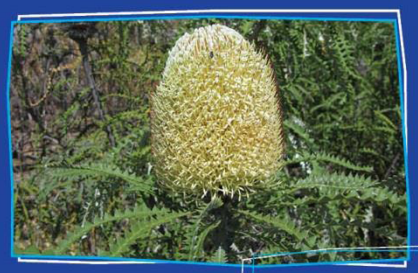
Vegetation, Flora, Fauna and Environmental Considerations, and Targeted Flora Report

Shire of Esperance – Bandy Creek Pathway



Report complied by Shire of Esperance Environmental Team:

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November 2020

1 Executive Summary

This 'Vegetation, Flora, Fauna and Environmental Considerations and Targeted Flora Report' has been undertaken in accordance with the 'Environmental Protection Authority (EPA) Technical Guidance, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (2016)', as part of the application to the Department of Water and Environmental Regulations (DWER) to clear 1.79 ha in a 1.92 ha area of native vegetation between the end of the Castletown Quays development and Bandy Creek for the purpose of constructing a dual share use path, providing a linkage between the two areas.

2 Introduction

A shared path is proposed to be constructed, connecting the suburb of Castletown to the Bandy Creek Harbour. The Bandy Creek Harbour area is a strategic destination in relation to recreational activity. The proposal will connect the public boat ramp, commercial and recreational marina facilities, Department of Transport offices, angling club rooms, recreational park with picnic BBQ and toilet facilities, recreational fishing, swimming, fish shop and Lucky Bay Brewery. Additionally, it will provide an amenity and additional trail within the area. The shared path was highlighted in the Regional 2050 Esperance Cycling Strategy as a high priority. Currently, there is no pathway and the proposed alignment traverses a future residential subdivision area between developed areas. Currently it consists of intact vegetation. After the proposed residential estate has been developed, it will be a key pathway for the new suburb.

Funding through the Department of Transport has been successful to complete to construct the asphalt component of the shared path, which extends along the Shire of Esperance owned properties (Table 1) and the Department of Transport managed area. However, there is an area in the centre of the final design that requires a proposed boardwalk on either Crown Land managed by DPLH (with Native Title existing) or private property. Negotiations are currently underway but are likely to not be finalized upon the commencement of the construction of the asphalt component of the pathway. It's therefore proposed by the Shire of Esperance that this permit will cover the first stage of the project, and either an additional permit or an amendment will be applied for when development on the other tenure has been finalized.

The proposed works covered under the Bandy Creek Pathway clearing permit are located within the Esperance townsite, extending between the residential suburb of Castletown, Castletown Quays and Bandy Creek Harbour (Figure 1). The proposed pathway will connect form the end of Castletown Quays along the beach front to the Bandy Creek Harbour. The area extends through reserves of intact vegetation with various levels of degradation and disturbance. It covers three different land parcels (Table 1), two of which are owned by the Shire of Esperance. There is also a land parcel, Lot 881 on Plan 217292/Reserve 39635, included in the clearing permit managed by Department of Transport, and leased by various commercial companies. Permission to operate within the Department of Transport is included with the C2 Form attached with the application. A point within the proposed area is 400647 m N, 6255642 m E (UTM Zone 51H, GDA94).

Due to the nature of the coastal sand dune environment with large undulating slopes, the standard five to seven meters width impact required to implement a dual use pathway is much higher for the Bandy Creek Pathway, with a proposed impact of up to 10 to 15 m width in places. This allows for appropriate batters and drainage to be implemented, reducing erosion and blow outs. An area wider than will likely

be required has been applied for and where possible, clearing will be reduced, conserving vegetation and mitigating impact.

Table 1. Tenure of the proposed Bandy Creek Pathway clearing permit.

Description	Land Owner	Land Use
Lot 9003 on Plan 069443	Shire of Esperance	Currently intact bushland – future residential development
Lot 20 on Plan 251103	Shire of Esperance	Currently intact bushland– future residential development
Lot 881 on Plan 217292, Reserve 39635	Department of Transport	Commercial fishing operations and recreation

