cream silty sands at depths between 1100-2000mm BGL.

Groundwater was intersected in all the test pits. The highest water table (510mm BGL) was recorded at Test Pit 2 (closest to the wet area), with the remaining test pits recording between 1130mm to 1840mm BGL. Please refer to Soil Profile Sampling results at Appendix C.

4.2.2. Soil Laboratory testing

Laboratory testing was undertaken of representative samples for Permeability and Phosphorous Retention Index (PRI).

4.2.3. Soil Permeability

Permeability Testing was undertaken by Coffey, indicating the soils are medium draining (Appendix D). The sandy A Horizon soils were generally medium permeability being 4.3E-06 m/sec (10^{-6} m/sec) (Test Pit 1 650-1100mm) and 2.0E-07 (10^{-7} m/sec) (50-650mm BGL).

Sandy soils generally record high permeability, however the presence of some silt in the sample may account for the moderate permeability. The results indicate the sand soils on the Subject Site generally would be medium draining in the A – Horizon. Refer to Figure 7 and 8 outlining general permeability of soil types.

Figure 7 – Generalised Permeability (Hydraulic Conductivity of Soil Types)

(Source, Artiola *et al* 2004)

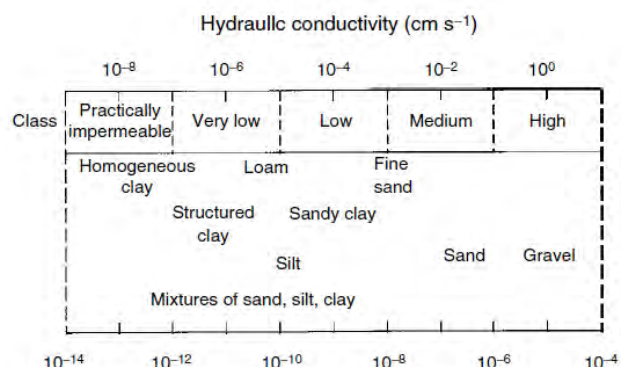
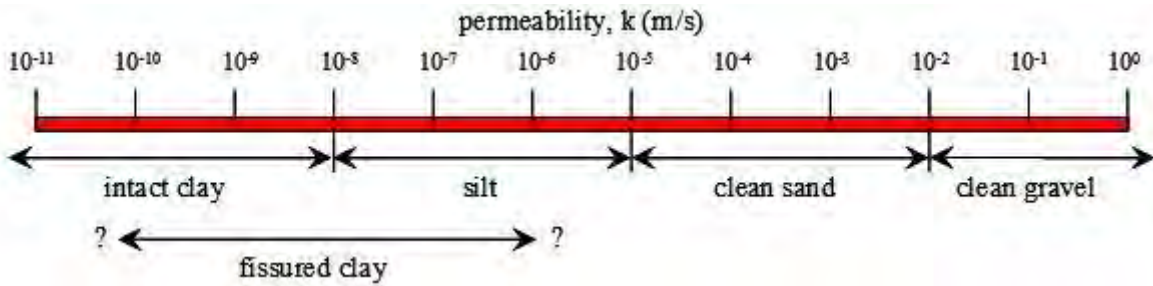


Figure 8 – Permeability scale m/sec



Source: UWA, 2013

4.2.4. Phosphorous 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, with soils >5 have a high ability to treat effluent waters (nutrients). PRI Testing was undertaken on the same samples for permeability by CSBP Soil Laboratories. The test results indicate the site has a moderate - low ability of treating effluent waters, with PRI of 2.5, 0.0 and 1.0 recorded.

A value of 0.0 indicates that the PRI was less than the detection limits of reporting, this was recorded at Test pit 4. Sandy soils generally record a moderate-low PRI, the laboratory testing (CSBP, 2013) at Appendix D, demonstrate that these soils have a moderate-low ability to fix nutrients within the soil profile.

4.2.5. Acid Sulphate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils containing iron sulphides. These soils are typically benign within an anaerobic environment. However, when they become oxidised through disturbance, acidification of soil and groundwater can occur. The resulting sulphuric acid can also break heavy metal bonds, releasing metals such as aluminium, iron and arsenic into the groundwater and environment.

A desktop assessment aimed at determining the potential for ASS within the project site revealed limited datasets available for the Denmark Area. The Wilson Inlet is defined as a High Risk in the Department of Environmental Regulation (DER, formerly DEC dataset) "Estuary" ASS digital dataset (Sourced WA Atlas 2012). Given the close proximity to the Wilson Inlet it is probable that ASS could be located in the inundated areas in the south east of the property. The "grey sands" in the north and west are not waterlogged until depths over 1100-1300mm BGL, ASS is unlikely in this soil type.

It is recommended when the nature of the disturbances are known for the development (i.e. cut fill etc), then a Department of Environment and Regulation (DER, formerly part of DEC) "ASS Self Assessment" form is completed, and if required, an ASS Investigation and reporting occur as required by the DER. This could be undertaken at conditional approval of tourist.

It is therefore recommended:

- When the nature of the disturbances are known for the development (i.e. cut fill etc), a Department of Environment and Regulation (DER, formerly part of DEC) "ASS Self Assessment" form is completed, and if required, an ASS Investigation and reporting occur as required by the DER.

4.2.6. On site effluent disposal

The health and environmental requirements for wastewater treatment and disposal for developments not serviced by deep sewerage systems are contained in the *Draft Government Sewerage Policy*, (Department of Health, 2011). The Subject Site is situated in an

area that does not have deep or reticulated sewerage. The Subject Site is adjacent to the Wilson Inlet. These factors mean that the Subject Site is required to meet the criteria for Environmentally Sensitive Areas (ESA) section of the Draft Government Sewerage Policy. The Draft Government Sewerage Policy (2011) states the following minimum requirements apply for all on-site sewage disposal systems. Please refer to Table 1 below.

Table 1 – Minimum requirements for all on-site wastewater disposal systems

Site Feature	Minimum Requirement
Drainage System/channels	No apparatus shall be constructed so sewage is discharged into the ground within 6 metres of any sub-soil drainage system or open drainage channel.
Flooding	Land application area shall not be subject to inundation or flooding at a probability greater than once in twenty (1:20) years.
Gradient to the Land	Not to exceed one in five (1:5). Shall be engineered to prevent run-off from the land application area (e.g. bunding, Gradient of the land terracing). application area Surface contours shall be provided on the site plan
Land application area	Depending on the soil type, an unencumbered area of at least 150m ² , or the area calculated from Appendix 4.2A in AS/NZS 1547:2000, must be set aside for the disposal of sewage for each dwelling [1]. This area excludes the area required for the apparatus. In the case of non-residential development or subdivision, the unencumbered area to be set aside shall be approved by the Department of Health. The area set aside for the disposal of the sewage shall: <ul style="list-style-type: none"> • not be built on or paved in a manner which precludes reasonable access; and • be kept in a manner which enables servicing and maintenance of the disposal system. All sewage shall be confined within the bounds of the designated land application area. All sewage shall be confined within the bounds of the designated land application area.
Soil absorption zone	For absorptive soils, the soil absorption zone of the land application area shall have a depth of at least 0.6 metres [2] above the highest seasonal or permanent water table. For sandy soils, the soil absorption zone of the land application area shall have a depth of at least 1.5 metres above the highest seasonal or permanent water table.
Soil permeability	Tests to be conducted as per Appendix 4.1F <i>Soil permeability measurement – Constant head test</i> in AS/NZS 1547 <i>On-site domestic wastewater management</i> .
Soil profile	To be carried out in accordance with Appendix 4.1A <i>Site and soil evaluation: procedures</i> , 4.1D <i>Site and soil properties</i> and Appendix 4.1 E <i>Dispersive soils and sodicity</i> in AS/NZS 1547:2000 <i>On-site domestic wastewater management</i> . Depth of soil samples shall be a minimum of 2.0 metres from ground level.
Water supply	Apparatus shall not be constructed or situated in a place where sewage will be discharged into the ground at a distance less than 30 metres from any well or other underground source of water supply, which water is used or intended or likely to be used for human consumption.

(DoH, 2011)

Groundwater was encountered in the entire test pits, with the highest recorded at test Pit 2 near the low lying area in the east of the Subject Site. Other locations (north and western) across the Subject Site recorded groundwater between 1100mm BGL and 1800mm BGL.

The sandy soil profiles throughout the Subject site (moderately draining and moderate-low PRI) indicate that traditional septic style systems for on-site effluent would not be appropriate. It is recommended that Phosphorous Removing Alternative Treatment Units (ATU's) are installed across the site. Given the proposal is for a Tourist Development, consideration could be given to a central treatment system installed which is located on the near or adjacent to the lowest known groundwater (Test pit 5, south east of the property 1840mm BGL)

As the Wilson Inlet to the east is categorised an "Environmentally Sensitive Area" (ESA) as per the Government Sewerage Policy (2011), a minimum setback of 100m is required from the high water mark (DoH, 2011).