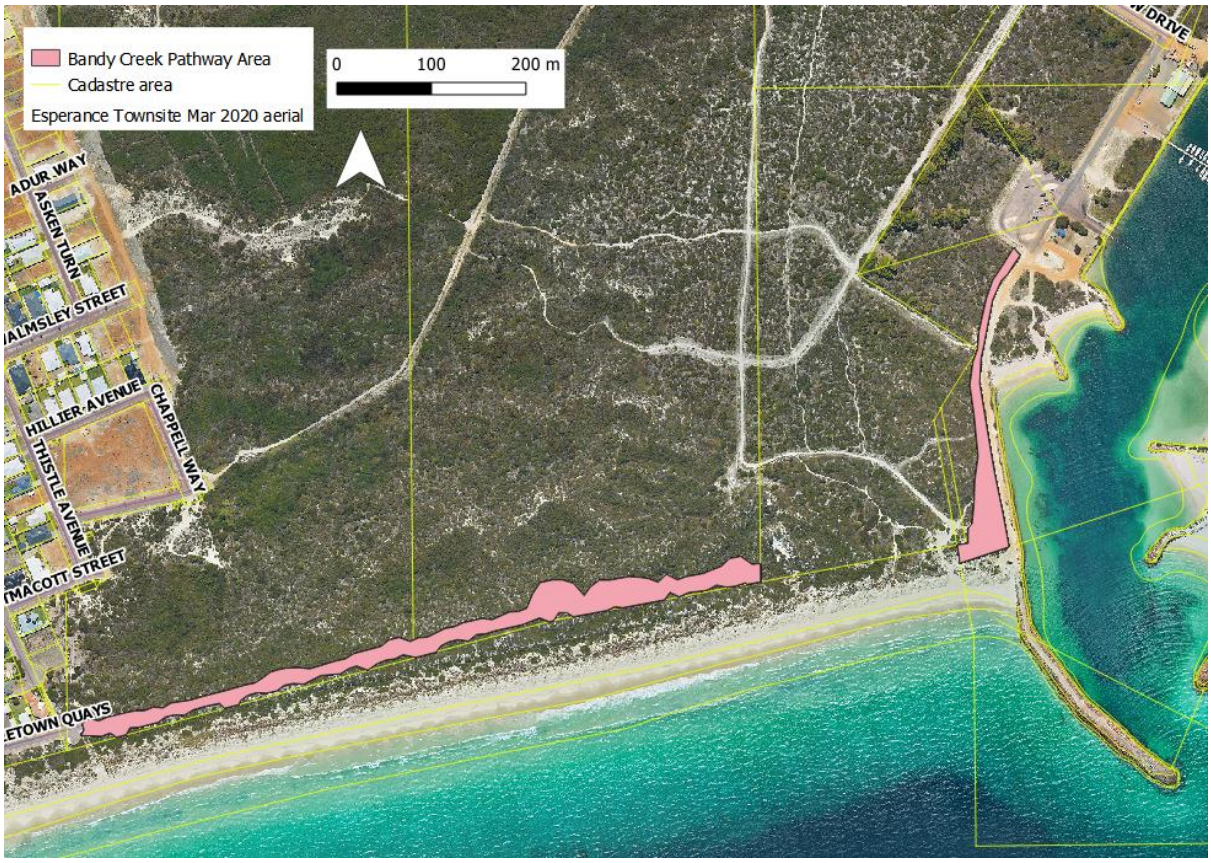

Figure 1. Location of the proposed Bandy Creek Pathway clearing permit area.

3 Environmental Background

3.1 Scope

Clearing native vegetation to develop a dual use footpath through intact bushland has the potential to affect a multiple environmental factors.

Possible impacts include;

- Threatened flora (TF) and priority flora (PF).
- Threatened, priority and specially protected fauna

- Threatened ecological communities (TEC) and priority ecological communities (PEC), specifically the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 listed 'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia' (Kwongkan) TEC and 'Subtropical and Temperate Coastal Saltmarsh' TEC.

Assessing these impacts involves two approaches; desktop study and field survey. The desktop study gathered background information on the target area. The field survey allows for detailed understanding of vegetation communities, targeted flora surveys for possible TF or PF, environmental condition, presence of PEC and TEC, and overall potential impact of clearing.

3.2 Catchment

Bandy Creek Pathway is present within the coastal catchment area, draining directly into the ocean through the sand dunes.

3.3 Climate

The Esperance climate is described as Mediterranean, characterised by cool wet winters and dry warm summers (BoM 2020). The area receives an average annual rainfall of 618 mm.

3.4 Geology

A single geological unit was identified within the Bandy Creek Pathway Area, by Schoknecht et al. (2004). It is described as "Beach and coastal sand dunes, calcareous and siliceous, locally shelly and/or cemented (beach rock)".

3.5 Soils

The soil of Bandy Creek Pathway is broadly defined as Tooregullup 5 subsystem (Schnoknecht et al. 2004), described as level plain with moderately inclined dune ridges and associated swales with occasional swamps and calcareous deep sands, with associated pale deep sands and minor calcareous shallow sands.

3.6 Topography

During the field survey, topography was observed to be dominated by beach sand dunes with distinctive swales and ridges. The RAMSAR listed Lake Warden system is within 20 km of the site (DAWE 2020), however is a completely separate hydrological system. It is extremely unlikely that any works that occur will impact on this.

3.7 Vegetation

The site is located within the Interim Biogeographic Regionalisation for Australia (IBRA; Thackway & Cresswell 1995) Esperance Plains region (Esp2) and Recherche sub-region. The Esp2 region is described as "Proteaceae Scrub and Mallee heaths on sandplain overlying Eocene sediments, rich in endemics. Herbfields and heaths (rich in endemics) on abrupt granite and quartzite ranges that rise from the plan. Eucalyptus woodlands occur in gullies and alluvial foot-slopes".

Beard (1973) mapped a single vegetation association (VA) within the Bandy Creek Pathway area (Table 2). VA42 is common and consistent across the south coast of Western Australia, with large amounts of pre-European vegetation remaining in the Esp2 IBRA region and Shire of Esperance area. It is also well represented in the conservation estate.

Table 2. Vegetation associations mapped by Beard (1973) within the Bandy Creek Pathway, and statistics on pre-European remaining areas.
Nt. Acronyms used include Interim Biogeographic Regionalisation of Australia (IBRA), Eastern Mallee bioregion (MaL01), local government area (LGA) and International Union of Conservation Nature (IUCN).

Vegetation Association	
Name	42
Description	Mallee and Acacia scrub shrublands on south coastal dunes
Pre-European extent in IBRA region Esp2 (%)	94.56
Pre-European extent in LGA (%)	94.87
Current extent conserved in IUCN area (%)	54.16

3.8 Land use

The area directly included in the clearing permit application site, Bandy Creek Pathway, is currently intact and vegetated reserve. However, surrounding it is residential development and the commercial industrial Bandy Creek Fishing Wharf. It is planned in the long term that the Shire of Esperance owned land will be developed into residential suburbs. In the wider regional area, the Bandy Creek Pathway is in the centre of the Esperance townsite.

4 Methodology

4.1 Desktop study

A desktop study was completed prior to any site visit. Geographical Information System (GIS) review existing

- Existing site digital orthophotos, as sourced from LandGate (2020)
- Western Australian Local Government Association's (WALGA) 'Local Government Mapping (LGMap 2020)' program was used to assess spatial information of geology, topography, soil profiles, native and planted vegetation, water bodies and Interim Biogeographical Regionalisation for Australia (IBRA; Thackway & Cresswell 1995) classification system.
- Data provided by Department of Biodiversity, Conservation and Attractions (DBCA) and Western Australian Herbarium in July/August 2020 was used to assess threatened flora (TF), priority flora (PF), and threatened (TEC) and priority (PEC) ecological communities within 20 km radius of the site. Specifically, spatial data included;
    - WAHerb extract (DBCA 2020e).
    - Threatened and Priority Reporting (TPFL; DBCA 2020c).
    - Esperance District Threatened Flora (DBCA 2020a).
    - TEC and PEC 'Likely to Occur' buffer and boundary areas (DBCA 2020d).
    - Department of Agriculture, Water and the Environment Protected Matters Search Tool
    - Index of Biodiversity Surveys for Assessment (IBSA 2020).
- To assess fauna, the following databases were searched with a 20km buffer from the center of the site (lat and longs);
    - Department of Biodiversity, Conservation and Attractions (DBCA) and Western Australian Museum (WAM) NatureMap data portal (DBCA & WAM 2020)
    - BirdLife Australia's Atlas and Birdata datasets (BirdLife 2020)

- Department of Agriculture, Water and the Environment Protected Matters Search Tool
- Atlas of Living Australia database (ALA 2020)
- Index of Biodiversity Surveys for Assessment (IBSA 2020).

4.2 Field investigation: possible ecological impacts

The site was inspected on15/07/2020, by the Shire of Esperance's Environmental Officer, Katie White. An assessment of possible ecological impacts included historical clearing, artificial water way constructions, impact of fire regimes, regeneration from disturbance, waterlogging, senescence, weeds, erosion, sedimentation, invasive fauna, *Phytophthora cinnamomi* Dieback, and illegal dumping of rubbish.

Vegetation community was also assessed during the field survey. Broad vegetation types defined by structure and composition were recorded and described. Condition of vegetation was assessed using Keighery (1994) categories, as 'Excellent', 'Very Good', 'Good', 'Degraded' or 'Completely Degraded'. This illustrates how healthy vegetation is, determined by number of dead or dying plants, weed cover and other forms of degradation. Additionally, possible environmentally sensitive areas, such as wetlands or granite, were noted. Overall, an assessment of environmental impacts to Department of Water and Environmental Regulation's (DWER) biodiversity values were inspected and valued.

Only a very basic fauna survey was conducted as per EPA (2020) guidelines. Observations of fauna presence, such as call sounds, footprints and scats were also noted, and the area assessed for suitability of endangered Carnaby's Black Cockatoo (*Calyptorhynchus latirostris)* feeding, roosting and nesting habitat. Additionally, species that corresponded with suitable habitat within Bandy Creek Pathway identified in the desktop 20 km radius search were assessed, including Southern Death Adder, Southern Brown Bandicoots, Fork Tailed Swift, Culew Sandpiper, Red-necked Stint, Double Banded Plovers, Peregrine Falcon, Caspian Tern, Osprey, Grey Plover, Crested Tern and Hooded Plover.

4.3 Field investigation: Assessing Threatened and Priority Ecological Communities

The vegetation community of Bandy Creek Pathway was assessed for the presence a TEC or PEC. Two TEC's of particular interest and criteria to meet vegetation communities are outlined below:

- The Environmental Protection and Biodiversity Conservation Act 1999 listed 'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia (Kwongkan)' TEC. The presence of Kwongkan was identified using diagnostic characteristics defined in the 'Approved Conservation Advice for Kwongkan (Commonwealth of Australia 2014)' as;
- The Environmental Protection and Biodiversity Conservation Act 1999 listed Subtropical and Temperate Coastal Saltmarsh. The presence of Subtropical and Temperate Coastal Saltmarsh was identified using the key diagnostic characteristics defined in the 'Approved Conservation Advice for Subtropical and Temperate Coastal Saltmarsh (CoA 2013)'.

PEC's do not have published approved conservation advice. Comparison of the vegetation community occurred using 'Priority Ecological Communities for Western Australia Version 30 (DBCA 2020d)' definitions.

4.4 Field Investigation: Targeted flora survey

The targeted flora survey was undertaken following the Environmental Protection Authority's (EPA) 'Technical Guidance, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (2016)'. All flora within the clearing permit area was surveyed on 15/07/2020 by Katie

White, the Shire's Environmental Officer. Whilst it was mid-winter, many plants were beginning to flower and many annual herb species were present with the wetter soil conditions. It is therefore believed that timing was suitable to determine diversity and the presence of any PF or TF. Vegetation was thoroughly searched throughout the permit area. Suitable associated habitat for TF or PF identified in the desktop study were particularly focused on, and extensively searched.

Due to the high diversity and complexity of Esperance's flora, all species were recorded to compile an incidental species list (Appendix 8.1). All species unknown in the field were collected and identified exsitu, using keys, WA Herbarium's Florabase (DBCA 2020e), manuals and Esperance District Herbarium, to ensure no TF or PF were missed. Material was collected under Katie White's Regulation 61, Biodiversity Conservation Regulations 2018 Licence for Flora Taking, FT61000029.

Over the course of the 2020 wildflower season, surveyors re-familiarised themselves with key taxonomic indicators and associated habitat, by visiting verified populations of *Dampiera sericantha* (P3) and *Banksia prolata* subsp. *calcicola* (P4). For other PF or TF species identified in the desktop survey as possible to occur, scans of pressed specimens from the local Esperance District Herbarium were taken into the field. Any flora thought to be TF or PF was formally collected, counted and mapped using a Panasonic FS-G1 Toughpad with the program ROAM or a GPS Garmin GPS64. Specimens were then lodged with the WA Herbarium for formal verification. When PF were confirmed, TPFL forms were completed and submitted to the DBCA's District Conservation Officer, and Species and Communities Branch.

5 Results and Discussion

5.1 Ecological Impact

5.1.1 Vegetation Communities

A single vegetation community was identified within the Bandy Creek Pathway, as defined by structure and composition (Figure 2). It was described as common immediate coastal fore-dune shrubland, with swales dominated by *Lepidosperma gladiatum* and *Tetragonia implexicoma,* the slopes by *Acacia cochlearis* and *Rhaggodia baccata,* and the ridges dominated by *Spyridium globulosum*. The incidental flora list identified a total of 37 species. It is believed that the Beard (1973) vegetation associations identified in Section 3.6 are an appropriate match for the vegetation community observed.

Figure 2. Vegetation type one identified in Bandy Creek Pathway project, described as common immediate coastal fore-dune shrubland.

5.2 Vegetation Condition

Vegetation condition varies across the site, ranging from very good condition in the centre of the intact vegetation to completely destroyed closer to the Bandy Creek area (Figure 3). Areas in poor condition had extensive previous disturbance mainly from informal walk trails, high weed burden and scattered rubbish (Figure 4). Invasive species were localised to disturbed area and are species unlikely to invade intact bushland, such as Fleabane, Treasure Flower and Sea Rocket. It is unlikely proposed works will impact natural hydrological regimes of the area, with the deep draining nature of the beach sand that directly drains to the ocean continuing to occur post development. However, there is the potential of erosion without careful management. The Shire is aware of this and will implement the appropriate physical construction design and employ revegetation techniques, such as jute matting, where necessary. It is also highly unlikely acid sulphate soils will develop, being the incorrect soil type present and the shallow depth to which any excavations will be carried out. Evidence of rabbits was observed throughout the area, which is supported by regular complaints from the local residents to the Shire. There is no evidence of any recent fires and unknown when the last fire had occurred. Quantifying vegetation condition, there is:

- 1.312 ha of vegetation (68%) is in Very Good condition,
- 0.188 of vegetation (9.6%) is in Good condition,
- 0.253 of vegetation within a 0.268 ha footprint (13.9%) is in Poor condition,
- 0.037 of vegetation within a 0.084 ha footprint (4.3%) is in Degraded condition,
- 0.071 ha footprint (3.4%) is in Completely Destroyed condition.