It is further recommended that only approved Health Department WA Phosphorous ATU's are to be installed due to the nature of the site and must be approved by the Shire of Denmark at development stages. Please refer to Appendix F for approved Department of Health (DoH) WA Phosphorous Removing ATU's. These will need to be installed and maintained by future owners to manufacturer's recommendations/instructions.

It is therefore recommended that:

- On Site effluent disposal will need to be a minimum setback of 100m from any the edge of the tidal high water mark of the Wilson Inlet; and
- Recommended on-site effluent is via DoH WA Phosphorous Removing Alternative Treatment Units (Appendix F) and approved by the Shire of Denmark prior to installation. Consideration to installing a commercial central unit in the south of the Subject site where water table is >1500mm BGL.

4.3. Vegetation Types

Desktop assessment reveals the subject lies within the Warren IBRA bioregion. This bioregion is comprised of "*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.*" (Hearn et al 2002)

The vegetation has been mapped on a broad scale by 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 DEC database search of Beards vegetation classification for general area places the site within 1 broad Vegetation Association for the site:

1. System Association: Denmark

- Vegetation Association number: 14
- Vegetation Description: Low forest; jarrah.) (e2Lc)
(Source DEC Pre-European Vegetation GIS dataset).

4.4. Vegetation Assessment and Methodology

The survey area is defined as Lot 1 Ocean Beach Road, Denmark, with the whole property mapped for vegetation types and intensive flora sampling/Threatened Flora searches undertaken by K. Kinnear (Bio Diverse Solutions) in September 2013 in proposed disturbance areas. The Subject Site was traversed on foot and a list of dominant flora species present

(native and exotic) was compiled as seen; samples or photographs were collected for unfamiliar species. Specimens collected were pressed, dried and identified. Specialist texts were used to identify specimens (Wheeler *et al*, 2002) with some checked against examples in the reference herbarium at the DPAW Albany Regional Herbarium for confirmation. The authority for taxonomic names was DPAW's Florabase website as of October 2013.

Intensive survey was undertaken for Threatened Flora species, with follow up identification at the DEC Regional Herbarium. Areas were searched for Threatened Flora adjacent to known populations and likely habitat for specific species. Vegetation condition was assessed during the field survey. Vegetation condition was assessed using the vegetation condition scale as per Keighery (1994).

The Subject Site supports vegetation types reflective of the underlying soil types and general native vegetation of the area. Two vegetation types were identified on site:

- Low Open Peppermint (*Agonis flexuosa*) Woodland; and
- Low flats of *Centella asiatica*

Disturbance is evident and throughout the Subject Site from previous grazing and agricultural pursuits. Discussion with the current owners indicates that the property has been utilised for grazing of cattle and possibly seasonal horticulture such as potato farming in low lying areas.

Vegetation condition was assessed to the criteria as outlined in *Bushland Plant Survey, A Guide to Community Survey for the Community*:

- *Pristine: Pristine or nearly so, no obvious signs of disturbance;*
 - *Excellent: Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species;*
 - *Very good: Vegetation structure altered, obvious signs of disturbance;*
 - *Good: Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate to it; and*
 - *Degraded: Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.*
- (Keighery, 1994)

All of the vegetation types were generally considered to be in "Degraded" condition: "*Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management*" (Keighery, 1994).

4.5. Low Open Peppermint Woodland

This vegetation type comprises of 60% of the Subject Site and is confined to the north and western portion of the site. The Peppermint trees (*Agonis flexuosa*) comprise almost 100% of the canopy cover with Peppermints generally 3m – 5m in height. Flora survey revealed there is a lack of middle storey and a degraded understorey present. The sedge and herb storey in this vegetation complex has over 70% ground cover. The majority of species were less than 1m in height however some herbs were between 1m – 2m in height. Native species recorded within this vegetation unit included Native Wisteria (*Hardenbergia comptoniana*), *Tremandra stelligera*, *Pimelea clavata*, and Bracken Fern (*Pteridium esculentum*). Introduced (weed) species identified within this cover class including: Kikuyu grass (*Pennisetum clandestinum*), Bridal creeper (*Asparagus asparagoides*), Deadly nightshade (*Solanum nigrum*), water couch grass (*Paspalum distichum*), Inkweed (*Phytolacca octandra*), Arum lily (*Zantedeschia aethiopica*), Spear thistle (*Cirsium vulgare*) and an introduced sedge *Juncus acutus*.

Please refer to Photographs 7 and 8 below and Vegetation Mapping Appendix E.



Photograph 7 – View of Low Open Peppermint Woodland in southern portion of site.



Photograph 8 – View of Peppermint Woodland in north of Subject site.

The vegetation has sustained severe alteration from grazing and agricultural pursuits and is generally in low species diversity. It is recommended however that the trees are retained across the site to provide amenity and possible habitat for birds, reptiles and small mammals.

4.6. Low flats of *Centella asiatica*

The south/south western portion of the Subject site is predominantly low flats of *Centella asiatica* (dominant species) with a variety of sedges and rushes such as *Juncus kraussii*, Seablite (*Suaeda australis*), *Juncus acutus* (introduced) and occasional Saltwater paperbarks (*Melaleuca cuticularis*) in the south eastern corner. Species surveyed indicate that this portion of the site could be subject (or was previously subject to) tidal inundation from the adjacent Wilson Inlet. Please refer to Photographs 9 and 10 below and Vegetation Mapping Appendix E.



Photograph 9 – View of Low flats of *Centella asiatica*.



Photograph 10 – View of interface of Peppermint Woodland and low flats central of Subject site.

The low lying (south eastern and eastern) portion of the site is possibly inundated with saline water in extreme flood events. This area may have once been salt water paperbark wetland vegetation type. To encourage local diversity and restore this area, revegetation/restoration is recommended. It is further recommended prior to revegetation or restoration that soil testing is undertaken to ascertain soil conditions and appropriate species selection.

It is therefore recommended:

- Trees are retained across the site where appropriate to encourage fauna habitat and site biodiversity; and
- Revegetation occurs in the low lying (wetland) areas.

4.7. Threatened Flora

Definitions of the Conservation Code (Threatened Flora listings) are defined under the *Wildlife Conservation Act 1950*, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 deal with those that are threatened and that are presumed extinct, respectively.

Definitions of Threatened Flora (Conservation Code) under the *Wildlife Conservation Act 1950* are as follows:

- **T: Threatened Flora (Declared Rare Flora — Extant)**

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:

CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild

EN: Endangered – considered to be facing a very high risk of extinction in the wild

VU: Vulnerable – considered to be facing a high risk of extinction in the wild.

- **X: Presumed Extinct Flora (Declared Rare Flora — Extinct)**

Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*).

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

- **Priority 1** - Poorly known Taxa. Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey;
- **Priority 2** - Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey;
- **Priority 3** - Poorly Known Taxa. Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey;
- **Priority 4** - Rare Taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened

- by any identifiable factors. These taxa require monitoring every 5-10 years; and
- **Priority 5** - Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years

Based on the degraded nature of the site a DPAW database search/request was not undertaken of the site as there was a very low probability of listed species being present in the north and western portion of the site (where disturbance is proposed). A detailed site search was undertaken of proposed disturbance zones (north and western portion of site) to assess the site for possible listed flora species. Site searches did not identify evidence of Priority Flora or Declared Rare Flora pursuant to Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950*, in the subject area.

4.8. Weeds and introduced species

In 1976 the Agriculture Protection Board introduced legislation to control weeds – the *Agriculture and Related Resources Protection Act 1976*. As of 1 May 2013, the *Biosecurity and Agriculture Management Act 2007 (BAM Act)* and regulations came into force. Legislation to be repealed is now covered by the BAM Act and its regulations. This legislation sets out “declared” plants and legal obligations to landowners in regards to these species. If a plant is declared then landowners are obliged to control that plant on their properties.

Environmental Weeds are defined by the “Environmental Weeds Strategy for Western Australia” (1999) as “plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade”. At present there is no legislation governing management of Environmental Weeds, landowners are encouraged to control movement and restrict further spread of these species.

Any plant other than a declared plant can be prescribed as a “Pest Plant”, under Section 22 of the *Biosecurity and Agriculture Management Act 2007 (BAM Act)*. Typically these are prescribed whereby the occurrence of these may adversely affect property values, comfort or convenience of the inhabitants of a particular district.