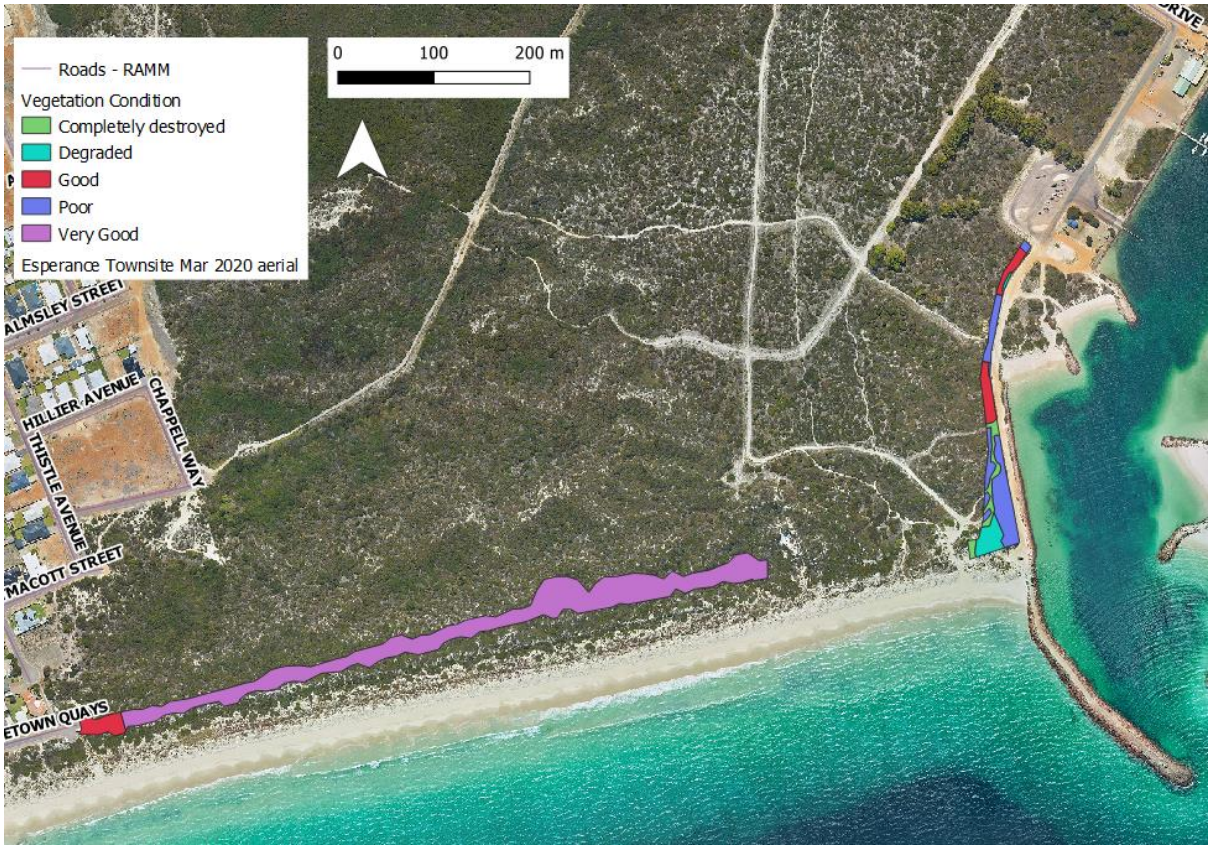

Figure 3. Vegetation condition across the Bandy Creek Pathway project, ranging from Very Good to completely destroyed condition, due to primarily to degradation from informal walk trails, scattered rubbish and weed invasion.

Figure 4. Areas in poor condition along the Bandy Creek Pathway area, due to previous disturbance, rubbish and weeds.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2020) shows no data of *Phytophthora cinnamomi* or other *Phytophthora* sp. There are no other Dieback samples in the surrounding area. The vegetation present is mostly not susceptible to *P. cinnamomi* and would likely be classified as uninterpretable. However, there is always a possibility that other plant pathogens could be introduced to species that are susceptible within the area. Proposed works will be conducted using appropriate hygiene measures to limit spreading of diseases, including clean down of vehicles and machinery before entering the site. However, there is always a possibility that proposed works will extensively spread *P. cinnamomi* dieback or another plant pathogen.

5.3 Threatened and Priority Ecological Communities

The desktop study did not identify the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 listed threatened ecological community (TEC) 'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia (Kwongkan)' directly within the Bandy Creek Pathway project area. However, it is present within a Kwongkan TEC buffer area, with the nearest record of Kwongkan 2.1 km from the site. Additionally, it is within a buffer zone of the Vulnerable TEC 'Subtropical and Temperate Coastal Saltmarsh (Saltmarsh)', with a small patch of salt marsh located 100 m north of the proposed area.

Following the vegetation survey, the vegetation type described does not meet Kwongkan or Saltmarsh TEC. No Proteaceae or saltmarsh species were identified within the area. It is possible historically Kwongkan was present on the sand dune rises, but have senesced, been killed by *Phytophthorra* Dieback, disturbance or lack of appropriate fire regimes. It's unlikely the coastal salt marsh was ever present within the proposed area, due to being related to the direct interface of tidal salt marshes on the edge of the creekline, and the pathway position too high in the landscape.

5.4 Threatened and Priority Flora

No threatened flora (TF) and 45 priority flora (PF) were recorded within a 20 km radius of the proposed impact site (Table 3; DBCA 2020a, DBCA 2020c, DBCA 2020e). Of these, seven PF species had suitable known associated habitat that corresponded with vegetation communities and soil type of Bandy Creek Pathway project. However, there were no confirmed records, indicating no known populations, of PF or TF within the site. There were no TF or PF species identified during the targeted flora survey (Appendix 8.1).

Table 3. Threatened or priority flora identified by the desktop study to be present within a 20 km radius of the Bandy Creek Pathway project area, using Threatened and Priority Flora Reporting (TPFL; DBCA 2020c), WA Herbarium (DBCA 2020e), Esperance District Threatened Flora (DBCA 2020a) and NatureMap (DBCA & WAM 2020).
Nt. Acronyms used in the table include priority flora (P), threatened flora (TF), Biodiversity Conservation (BC) Act 2018, Environmental Protection and Biodiversity Conservation (EPBC) Act 1999, critically endangered (CN) and endangered (EN).

Species	Conservation Status	Associated Habitat	Flowering time	Likely to occur
Adelphacme minima	P3	Bare, dry grey sand, associated with fire disturbance and water	Oct to Jan	No
Astartea reticulata	P3	Wetter areas, Kwongkan. Sand over gravel. Drainage lines	Summer	No

Austrostipa mundula	P3	Sandy soils in mallee-scrub in low woodland.	Oct to Nov	No
Banksia prolata subsp. *calcicola*	P4	Exposed limestone with shallow sands	Jul to Sept	Possible – if limestone present
Comesperma calcicola	P3	Calcareous or semi-saline clay loams, limestone and areas around saline water	Oct-Dec/Jan	No
Comesperma griffinii	P2	Yellow or grey sands on plains	Oct	No
Conospermum quadripetalum	P2	Was only recorded on DBCA & WAM (2020). Likely to be incorrect record, as on Florabase only present in Albany/Margret River area	Sep to Nov	No
Cyathostemon sp. Esperance	P1	Only record on margins on salt lake. Very old record, likely not well known.	Sept	No
Dampiera decurrens	P2	Sandy soils, granite rocks	Sept to dec/Jan	Unlikely
Dampiera sericantha	P3	Sand overlying gravel. Associated with Kwongkan shrublands	May/Aug - Dec	Unlikely
Dampiera triloba	P3	Was only recorded on DBCA & WAM (2020). Single record in Esperance, mostly in Avon Wheatbelt area. Banksia and Eucalyptus woodland with Myrtaceous shrubland. Mixed coastal shrublands.	Aug to Dec	Unlikely
Eucalyptus balanopelex	T	Sandy soils over lateritic gravel	Oct – Dec to Feb	No – likely to be incorrect on database, as all records are in Perth
Eucalyptus foliosa	P3	Grey/White sandy clay, flat adjacent to coastal salt lakes	Unknown	No
Eucalyptus insularis subsp. *contenentalis*	T	Only recorded in Cape Le Grand National Park	August	No
Eucalyptus litorea	P2	Calcareous sand, sandy clay loam and stones. Leeward of primary dunes around coastal salt lakes	Unknown	Possible

Eucalyptus preissiana subsp. *lobata*	P4	Coastal limestone rises and sand dunes. Mostly recorded western area of Esperance.	Nov	Possible
Eucalyptus semiglobosa	P3	White sand over laterite, silty sand on edge of granite shelf, limestone. Present on Hillslopes, Gullies and Cliffs	May or Oct – Dec/Jan	Unlikely
Eucalyptus x missilis	P4	Sand over limestone or granite, in directly coastal areas	Jan - Apr	Possible
Frankenia glomerata	P4	White sands, associated inland. Little Sandy Desert to coastal areas and Mallee.	Nov	No
Galium leptogonium	P3	Distribution across all of Southern Australia. Grows in forests, woodland and grasslands. Often found in rock crevices	Spring to Autumn	No
Gonocarpus pycnostachyus	P3	Sand or clay soils, wet depressions and granite rocks	Unknown	No
Goodenia exigua	P2	Coastal salt lakes	Spring	No
Goodenia quadrilocularis	P2	Sand, sand dunes, granite slopes on outcrops	Sept to Dec	Possible
Grevillea baxteri	P4	Sand and sandplains with granite or gravel. Sub-coastal Kwongkan shrublands.	May/Jul – Sept/Dec	No
Hibbertia carinata	P1	Well drained gravelly sand or yellow sand with gravel	Aug - Sept	No
Hibbertia turleyana	P2	Well drainng white sands, flats, seasonally wet areas	Aug	No
Hopkinsia adscendens	P3	Sand, dry or seasonally damp habitats along streams	Oct	Unlikely
Kennedia beckxiana	P4	Sand, loam, granite hills or outcrops. Only recorded in Cape Arid area	Sept - Dec	No
Kunzea salina	P3	White sand over clay at the margins of salt playa lakes. Restricted to edge of salt lakes	Dec – Feb	No

Lepidium fasciculatum	P3	Semi-arid areas.	May – Dec	Unlikely
Leucopogon apiculatus	P3	Skeletal sandy or stony hills over quartzite granite. Recorded in immediate coastal areas on edge of granite and rocky shelves	Jul – Nov	Unlikely
Leucopogon corymbiformis	P2	Deep white sand with Banksia heath. Banksia speciosa woodland on subcoastal dunes	Aug	Unlikely
Leucopogon interruptus	P3	Grey sand over granite	Spring	Unlikely
Leucopogon rotundifolius	P3	Wide range of soil habitats, ranging from coastal to sand over gravel. Wide distribution	Jan – Aug or Nov	Possible
Lobelia archeri	P1	Fire ephemeral. Only known from one property near Mt Merivale. Upper slopes on non-calcareous sand hills.	Nov – Jan	No
Myosotis australis	P4	Grey sand over limestone. Scattered across Southern Australia. Present on coastal dunes.	Aug – Nov	Possible
Myriophyllum muelleri	P1	Lagoons. Ephemeral water ponds.	Unknown	No
Paracaleana parvula	P2	Deep white sands on plains. Associated with Banksia media. Found only in area north of Condingup	Oct – Nov	No
Persoonia scabra	P3	White sand or sandy loam	Nov – Dec/Jan	Unlikely
Pityrodia chrysocalyx	P3	Sandy soils. Mostly distributed northern Esperance area.	Aug to Oct	No
Pterostylis faceta	P3	Open Mallee shrublands. Mostly recorded further inland	Spring	No
Schoenus sp. Grey Rhizome	P1	Sandy Clay, Sand. Associated with Melaleuca shrublands in sub-coastal areas	Unknown	Unlikely