The Act states (6) (1) .*The council may serve on the owner or occupier of private land...a duly completed notice...requiring him/her to destroy eradicate, or otherwise control any pest plant on that land’ (Agriculture and Related Resources Protection Act 1976)*. A few environmental weeds were present across the site predominantly in the cleared and disturbed areas. A summary of the weeds located on site is shown in Table 2.

Table 2 – Weed Species identified from Site Survey

Weed species
<i>Pennisetum clandestinum</i> Kikuyu grass
<i>Lagurus ovatus</i> Hare’s tail grass
<i>Arctotheca calendula</i> , Cape weed
<i>Paspalum distichum</i> , water couch
<i>Lotus spp</i>
<i>Rumex Spp</i>
<i>Solanum nigrum</i> Deadly nightshade
<i>Arum Lily</i>
<i>Asparagus asparagoides</i> Bridal creeper
<i>Cirsium vulgare</i> Spear thistle
<i>Juncus acutus</i>

Of the above listed species, Bridal creeper (*Myrsiphyllum asparagoides*) is listed under the Shire of Denmark's "Pest Plants". Local by-laws apply to the control and movement of the species.

The Department of Agriculture and Food Western Australia (DAFWA) is in the process of updating its website and will remove references to statutes to be repealed in due course. For further information relating to control and legislation please visit the Biosecurity and agriculture management website at <http://www.biosecurity.wa.gov.au>.

It is therefore recommended:

- Declared Pest plants and Environmental Weeds should be controlled from any further spread and controlled on site.

4.9. Fauna

Native animal populations have generally been in decline since European settlement (CALM 2005). This is primarily due to native vegetation habitat loss and the introduction of pest animals. A reconnaissance search was undertaken on site and revealed little to no indication of native animal habitat.

The Subject site supports possible habitat trees for the Western Ringtail Possum (*Pseudocheirus occidentalis*) Listed as "Threatened" *WA Wildlife Conservation Act* 1950 Notice September 2013, Listed as Vulnerable IUCN Red List of Threatened Species, and Commonwealth: Vulnerable (*Environment Protection and Biodiversity Conservation Act* 1999).

No signs of drays, feed and habitat trees (in the Peppermint trees, *A.flexuosa*) were noted during the assessment during the site assessment. The ground underneath all of the Peppermint trees within the Subject site was checked for possible feeding signs and no signs were noted for possible breeding habitat. In an effort to possibly provide future habitat it is recommended that the Peppermint trees are retained where possible for possible future habitat of the Western Ringtail Possum.

As the site is predominantly degraded in nature there was little evidence to support other threatened fauna may be present within the Subject Site.

It is therefore recommended that:

- In an effort to possibly provide future habitat it is recommended that the Peppermint trees are retained where possible for possible future habitat of the Western Ringtail Possum.

4.10. Waterways and wetlands

The Wilson Inlet is directly adjacent to the Subject Site. The Wilson Inlet is connected to the Denmark Inlet, a much larger body of water that feeds to the southern ocean. The Denmark inlet system is geologically recent, having only attained its present form during the Holocene sea level changes of approximately 7000 years before present. The inlet system was created by the isolation of flooded embayments of relatively old river valleys by the formation of dunes. Subsequent and highly dynamic processes, such as a fall in sea level, longshore drift of coastal sand, the infilling of estuaries with catchment sediments and highly seasonal water flows, have increasingly isolated these estuaries from the ocean. The opening and closing regimes of the estuaries depend on the degree of exposure of the inlet mouth to onshore sediment transport by swell and the flow characteristics of waterways that enter the system (DEC, 2009).

The Walpole and Denmark inlet system is a basin estuary that formed in association with geologically ancient river channels. This system remains one of only three permanently open estuarine systems on the south coast of Western Australia. An undulating landscape of forested laterite hills and low-lying peat swamp surrounds the inlet basins and the catchments.

Consideration to drainage and storm water will need to be given across the Subject Site due to moderately draining sandy soils with a low PRI ability.

Ongoing management of water quality and prevention of pollution or contamination to the Wilson Inlet catchment should be carefully considered. As the drainage of the Wilson Inlet catchment system is downslope from the Subject Site, the proposed development requires appropriate on-site effluent disposal systems installed and maintained as per manufacturers recommendations (See Section 4.2.6 for more detail).

It is recommended that a 100m buffer/setback apply from the Wilson Inlet for this development. Any stormwater treatments should not be located in or adjacent to the Wilson Inlet 100m buffer/setback area. The subject area is not located within a Public Drinking Water Source Area (PDWSA).

It is therefore recommended:

- Stormwater is retained on site and careful consideration given to moderately draining subsoils in stormwater design stages;
- All stormwater is treated within the lots and not in the 100m Buffer/setback Wilson Inlet foreshore area.

4.11. Ecologically Threatened Areas

A search for Threatened Ecological Communities (TECs) within the Warren IBRA bioregion on the DEC's database found that there are no TECs present on the Subject Site.

4.12. Disease Management

Phytophthora cinnamomi, otherwise known as dieback, is a soil borne water fungus which causes large scale death of vegetation, particularly the Jarrah trees and Banksia species. A survey for the presence of *P. cinnamomi* was not conducted for the purposes of this report. The spread of *P. cinnamomi* is through the movement of soil as a result of human activities which cause the translocation of soil sediments, be it a large scale (i.e. soil brought in for infill) or small scale (i.e. soil brought in unknowingly on machinery, shoes etc.) incidents. To maintain a disease free site it is suggested that all machinery operating during the proposed works be cleaned of accumulated soil and plant material prior to commencing any work. If such a case arises where the pathogen was found to be present on the lot or surrounding areas, then it is the developer's responsibility to ensure that the pathogen does not spread further.

It is therefore recommended:

- All machinery operating on site is to be cleaned of all accumulated soil and plant material from other sites prior to commencing work and on re-entry to site. This can be done via brushdown or washdown of soil and plant materials.

4.13. Drainage and storm water

To enable implementation of Water Sensitive Urban Design principles, planning consideration should be given at design stage to effectively manage drainage across the site. Nutrients from stormwater should be treated prior to entering the Wilson Inlet. According to the indicative permeability of each soil category with regard to AS/NZS 1547:2000 permeability results for the site indicate that the sands are moderate draining soils. Stormwater from each dwelling should be contained on site through "Point of Source Infiltration", this can be undertaken through the capture of rainwater for use and consumption, soak wells and swales. All stormwater structures should be located within the lot.

It is therefore recommended that:

- On-site infiltration is encouraged and installation of rain water tanks for capture of excess water; and
- Stormwater will need to be treated before entering creek systems, with stormwater

infrastructure located within the development (lot) footprint and not in foreshore or buffer areas.

4.14. Constructability

This report does not include any engineering assessment. The site is conducive to ease of excavation due to the development areas not having encountered rock. The proposed development areas (north and western areas) would most likely be classified as an *A Class Sites – Most sand and rock sites with little or no ground movement from moisture changes*. Prior to any building construction, this would need to be assessed by a structural engineer.

It is therefore recommended that:

- A structural engineer is engaged prior to building construction to ascertain structural ratings for any buildings on site.

4.15. Fire Management

A Fire Management Plan in consultation with Department of Fire and Emergency Services (DFES) and the Shire of Denmark has not been prepared as part of this assessment. Hazard Assessment is undertaken for residential areas and aligned to Planning for Bushfire Edition 2 (2010). The dwelling sites proposed are primarily in Low Open Woodland areas on flat ground.

Preliminary hazard assessment of the Subject Site revealed that there is a Moderate hazard predominantly of remnant Peppermint trees (Vegetation Type B) with the site. Adjacent to the site to the south and west are grasslands (low fire risk), and remnant woodland vegetation to the north and west along the Wilson Inlet foreshore (moderate risk).

Preliminary assessment suggests that housing will need to be constructed to AS 38959-2009 as 100m separation cannot be achieved from continuous vegetation. If a BAL-29 was applied to the buildings, this would require between 14m and 20m Hazard Separation Zone (HSZ) from any building wall to remnant vegetation (as per Planning for Bushfire Edition 2, 2010). The BAL rating and building to AS3959-2009 is not retrospective to existing dwellings. The HSZ and a 20 metre Building Protection Zone (BPZ) should be contained within the property for ease of maintenance from the lot owner.