Tecticornia indefessa	P2	Near edge of salt lakes – defined by white to grey brown sands	Unknown	No

5.5 Fauna

Within a 20 km radius of the Bandy Creek Pathway, 54 fauna have previously been recorded that are classified as priority (P), threatened (T), specially protected (S) or protected under international agreement (IA; Table 4). 14 species have suitable habitat within the proposed clearing permit area, including Southern brown bandicoot, Southern Death Adder, Fork Tailed Swift, Culew Sandpiper, Red-necked Stint, Double Banded Plovers, Peregrine Falcon, Caspian Tern, Osprey, Grey Plover, Crested Tern and Hooded Plover. Directly within the site, there have been six surveys recorded on BirdLife (2020). None of the species listed below have been recorded within the area. Details of impact are outlined below:

- Southern Brown Bandicoot, Quenda, *Isoodon obesulus* P4 – Found in low numbers in vegetation with dense cover up to 1 m high, and previously recorded by Castletown residents as living in the dunes, is it probable that Quenda's inhabit the area. Whilst no nest or burrows were observed during the survey, this project is likely to only have minimal impact on the species due to their large home range, but may impact on the species by opening up the area to predators making it easier for them to get through the thick vegetation.
- Southern Death Adder, *Acanthophis antarcticus,* P3 – Due to the wide distribution and lack of specific habitat requirements, it's believed that any impact from the proposed Bandy Creek Pathway would not be significant.
- Fork Tailed Swift, *Apus pacificus,* IA – Due to the wide range of climatic zones, habitats and nature of a bird that can fly to other sites, proposed works are unlikely to have a significant impact. It is protected under agreements for migratory bird, but overall populations are considered stable under the IUCN classifications.
- Recherche Atelomastix Millipede, *Atelomastix dendritica,* T – There is little information known on this species distribution or requirements. It's therefore unknown whether it is likely to be present within the area or works will have an impact.
- Curlew Sandpiper, *Calidris ferruginea,* T – Whilst likely to be present, any areas with water are considered suitable habitat. There are numerous areas directly within the surrounding area the species could relocate too if regularly occur in this area.
- Red-necked Stint, *Calidris ruficollis,* IA – Whilst likely to be present, any areas with water are considered suitable habitat. There are numerous areas directly within the surrounding area the species could relocate too if regularly occur in this area. It is protected under agreements for migratory bird, but overall populations are considered stable under the IUCN classifications.
- Great Knot, *Calidris tenuirostris,* T – Known roosting area within 20 km of site. Likely to be using site as roosting for night and shelter. However, any populations directly within the site can use the buffer of vegetation remaining between the bush and the pathway or retreat further into the intact bushland.
- Double Banded Plovers, *Charadrius bicinctus,* IA – Extremely wide range of habitats this species can survive in, ranging from coastal, man made, arid, inland and grasslands. Therefore, impact is considered insignificant. It is protected under agreements for migratory bird, but overall populations are considered stable under the IUCN classifications.
- Peregrine Falcon, *Falco peregrinus,* S – Due to the wide range of habitats, nomadic nature of the species and it's wide range a single animal roams, it's unlikely that the proposed site will have a significant impact.

- Caspian Tern, *Hydroprogne caspa,* IA – Occurring on shorelines, there is extensive coastlines that are intact and undisturbed in the Esperance area. It is protected under agreements for migratory bird, but overall populations are considered to be increasing under the IUCN classifications.
- Osprey, *Pandion cristatus,* IA – Extensive suitable habitat in the surrounding area. The roaming nature of this species also suggests that the species could relocate if an animal is roosting regularly or habituating the Bandy Creek Pathway area. It is protected under agreements for migratory bird, but overall populations are considered stable under the IUCN classifications.
- Grey Plover, *Pluvialis squatarola,* IA – Extensive suitable coastal habitat in the surrounding area. It is protected under agreements for migratory bird and not classified under any threatened categories for WA or IUCN. However, it is recognized that overall populations are showing trends towards decreasing, and is listed as near threatened in Victoria and Endangered in Tasmania.
- Crested Tern, *Thalasseus bergii,* IA – Recorded along the vast majority of Australian coastline, the Bandy Creek Pathway is considered a minor development in the large scale of suitable habitat in the Esperance region. Likely that occurrence of birds only occurs directly on the beach and not within the vegetation buffer the pathway is being placed. It is protected under agreements for migratory bird, but overall populations are considered stable under the IUCN classifications.
- Hooded Plover, *Thinornis cucullatus,* P4 – The Hooded Plover is considered quite sensitive to disturbance from people and dogs. Given that Castletown Quays allows dogs off leads, it is unlikely that the species frequents the area. Additionally, the Hooded Plover is actively surveyed by the Esperance Bird Observers Group and carefully monitored by many enthusiastic amateur ornithologists in Esperance.

Table 4. Potential threatened, priority and protected under international agreement fauna recorded within a 20 km radius of the proposed Bandy Creek Pathway, as sourced from DBCA & WAM (2020), BirdLife (2020), DAWE (2020), ALA (2020) and IBSA (2020).
Nt. Acronyms used include priority (P), threatened (T), vulnerable (Vu), endangered (En), critically endangered (Cr En), specially protected (S) and protected under international agreement (IA).

Scientific Name	Common Name	Source	Conservation Status	Likelihood of occurring	Associated habitat
Acanthophis antarcticus	Southern Death Adder	DBCA & WAM (2020) ALA (2020)	P3	Possible	Widespread across Southern Australia. Mainly threatened by ongoing toad invasion. Present in forests, woodlands, grasslands. Diet of small mammals and birds. Unlikely to have significant impact.