It is recommended that a 20 metre wide BPZ as the minimum width is to be constructed around all buildings. Activity within the BPZ must include:

- Width: 20 metres measured from any external wall of the building to adjacent vegetation;
- Location: within the boundaries of the lot on which the building is situated;
- Fuel load: reduced to and maintained to a maximum of 2 tonnes per hectare (as per Shire of Denmark Fire Regulations);
- Trees (crowns) are a minimum of 3 metres apart;
- Trees are low pruned at least to a height of 2 metres;
- No tall shrub or tree is located within 2 metres of a building (including windows);
- There are no tree crowns overhanging the building;
- Fences and sheds within the BPZ are constructed using non-combustible materials (e.g. colour bond iron, brick, limestone);
- Shrubs in the BPZ have no dead material within the plant;
- Tall shrubs in the BPZ are not planted in clumps close to the building i.e. within 5 metres; and
- Trees in the building protection zone have no dead material within the plant's crown or on the bole.

Refer to Limitations Mapping page 33, indicating possible BPZ around proposed and existing residences. The proposed new residences are located in the previously cleared areas, however some Peppermint trees may need thinned to achieve the BPZ. This will be subject

to further survey and confirmed in a detailed Fire Management Plan for the site. A detailed Fire Management Plan should be prepared at conditional approval stages and it is recommended it is prepared in consultation with DFES and the Shire of Denmark.

It is therefore recommended that:

- A BAL Rating and AS3959-2009 is to be applied to any new buildings on site;
- Hazard Separation Zones and Building Protection Zones are located within the individual lot to ensure that these can be maintained by the individual lot owners; and
- A detailed Fire Management Plan is prepared in consultation with DFES and the Shire of Denmark.

4.16. Access and infrastructure

The proposed dwellings are to be accessed via a newly constructed and sealed road from Ocean Beach Road. Power and telecommunications are available to service each new lot. Sewer is not available to the site. Potable water is to be collected from roof catchment areas from both dwellings and outbuildings limiting excess stormwater through retention. Landowners should further be encouraged to minimise water usage and reuse household water where able for household and garden use.

It is therefore recommended that:

- Waterwise initiatives are implemented at lots;
- Water recycling, reuse and water reduction is encouraged for the development; and
- Potable water via rainfall collection from dwellings to reduce stormwater runoff.

5. Land Use Requirements

Areas of land for sub-division approval are assessed through Land Capability to analyse the sustainability of the particular activity and the environmental effects the proposed use may have on the land. This determines the attributes the land contains which can affect the proposed land use for the area. The land use proposed for this Subject Site is 'Rural - Residential' as defined by the assessment process in *the State Planning Commission (1989) Land Capability Assessment for Local Rural Strategies*. This definition is not reflective of any zoning or Shire designations and is the Land Capability assessment criteria definition.

5.1. Rural - Residential

To assess the capability of the land, the WAPC Land Capability Assessment guideline does not have a tourism category, therefore the site has been assessed as "Rural Residential with on-site effluent disposal" (as per the State Planning Commission (1989) Land Capability Assessment definition not any other planning instrument) and is aligned to the Department of Agriculture and Food standards and State Planning Commission Land Capability Assessment for Local Rural Strategies (1989).

"Rural Residential is a multiple form of land use where land is utilised primarily for residential purposes, but often also for some form of agricultural uses. Individual lot sizes range from 1 hectare upwards, but are generally 2 and 5 hectares in size. One standard residential dwelling (i.e. not for hotel, guesthouse etc) is permitted.

State Planning Commission Policy requires that Scheme water be provided to each residence on lots smaller than 2 hectares but households on larger lots may not necessarily be provided with Scheme water. In this case, water for domestic purposes is obtained from rainfall stored in rainwater tanks and/or surface storage dams or groundwater supplies.

Deep sewerage is generally not provided to the residence and domestic sewerage and sullage are disposed of in on-site septic tank systems. Telephone and electricity connections are provided to each residence. Roads are often constructed to a lesser standard than in urban areas and are sometimes narrow, gravel rather than bitumen sealed and unkerbed.

Domestic gardens are usually established around the dwelling for fire protection purposes. The possible range of agricultural uses include dryland grazing (sheep, horses, goats, cattle), annual horticulture (market gardens) and perennial horticulture (orchards, vines) and are generally determined by the available of water for irrigation purposes, soil factors which affect production, and by the potential to pollute water resources.

Agriculture use on the balance of the lot is generally of a non-commercial nature and is often promoted as an integral part of the rural-residential lifestyle. However, the use may supplement the income of the household. Land use requirements are divided into two groups; requirements relating to residential use and requirements relating to agriculture use.

Land Use requirements – residential use

- *The land should provide stable surface and stable soil conditions for housing construction;*
- *The land should be capable of being trenched to approximately 1m deep;*
- *The land should be capable of being relatively easily excavated to a maximum depth of 1.5 metres to allow installation of septic tank system;*
- *Soil should be capable of absorbing the effluent efficiently and purify water stream percolating through the soil;*
- *Soils should be capable of absorbing stormwater discharge;*
- *Soils should not be subject to waterlogging; and*
- *Dwelling and septic tank should not be threatened by flooding, wind erosion, soil erosion or bushfires.*

Note: the quote of “Rural Residential” does not relate to any planning instrument, and is the category used for the land capability assessment process.

5.2. Land Resource Characteristics

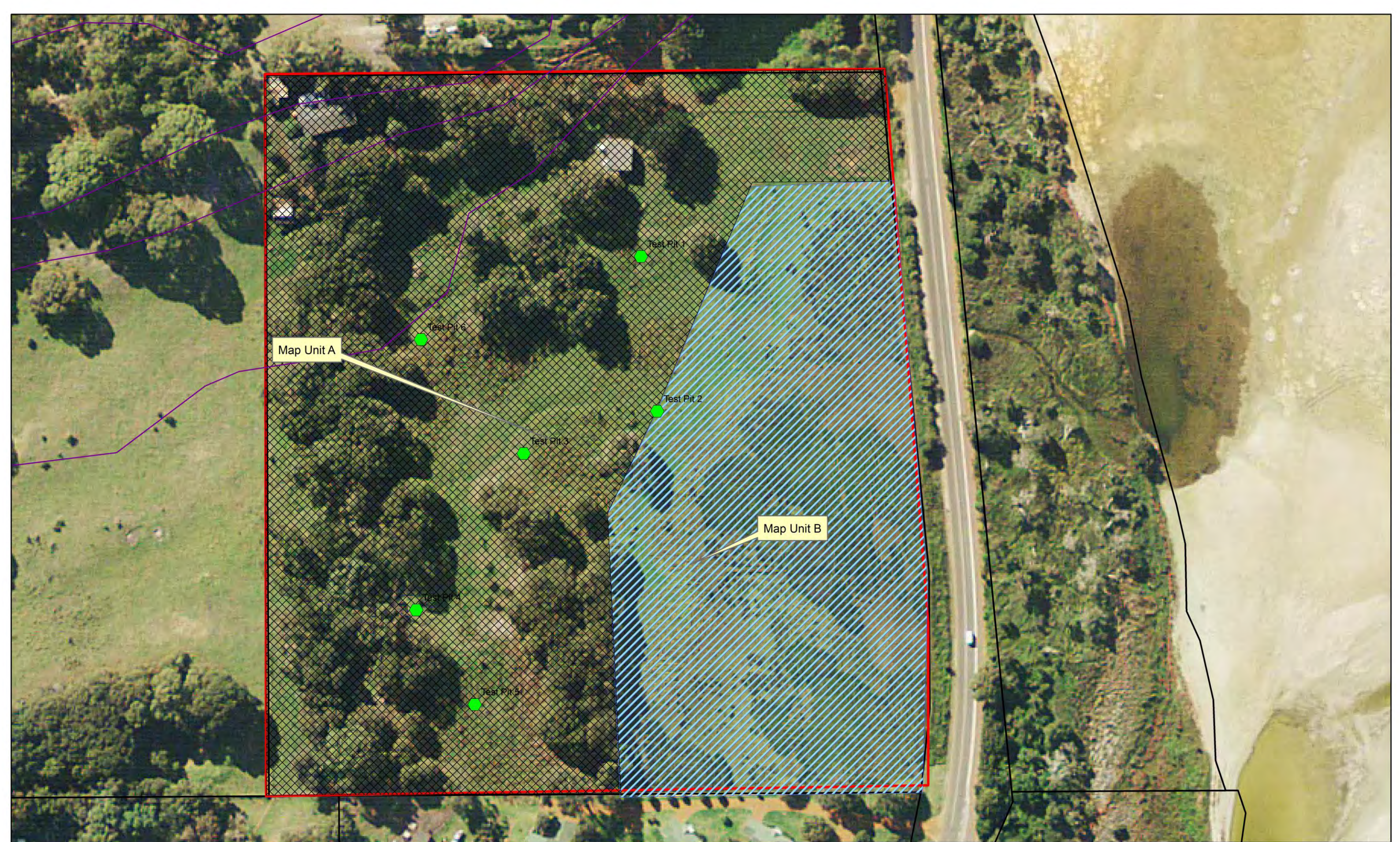
The Land Resource Characteristics have been overlaid to determine the mapping units assessed at the subject site. The mapping units were determined by the following information:

- Soil and Landscape characteristics, including texture, depth, soil profile, aspect, slope and water table;
- Site soil testing;
- Laboratory testing of soils;
- Environmental/vegetation mapping; and
- Historical land use.





The 2 Mapping Units are defined in Table 3 below and shown diagrammatically over the page.

Table 3 – Mapping Units Proposed Rural Residential Lot 1 Ocean Road Denmark

Map Unit	Characteristics
Map Unit A	Sandy topsoil grading to silty sands, predominantly Peppermint woodland. Slopes <5° PRI very low, moderate permeability.
Map Unit B	Low flat areas, possibly seasonally inundated. Low flats of <i>Centella asiatica</i> .



Legend

-  Test pits
-  Map Unit A
-  Map Unit B
-  Subject Site

Scale
1:1,000@A3
MGA GDA 94 Zone 50



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CLIENT
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Map Units

STATUS	FILE	DATE
Final	DSM002	24/10/2013

6. Land Resource Survey

The Department of Agriculture and State Planning Commission utilise a five class system of assessing Land Capability, these five classes rate the degree of physical limitations associated with land use and management needed for these. Please refer to Table 4.

Table 4 - Land Capability Classes

CAPABILITY CLASS	DEGREE OF LIMITATION	GENERAL DESCRIPTION
I	Very low	Areas with a very high capability for the proposed activity or use. Very few physical limitations to the specified use are present or else they are easily overcome. Risk of land degradation under the proposed use is negligible.
II	Low	Areas with a high capability for the proposed activity or use. Some physical limitations to the use do occur affecting either its productive use or the hazard of land degradation. These limitations can however, be overcome through careful planning.
III	Moderate	Areas with a fair capability for the proposed activity or use. Moderate physical limitations to the land use do occur which will significantly affect its productive use or result in moderate risk of land degradation unless careful planning and conservation measures are undertaken.
IV	High	Areas with a low capability for the proposed activity or use. There is a high degree of physical limitations which are either not easily overcome by standard development techniques or which result in a high risk of land degradation without extensive conservation requirements.
V	Very High	Areas with a very poor capability for the proposed activity or use and the severity of physical limitations is such that its use is usually prohibitive in terms of either development costs or the associated risk of land degradation.

6.1. Qualities and limitations

The proposed land use has a set of qualities for which the Land Capability Assessment will be considered. Table 5 below outlines the landscape qualities and the overall Capability rating for septic tanks in rural residential and this Subject Site. The alphabet symbol given to each quality (e.g. Ease of excavation, “x”) represents the WAPC Guidelines (1989) reference to that same characteristic. Note that for Rural Residential there are land qualities for each of the separate uses; residential, annual and perennial horticulture, and hobby farm grazing. This report focuses on the land use of Residential Use in Rural Areas (detailed at Table 9 of the WAPC Guidelines). The main qualities required in assessing land capabilities for this Subject Site are:

- Ease of excavation;
- Foundation stability;
- Water logging hazard;
- Water erosion hazard;
- Soil nutrient retention capacity;
- Soil microbe disinfectant ability;
- Soil absorption;
- Flood hazard;
- Water pollution;
- Acid Sulphate Soils, and
- Bushfire hazard.

Table 5 – Land Capability for Residential Use in Rural Areas

The following table is the land capability classification system for Rural Residential from the State Planning Commission (1989) Land Capability Assessment for Local Rural Strategies.

Landscape Qualities Rural Residential					
Ease of excavation, x	Very high	Moderate	Low	Low	
Foundation stability, b	Very high	High	Moderate	Low	Very Low
Water logging hazard, i	Low	Moderate	High	Very High	
Water erosion hazard, e	Low	Moderate	High	Very High	
Wind erosion hazard, w	Low	Moderate		High	Very High
Wave erosion hazard, u				High	Very High
Soil absorption ability, a	High	Moderate	Low	Very Low	
Flood hazard, f				High	Very High
Water pollution hazard, s	Low	Moderate	High		
Bushfire hazard, z	Very low	Low	Moderate	High	Very High
Soil Salinity, y	Very low	Low	Moderate	High	
Overall capability rating	I	II	III	IV	V

Utilising the above table the following assessment for limitations to the Subject Site is made for Map Units A and B, please refer to Tables 6 and 7 over the page.

Table 6 – Land Capability Rating Map Unit A

Landscape Qualities Rural Residential	Map Unit A	Comments
Ease of excavation, x	High	Sandy soils
Foundation stability, b	High	Sandy soils
Water logging hazard, i	Low	Most water tables >1100m BGL, Test pit 2 marginal.
Water erosion hazard, e	Low	Low slopes <5°
Wind erosion hazard, w	Low	Site not exposed to prevailing winds, woodlands and vegetation cover
Wave erosion hazard, u	Nil	Site not subject to
Soil absorption ability, a	Low-Moderate	Low PRI's with moderate permeability, Phosphate ATU's recommended.
Flood hazard, f	Moderate	Above the 4-5m Contour
Water pollution hazard, s	Moderate	Setbacks from Wilson Inlet 100m achievable
Bushfire hazard, z	Moderate	BAL 29 recommended, HSZ & 20m BPZ located within the lot.
Soil Salinity, y	Low	Grey sands, nil to low salinity expected and site well drained
Acid Sulphate Soils, as	Low	Grey sands low risk of ASS expected and site moderately drained
Overall capability rating	II	Areas with a High capability for the proposed activity or use.

Utilising Table 5 the following assessment is made for Map Unit B, please refer to Table 7 below.

Table 7 – Land Capability Rating Map Unit B

Landscape Qualities Rural Residential	Map Unit B	Comments
Ease of excavation, x	High	Sandy soils expected
Foundation stability, b	High	Sandy soils
Water logging hazard, i	High	Area closest to Inlet
Water erosion hazard, e	Low	Low slopes
Wind erosion hazard, w	Low - Moderate	Site subject not exposed to prevailing winds, vegetated
Wave erosion hazard, u	Low	Site not subject to
Soil absorption ability, a	Very low	Sandy soils, waterlogged
Flood hazard, f	High	Water logged and within 100m of Wilson Inlet, seasonal inundation.
Water pollution hazard, s	High	Setbacks from Wilson Inlet cannot be achieved to 100m
Bushfire hazard, z	Low	Predominantly cleared
Soil Salinity, y	Low	Sandy soils, possible salinity from flooding from Inlet
Acid Sulphate Soils, as	High	High risk of ASS expected and site poorly drained
Overall capability rating	IV	Areas with a Low capability for the proposed activity or use.

Limitations: The Map Units each present specific limitations due to the particular soil or landform conditions.

- 1) Map Unit A – Sandy grey soils: This unit is limited by the moderate ability of the soils to purify effluent and retain nutrients (Phosphate removing ATU's recommended), retain the vegetation (peppermint trees) where possible, and bushfire hazard setbacks; and
- 2) Map Unit B – Water logged sands. This unit is limited by the proximity to the Wilson Inlet and the subsequent waterlogging.

Map Unit A areas are most suited to Phosphate Removing ATUs for wastewater management.

Map Unit B is most suited to buffers, building exclusion zones and remain as remnant native vegetation areas, with possible revegetation.

The overall capability of the subject area to sustain the proposed developments is summarised as **Map Unit A – areas with a High capability (Land Capability Class II) of supporting the land use and limitations can be overcome by design and management inputs. Map Unit B - Low (Land Capability Class IV) of supporting the land use. There is a high degree of physical limitations which are either not easily overcome by standard development techniques or which result in a high risk of land degradation without extensive conservation requirements.**

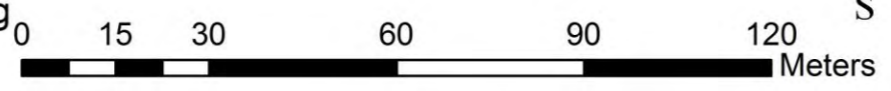
Please refer to Limitations Mapping over the page.



Legend

- Subject Site
- 20m BPZ
- 100m setback
- Waterlogging

Scale
1:1,000@A3
MGA GDA 94 Zone 50



**BIO
DIVERSE
SOLUTIONS**

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CLIENT
Mark & Steve Allen
Lot 1 Ocean Beach Road
Denmark WA 6333

Limitations Mapping

STATUS	FILE	DATE
Final	DSM013	24/10/2013

7. Planning and Management Considerations

The following recommended planning and land management considerations arise from the Environmental and Land Capability Assessment.