Actitis hypoleucos	Common Sandpiper	DBCA & WAM (2020) ALA (2020)	IA	No	Migratory bird. Coastal or inland saline and fresh wetlands. Located on muddy edges or rocky shores.
Apus pacificus	Fork tailed Swift, Pacific Swift	DBCA & WAM (2020) ALA (2020)	IA	Possible	Migratory bird, spending summer in Australia. Wide range of climatic zones and habitats. Unlikely to have significant impact.
Arctocephalus forsteri	New Zealand Fur Seal, Long Nosed Fur Seal	DBCA & WAM (2020) ALA (2020)	S	No	Water based mammal
Ardenna carneipes	Flesh-footed Shearwater	DBCA & WAM (2020) ALA (2020)	T	No	Trans-equatorial migrant. Widely distributed southern Pacific. Breeds off Islands off Esperance and reaminder of time at sea.
Ardenna tenuirostris	Short-tailed Shearwater, Yolla, Moonbird	DBCA & WAM (2020) ALA (2020)	IA	No	Coastal waters. Migratory across the Pacific.
Arenaria interpres	Ruddy Turnstone	DBCA & WAM (2020) ALA (2020) BirdLife (2020)	IA	Unlikely – Whilst on the edge of the beach, Castletown Beach is long open water.	Migratory bird. Small groups along the coastline with exposed rocks, reefs and shallow pools.
Atelomastix dendritica	Recherche Atelomastix Millipede	DBCA & WAM (2020) ALA (2020)	T	Unknown	Unknown
Balaena gracialis subsp. *australis*	Southern Right Whale	DAWE (2020)	En	No	Marine Mammal in the ocean
Calidris acuminata	Sharp-tailed Sandpiper	DBCA & WAM (2020) ALA (2020)	IA	No	Grassy edges of shallow inland freshwater wetlands. Found around sewerage farms, flooded fields, mudflats, mangroves and rocky shores.

Calidris alba	Sanderling	DBCA & WAM (2020) ALA (2020)	IA	Unlikely – Likely to be present in adjacent beach, but not in the dense shrubland of clearing permit.	Open sandy beaches on edge of waves, on sandbars and spits, Roost on bare sand in dunes or behind kelp. Migratory bird.
Calidris canutus	Red Knot	DBCA & WAM (2020) ALA (2020)	IA	No	Coastal sandy estuaries with tidal mudflats
Calidris canutus subsp *rogersi*	Red Knot – north-eastern Siberia	DBCA & WAM (2020) ALA (2020)	T	No	Coastal sandy estuaries with tidal mudflats
Calidris ferruginea	Curlew Sandpiper	DAWE (2020) DBCA & WAM (2020) ALA (2020) BirdLife (2020)	T – Cr En (IUCN), Vu (WA)	Possible.	Intertidal mudflats of estuaries, lagoons, mangroves, beaches, rcoky shores. Anywhere with water present. Wide range of habitats
Calidris melanotos	Pectorol Sandpiper	DBCA & WAM (2020) ALA (2020)	IA	Unlikely	Shorebird. Only small portion of global population migrate to Australasia.
Calidris ruficollis	Red-necked Stint	DBCA & WAM (2020) ALA (2020)	IA	Possible	Coast in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and sandy shores. Wide habitat and various vegetation.
Calidris tenuirostris	Great Knot	DAWE (2020) DBCA & WAM (2020) ALA (2020)	T – Cr En	Possible	Known Roosting record in area. Intertidal mudflats and sandflats in sheltered coasts. Forage on moist mud and roost in beach or nearby low vegetation
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	BirdLife (2020) DAWE (2020) DBCA & WAM (2020) ALA (2020)	T - En	No	Tall trees for roosting and Kwongkan Proteaceous Shrubland for foraging grounds.
Carcharias taurus	Grey Nurse Shark	DBCA & WAM (2020) ALA (2020)	T	No	Ocean
Carcharodon carcharias	Great White Shark	DAWE (2020)	T – Vu	No	Ocean

Cereopsis novaehollandiae	Cape Barren Goose	BirdLife (2020) DAWE (2020) DBCA & WAM (2020) ALA (2020)	T - Vu	Unlikely	Migratory Bird. Located on islands during the day and spend night in sheltered open areas in the townsite.
Charadrius bicinctus	Double Banded Plovers	DBCA & WAM (2020) ALA (2020) DAWE (2020)	IA	Possible	Coastal beaches, mudflats, sewage farms, river banks, fields, dunes and upland tussock grasses
Charadrius leschenaultii	Greater Sand Plover	DBCA & WAM (2020) ALA (2020)	T	Unlikely – possible in the adjacent Bandy Creek, but not in the dense shrubland.	Migratory bird. Spends summer in Australiasia area. Small wader.
Charadrius mongolus	Lesser Sand Plover	DBCA & WAM (2020) ALA (2020)	T	Unlikely - possible in the adjacent Bandy Creek, but not in the dense shrubland.	Migratory bird. Small Wader in mudflats, feeding on insects, crustaceous and annelid worms.
Dermochelys coriacea	Leatherback Turtle	DBCA & WAM (2020) ALA (2020)DAWE (2020)	T	No	Ocean
Diomedea exulans	Wandering Albatross	DBCA & WAM (2020) ALA (2020)	T	No	Spends life on the open water or granite outcrops in the ocean.
Eubalaena australis	Southern Right Whale	DAWE (2020) DBCA & WAM (2020) ALA (2020)	T - En	No	Ocean
Falco peregrinus	Peregrine Falcon	DAWE (2020) DBCA & WAM (2020) ALA (2020)	S	Possible	Found in most habitats, from rainforest to arid zone and across altitudes, from coast to alpine. Requires abundant prey and secure nest sites.
Geotria australis	Pouched Lamprey	DBCA & WAM (2020) ALA (2020)	P3	No	Freshwater was a juvenile and ocean as an adult
Hydroprogne caspia	Caspian Tern	DAWE (2020) DBCA & WAM (2020) ALA (2020)	IA	Possible	Migratory bird. Found on shorelines, wide distribution across the world.