Acid Sulphate Soils

- When the nature of the disturbances are known for the development (i.e. cut fill etc), a Department of Environment and Regulation (DER, formerly part of DEC) "ASS Self Assessment" form is completed, and if required, an ASS Investigation and reporting occur as required by the DER.

Vegetation

- Trees are retained across the site where appropriate to encourage fauna habitat and site biodiversity; and
- Revegetation occurs in the low lying (wetland) areas.

Weed Management

- Declared Pest plants and Environmental Weeds should be controlled from any further spread and controlled on site.

Fauna

- In an effort to possibly provide future habitat it is recommended that the Peppermint trees are retained where possible for possible future habitat of the Western Ringtail Possum.

Stormwater, Waterways and Wetlands

- Stormwater is retained on site and careful consideration given to moderately draining subsoils in stormwater design stages;
- All stormwater is treated within the lots and not in the 100m Buffer/setback Wilson Inlet foreshore area; and
- On-site infiltration is encouraged and installation of rain water tanks for capture of excess water.

Disease Management

- All machinery operating on site is to be cleaned of all accumulated soil and plant material from other sites prior to commencing work and on re-entry to site. This can be done via brushdown or washdown of soil and plant materials.

On-site effluent Disposal

- On Site effluent disposal will need to be a minimum setback of 100m from any the edge of the tidal high water mark of the Wilson Inlet; and
- Recommended on-site effluent is via DoH WA Phosphorous Removing Alternative Treatment Units (Appendix F) and approved by the Shire of Denmark prior to installation. Consideration to installing a commercial central unit in the south of the Subject site where water table is >1500mm BGL.

Fire Management

- A BAL Rating and AS3959-2009 is to be applied to any new buildings on site;
- Hazard Separation Zones and Building Protection Zones are located within the individual lot to ensure that these can be maintained by the individual lot owners; and
- A detailed Fire Management Plan is prepared in consultation with DFES and the Shire of Denmark.

Constructability

- A structural engineer is engaged prior to building construction to ascertain structural ratings for any buildings on site.

Access and Infrastructure

- Waterwise initiatives are implemented at lots;
- Water recycling, reuse and water reduction is encouraged for the development; and
- Potable water via rainfall collection from dwellings to reduce stormwater runoff.

8. Conclusions

Mark and Steve Allen commissioned Bio Diverse Solutions (Environmental Consultants) to undertake an Environmental and Land Capability Assessment of Lot 1 Ocean Beach Road, Denmark. The Land Capability Assessment compares the physical requirements for a particular land use with the qualities of the land. The analysis determines the ability of the land to sustain a particular land use without resulting in significant environmental degradation.

To assess the capability of the land, the WAPC Land Capability Assessment does not have a tourism category, therefore the site has been assessed as "*Rural Residential with on-site effluent disposal*" (as per the State Planning Commission (1989) Land Capability Assessment definition not any other planning instrument) and is aligned to the Department of Agriculture and Food standards and State Planning Commission Land Capability Assessment for Local Rural Strategies (1989).

The assessment of the subject site involved desktop analysis of climate, site history, vegetation, river systems and geology of the site. Site assessment was undertaken of soils, remnant vegetation, and spring flora survey. Assessment of the Subject Site included laboratory analysis of soils for permeability and PRI.

The soils were generally of a sandy nature in the A Horizon and B Horizon. The soil testing found soils with low PRIs and moderate permeability. The site is also in close proximity to the Wilson Inlet and setbacks of 100m are required. The soils are deemed capable of Residential use with the use of Department of Health approved Phosphate Removing ATU's. The waterlogged (low areas) closer to the Wilson Inlet are not deemed suitable for Rural Residential Land use.

The site testing and environmental assessment revealed two Map Units – Map Unit A (Sands) and Map Unit B (Sands, waterlogged areas). Map Unit A revealed a Land Capability Rating of **II-Areas with a High Capability for the proposed activity or use**. The Map Unit B revealed a Land Capability Class Rating **IV- Areas with a low capability for the proposed activity or use**.

Some planning considerations are required for Map Unit A, particularly Phosphate Removing ATU's, setbacks from the Wilson Inlet and Bushfire hazard setback. Further engineering is required to ascertain flood susceptibility of the site and Structural Engineering ratings for any proposed dwellings. It is considered these requirements would form the conditions of approval.

Map Unit B does not have site soils and conditions which support the proposed Rural Residential land use, and it is not recommended that any development occurs in these areas. These areas are suitable for maintaining buffer zone from Wilson Inlet and restoring diversity with revegetation.

Bio Diverse Solutions conclude that if the listed Planning and Management recommendations are implemented by the client, the development of tourism on the Subject Site, can be implemented sustainably and in an environmentally sound manner.

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Appendices

Appendix A – Location Mapping & Development Plan

Appendix B – Aboriginal Heritage Site Report

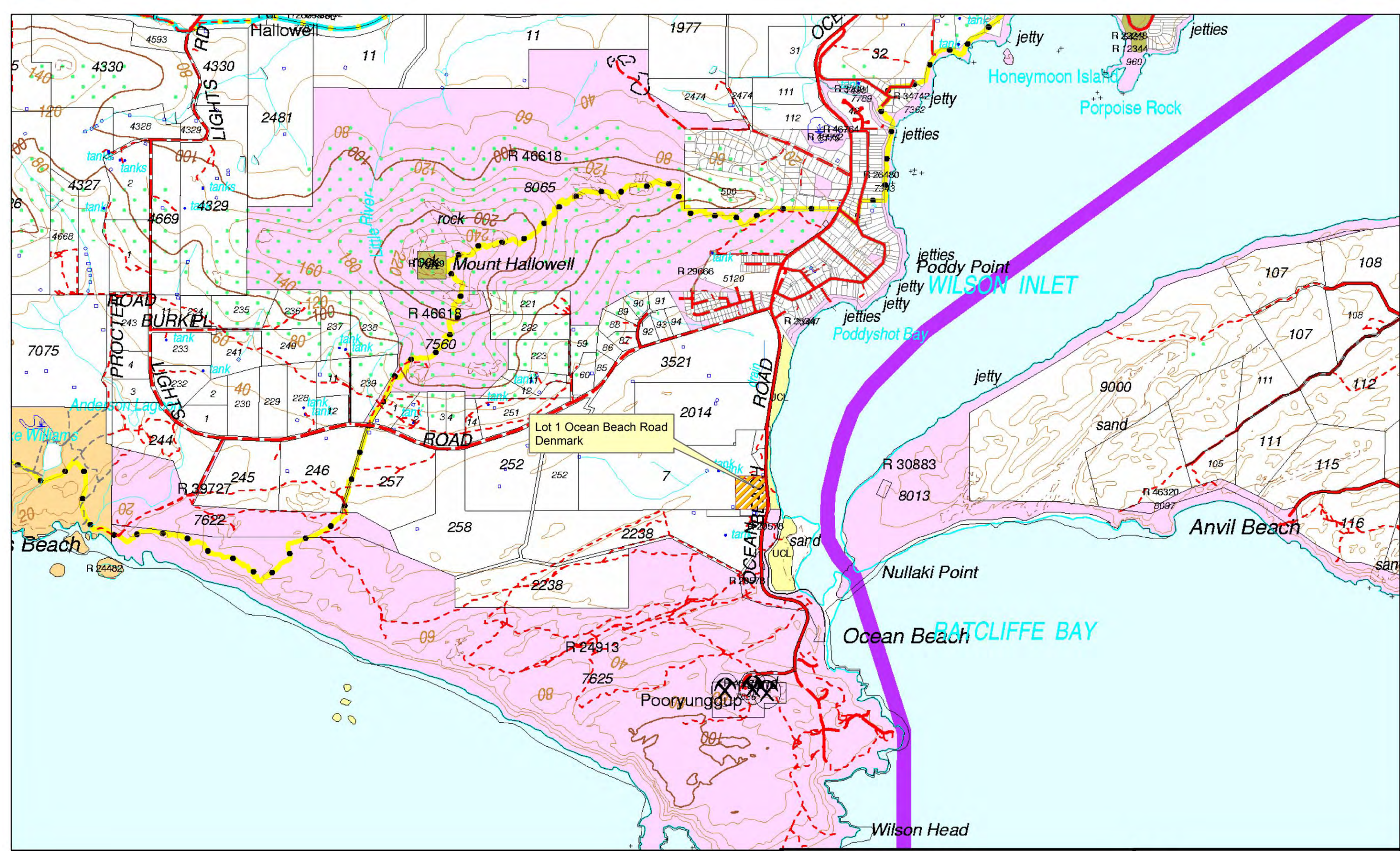
Appendix C - Soil Profile Sampling Results and Test Pit Mapping

Appendix D – Soil Laboratory Results


Appendix E – Vegetation Mapping

Appendix F – Health Department approved ATUs

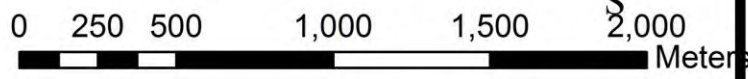
Appendix A:
Location Mapping
& Development Plan



Legend

 Subject Site

Scale
1:24,000@A3



55 Peppermint Drive
Albany, WA 6330
Australia
Tel: 08 9841 3936
Fax: 08 9841 3936
Mob: 0447 555 516

CLIENT
Mark Allen
Lot 1 Ocean Beach Road
Denmark WA 6333

Location Mapping

STATUS	FILE	DATE
Final	DSM002	24/09/2013

**SCHEMATIC FOR
POSSIBLE TOURIST ZONE
LOT 1 OCEAN BEACH ROAD
DENMARK WA 6333**



ORIGINAL PLANNING:	JR
ORIGINAL DRAFTER:	ASR
ISSUED DATE:	21/02/2013
PERIOD DATE:	LANDSTATE 2011
CURRENT DATA:	SC20-222613
DISCHARGED DATA:	LANDSTATE

THIS PLAN IS A REPRESENTATION OF PLANNED PROPOSED WORKS ONLY AND DOES NOT CONSTITUTE A CONTRACT.



1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
REVISION	DESCRIPTION	DRAWN	DATE

CONSENTS:
THE PROJECT IS A DEVELOPMENT OF THE PROPERTY OF DENMARK SURVEY & MAPPING
AND IS SUBJECT TO THE LOCAL GOVERNMENT'S POLICY ON THE DEVELOPMENT OF THE PROPERTY.
THE PROJECT IS SUBJECT TO THE LOCAL GOVERNMENT'S POLICY ON THE DEVELOPMENT OF THE PROPERTY.
THE PROJECT IS SUBJECT TO THE LOCAL GOVERNMENT'S POLICY ON THE DEVELOPMENT OF THE PROPERTY.

Ref: 1804-02B



Denmark Survey & Mapping
PO Box 339
1 / 55 Strickland St, Denmark 6333
(08) 9948 2262

20578
8234

Appendix B

Aboriginal Heritage Site Report



Search Criteria

1 Registered Aboriginal Sites in Custom search area (3); 529438.61mE, 6124600.66mN (zone 50) - 529922.73mE, 6125017.07mN (zone 50)

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

Copyright

Copyright in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved.

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

Terminology (NB that some terminology has varied over the life of the legislation)

ID/Site ID: This a unique ID assigned by the Department of Aboriginal Affairs to the place

Status:

- o **Registered Site:** The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*
- o **Other Heritage Place which includes:**
 - **Stored Data:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*
 - **Insufficient Information:** There is not enough information presented to determine if the place meets Section 5 of the *Aboriginal Heritage Act 1972*
 - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972*

Access and Restrictions:

- o **Open:** Availability of information that the Department of Aboriginal Affairs holds in relation to the place is not restricted in any way.
- o **Closed:** Some of the information that the Department of Aboriginal Affairs holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Aboriginal Affairs receives written approval from the informants who provided the information. Download the [Request to Access Restricted Information](#) letter and form. The Department of Aboriginal Affairs maps the locations of all sites and heritage places, including Closed sites, as accurately as the information lodged with the Registrar allows. However, to preserve the confidentiality of Closed sites their locations are published in reports from the Register and displayed on the Aboriginal Heritage Inquiry System within one or more two-kilometre-square boxes. These 2 km boxes act as indicators for the presence of sites or heritage places rather than the exact location of the place.
- o **Restriction:**
 - **No Restrictions:** Anyone can view the information.
 - **Male Access Only:** Only males can view restricted information.
 - **Female Access Only:** Only females can view restricted information.

Reliability:

- o **Reliable:** The spatial information recorded about the place is deemed to be reliable, due to methods of capture.
- o **Unreliable:** The spatial information recorded about the place is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information recorded.

Number/No./Site No: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the ID/SiteID



Aboriginal Heritage Inquiry System

Aboriginal Sites Database

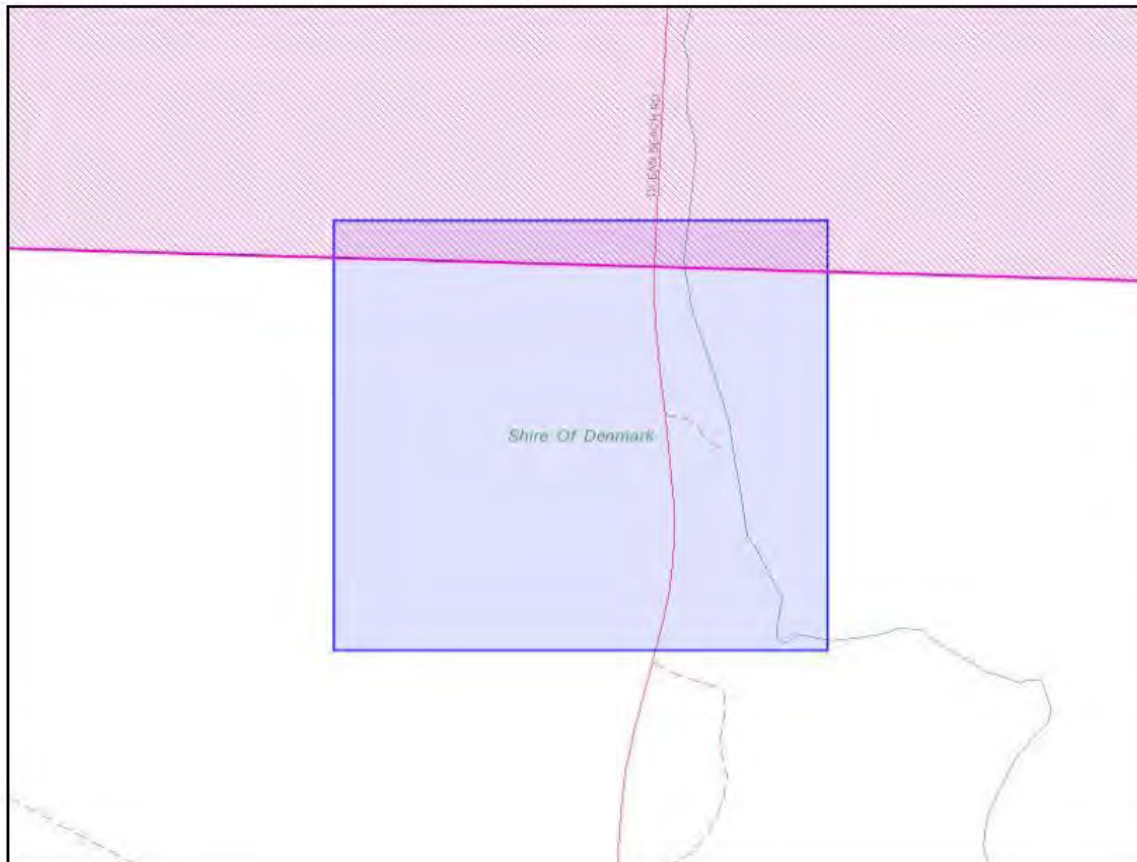
List of Registered Aboriginal Sites with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
4436	Registered Site	Closed	No Gender Restrictions	PODDY POINT BURIAL	Skeletal material/Burial			Not available for closed Sites	S02820



Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

-  Registered Sites
-  Aboriginal Community Occupied
-  Aboriginal Community Unoccupied
-  Town
-  Search Area

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Appendix C

Soil Profile Sampling Results and

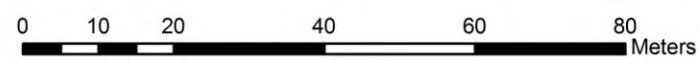
Soil Test Pit Mapping



Legend

- Test pits
- Subject Site

Scale
1:1,000@A3



55 Peppermint Drive
Albany, WA 6330
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Tel: 08 9841 3936
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Mob: 0447 555 516

CLIENT

Mark Allen
Lot 1 Ocean Beach Road
Denmark WA 6333

Test Pit Locations

STATUS	FILE	DATE
Final	DSM002	24/09/2013



Soil Profile Sampling



Location: Lot 1 Ocean Beach Road, Denmark, Western Australia



Date tested: 5th September 2013

Sampled by: K. Kinnear of Bio Diverse Solutions (Environmental Consultants)

Weather: Overcast showers 16°C

<u>Location</u>	<u>Site description</u>	<u>Depth of profile (mm)</u>	<u>Soil Description</u>	<u>Laboratory Sample ID</u>
Test Pit 1 0529663 6124851	North central south of existing house	0-350 350-650 650-1100 1100-1500 1500-2000	Dark brown sandy peat (organic matter), moist Dark grey sand, moist Brown coarse sand, moist Light brown coarse sand, moist Cream sand, wet Water Table 1300mm BGL 	Sample 1 (S1)
Test Pit 2 0529661 6124812	Mid block east near wet area	0-180 180-650 650-900 900-1100 1100-2000	Dark grey sandy peat (organic matter), moist Dark grey sand, moist Brown coarse sand, wet Dark brown sandy silt, wet Dark brown sandy silt, wet Water Table 510mm BGL 	

<u>Location</u>	<u>Site description</u>	<u>Depth of profile (mm)</u>	<u>Soil Description</u>	<u>Laboratory Sample ID</u>
Test Pit 3 0529625 6124788	Mid block higher ground, near proposed lodge	0-100 100-650 650-1000 1000-1600 1600-2000	Dark grey sandy peat (organic matter), moist Sark grey sand, moist Brown sand, moist Light brown coarse sand wet Brown silty sand, wet Water table 1130mm BGL 	
Test Pit 4 0529590 6124735	South west of lot mid lower	0-50 50-650 650-1100 1100-1800 1800-2000	Dark grey sand (organic matter), moist Dark grey sand, moist Brown coarse sand, moist Light brown sand, moist grading to wet Brown silty sand, wet Water Table 1310mm BGL 	Sample 1 (S1)

<u>Location</u>	<u>Site description</u>	<u>Depth of profile (mm)</u>	<u>Soil Description</u>	<u>Laboratory Sample ID</u>
Test Pit 5 0529609 6124705	South end of block 20m from boundary	0-150 150-1000 1000-1300 1300-1500 1500-2000	Dark grey sand (organic matter), moist Dark grey sand, moist Grey sand, moist Brown coarse sand, moist Light brown/cream sand, wet Water Table 1840mm BGL 	Sample 1 (S1) PRI only
Test Pit 6 0529592 6124825	North east of block	0-150 50-650 650-850 850-1300 1300-2000	Dark grey sand (organic matter), moist Dark grey sand, moist Grey sand Brown sand Light brown/cream sand, wet Water Table 1430 BGL 	

Appendix D

Soil Laboratory Results

Permeability &

Phosphorus Retention Index (PRI)



Customer Bio Diverse Solutions
Job Lot 1 Ocean Beach Road Denmark
Date Rec'd 6/09/2013

Lab Number	Name	Code	Customer	Depth	Phosphorus Retention Index
F6S13086	TP1 S1'	03/09/13	Bio Diverse Solutions	65-110	2.5
F6S13087	TP 4 S1	03/09/13	Bio Diverse Solutions	5-65	0.0
F6S13088	TP 5 S1	03/09/13	Bio Diverse Solutions	150-200	1.0



Welshpool Laboratory

Coffey Testing Pty Ltd
 ABN 92 114 364 916
 26/6 Treasure Road
 Welshpool Western Australia 6106
 Telephone: +61 8 9466 2400
 Facsimile: +61 8 9466 2450

Test Report

Report No.: WELS13S-403953FH

Issue No.: 1

Please refer to previous issues of report no. WELS13S-W191.M3F

Client: Albany Soil and Concrete Testing
Client Address: 39 Hill Street Albany WA 6330
Principal: -
Project: Submitted Samples
Project No.: INFOWELS01564AA
Work Order No.: WELS13W40805
Location: -

(Signature)
 Reported By:
 Thomas Stevenson
 Laboratory Manager
 Date of Issue: 15-10-13

Sample Details

Sample No.: WELS13S-403953
Sample ID: Lot 1 Ocean Beach Dr Denmark TP1 S1 @ 650 - 1100mm
Date of Test: 15-10-13

Other Sample Details:

Test Results

Falling Head Permeability
AS 1289 6.7.2

Compactive Effort: AS1289.5.2.1
Maximum Dry Density: 1.73 t/m³
Optimum Moisture Content: 14.0 %

Material Retained and discarded	Sieve Size (mm)	-
	% Retained	-

Surcharging Applied (kg) None applied
Hydraulic Pressure Applied (kPa) NA
Head Height (mm) NA
Achieved Dry Density (t/m³): 1.64
Achieved Dry Density Ratio (%): 94.6
Achieved Moisture Content (%): 14.5
Achieved Moisture Content Ratio (%): 104
Average Coefficient of Permeability: 4.3E-06 m/sec

Comments:

Sample supplied by client
 The material passing 19.00mm sieve was remoulded to 95% MOD.MDD & 100% OMC as requested by client

Form Number: P6003 Issue 4 Date: 04/07/2013

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Welshpool Laboratory

Coffey Training Pty Ltd
 ABS 92 114 264 896
 289a Trussart Road
 Welshpool Western Australia 6100
 Telephone: +61 8 9466 2400
 Facsimile: +61 8 9466 2450

Test Report

Report No.: WELS13S-403954FH

Issue No.: 1

This report represents all the measurements of properties: WELS13S-403954FH

Client: Albany Soil and Concrete Testing
Client Address: 39 Hill Street Albany WA 6330
Principal: -
Project: Submitted Samples
Project No.: INFOWELS01564AA
Work Order No.: WELS13W40805
Location: -

[Signature]
 Reported By:
 Thomas Stevenson
 Laboratory Manager
 Date of Issue: 10-10-13

Sample Details

Sample No.: WELS13S-403954
Sample ID: Lot 1 Ocean Beach Dr Denmark TP4 S1 @ 50 - 650mm
Date of Test: 03-10-13

Other Sample Details:

Test Results

Falling Head Permeability
AS 1289 6.7.2

Compactive Effort: AS1289.5.2.1
Maximum Dry Density: 1.70 t/m³
Optimum Moisture Content: 13.0 %

Material Retained and discarded	Sieve Size (mm)	-
	% Retained	-

Surcharging Applied (kg) None applied
Hydraulic Pressure Applied (kPa) NA
Head Height (mm) NA
Achieved Dry Density (t/m³): 1.62
Achieved Dry Density Ratio (%): 95.1
Achieved Moisture Content (%): 12.7
Achieved Moisture Content Ratio (%): 97.6
Average Coefficient of Permeability: 2.0E-07 m/sec

Comments:

Sample supplied by client
 The material passing 19.00mm sieve was remoulded to 95% MOD.MDD & 100% OMC as requested by client

Form Number: 20200 - Issue 4 - Date: 04/07/2013

CDP/MS/ST/13/Coffey Training Pty Ltd - 2013



Appendix E

Vegetation Mapping



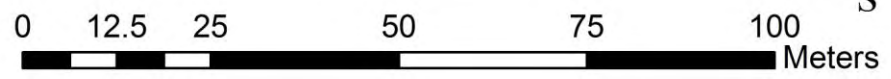
Low Open Peppermint Woodland

Low flats of Centella asiatica

Legend

-  Low Flats
-  Peppermint Woodland
-  Subject Site

Scale
1:1,000@A3
MGA GDA 94 Zone 50



**BIO
DIVERSE
SOLUTIONS**

55 Peppermint Drive
Albany, WA 6330
Australia
Tel: 08 9841 3936
Fax: 08 9841 3936
Mob: 0447 555 516

CLIENT
Mark Allen
Lot 1 Ocean Beach Road
Denmark WA 6333

Vegetation Mapping

STATUS	FILE	DATE
Final	DSM002	24/10/2013

Appendix F

Department of Health

approved ATU information



Department of Health
Government of Western Australia

Approved Alternative Effluent

Disposal Systems (Continued)

NUTRIENT (PHOSPHATE) REMOVING EFFLUENT DISPOSAL SYSTEMS

ECOMAX

Ecomax Waste Management Systems Pty Ltd
Unit 2/13 Emplacement Crescent
HAMILTON HILL, WA 6163
Ph: 9335 1600
Fax: 9335 1606
Website: <http://www.ecomax.com.au>
Email: ecomax@bigpond.com.au



FILTREX WASTEWATER IRRIGATION SYSTEM

Filtrex Innovative Wastewater Solutions
P.O. Box 5122
BUNBURY, WA 6231
Ph: (08) 9726 0118
Fax: (08) 9726 0117
Website: <http://www.filtrex.com.au>
Email: info@filtrex.com.au



BIOLOGICAL FILTER SYSTEMS

BIOLYTIX FILTER (BF-6 Aerated) - Biolytix Technologies

P.O. Box 591
MALENY, QLD 4552
Ph: (07) 5435 2700
Fax: (07) 5435 2701
Website: <http://www.biolytix.com>
Email: info@biolytix.com