Isodon fusciventer	Quenda, Southern Brown Bandicoot	DAWE (2020) DBCA & WAM (2020) ALA (2020)	P4	Likely	Scrubby, often swampy vegetation with dense cover up to 1 m.
Leipoa ocellata	Malleefowl	DBCA & WAM (2020) ALA (2020)	T	No	Semi-arid to arid shrublands and low woodlands, dominated by Mallee or Acacia
Limosa lapponica subsp. *baueri*	Bar-tailed Godwit, Western Alskan Bar-tailed Godwit	DAWE (2020) DBCA & WAM (2020) ALA (2020)	T – Vu	Unlikely - possible in the adjacent Bandy Creek, but not in the dense shrubland	Estuarine mudflats, beach and mangroves. Common in coastal areas. Like company of other waders.
Neophoca cinerea	Australian Sea Lion	DBCA & WAM (2020) ALA (2020)	T	No	Ocean
Notamacropus irma	Western Brush Wallaby	DBCA & WAM (2020) ALA (2020)	P4	Unlikely	Wide distribution from Kalbarri to Cape Arid, in Mallee and Heathland. Prefer open forests with good grazing
Oxyura australis	Blue Billed Duck	DBCA & WAM (2020) ALA (2020)	P4	Unlikely - possible in the adjacent Bandy Creek, but not in the dense shrubland	Prefers estuarine open waters and mudflats
Pandion cristatus	Osprey	DAWE (2020) DBCA & WAM (2020) ALA (2020)	IA	Possible	Directly coastal environments, terrestrial wetlands, offshore islands, rivers
Parantechinus apicalis	Dibbler	DBCA & WAM (2020) ALA (2020)	T	Unlikely	Believed to be extinct until rediscovered in 1967 at Cheynes beach. Dense bushland.
Petrogale lateralis subsp. *lateralis*	Black-flanked Rock Wallaby, Moorong	DAWE (2020)	T – En	No	Known translocated population within the area. Historically widespread and now restricted to few remnant areas. Prefer large rocky habitat.

Plegalis falcinellus	Glossy Ibis	DAWE (2020) DBCA & WAM (2020) ALA (2020)	IA	Unlikely - possible in the adjacent Bandy Creek, but not in the dense shrubland	Globally distributed. Wader. Shallow water and nest in freshwater or brackish wetlands with dense stands or emergent water. Preference for marshes and margins of lakes and rivers.
Pluvialis fulva	Pacific Golden Plover	DAWE (2020) DBCA & WAM (2020) ALA (2020)	IA	Unlikely - possible in the adjacent Bandy Creek, but not in the dense shrubland	Migratory bird in Australasia in summer, wader foraging for food on fields, beaches and tidal flats.
Pluvialis squatarola	Grey Plover	DBCA & WAM (2020) ALA (2020)	IA	Possible	Entirely coastal, found on marine shores, inlets, estuaries, lagoons with large tidal mudflats or sandflats, roosting in sandy beaches.
Stercorarius antarticus	Brown Skua	DAWE (2020) DBCA & WAM (2020) ALA (2020)	P4	No	Sea bird, feeding on fish, penguin chicks and other seabirds. Rocky outcrops on edge of ocean.
Sternula nereis subsp. *nereis*	Australian Fairy Tern	DAWE (2020)	T – Vu (IUCN)	Unlikely – likely present on Castletown Beach but not in the dense Shrubland.	Shallow sea bird, feeds on fish. Breeds on sheltered beaches on mainland or offshore islands. Often present on the beach edge.
Thalassarche carteri	Indian yellow-nosed albatross	BirdLife (2020)	T - En	No	Extremely wide distribution globally. Mostly out at ocean
Thalassarche chlororhynchos	Atlantic Yellow Nosed Albatross	DBCA & WAM (2020) ALA (2020)	T	No	Extremely wide distribution globally. Mostly out at ocean
Thalasseus bergii	Crested Tern	DBCA & WAM (2020) ALA (2020)	IA	Possible	Recorded along vast majority of Australian coastline. Breed on offshore islands. Strictly coastal species.

Thinornis cucullatus	Hooded Plover	BirdLife (2020) DAWE (2020)	P4	Possible	Located coastally, seen on edge of water, freshwater lakes, freshwater marshes, coastal saline lagoons, sandy beaches
Tringa brevipes	Grey Tailed Tattler	DBCA & WAM (2020) ALA (2020)	P4	Unlikely	Sheltered coasts with reefs and rock platforms, in intertidal mudflats
Tringa glareola	Wood Sandpiper	DBCA & WAM (2020) ALA (2020)	IA	Unlikely	Inland shallow freshwater wetlands, with other waders. Prefer water and pools with reeds, grasses and tall dead timbers
Tringa nebularia	Common Greenshank	DBCA & WAM (2020) ALA (2020)	IA	Unlikely - possible in the adjacent Bandy Creek, but not in the dense shrubland	Coastal and inland, estuaries, mudflats, mangrove swamps, lagoons, swamps, sewage farms, flooded crops
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	DBCA & WAM (2020) ALA (2020)	IA	Unlikely – surrounded by salt water	Fresh or slightly brackish wetlands, such as rivers, sewage farms, flooded meadows, drains, lagoons
Turnix varius	Painted Button Quail	BirdLife (2020)	T - En	No	Temperate woodlands. Closed canopies with some understorey and damp leaf litter on the ground
Westralunio carteri	Carter's Freshwater Mussel	DBCA & WAM (2020) ALA (2020)	T	No	Freshwater streams

6 Conclusion; assessment of Department of Water and Environmental Regulations clearing principles

The Bandy Creek Pathway project may be at variance to some of the clearing principles that the Department of Water and Environmental Regulations (DWER) assess applications, as listed under Schedule 5 of the Environmental Protection Act 1986 (DWER 2019). The proposed development doesn't impact on a vegetation community that is extensively cleared or poorly represented in the conservation estate. Whilst, the majority of the vegetation proposed to be cleared is in very good condition, impact has been mitigated by aligning the pathway on disturbed areas as much as possible. Additionally, the surrounding area is proposed to be developed as a residential subdivision in the future, which will likely affect the condition of the

surrounding vegetation more than the proposed pathway. No threatened ecological communities (TEC) or priority ecological communities were identified directly within the site, but is in close proximity to the vulnerable TEC 'Subtropical and Temperate Coastal Saltmarsh'. No threatened or priority flora were identified at the site. Of the 13 identified fauna recorded within a 20 km radius of the site that had matching habitat requirements for the Bandy Creek Pathway vegetation, none were highlighted as proposed works having a significant effect on the conservation status of the species.

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8 Appendix

8.1 Incidental species list

Family	Genus	Species	Common Name	Invasive
Aizoaceae	*Carpobrotus*	*virescens*	Coastal Pig Face	Potentially – impossible to differentiate with invasive sp.
	Tetragonia	*implexicoma*	Bower Spinach	
Asparagaceae	*Asparagus*	*asparagoides*	Bridal Creeper	*
Asteraceae	*Erigeron*	*bonariensis*	Fleabane	*
	Gazania	*linearis*	Treasure Flower	*
	Olearia	*axillaris*	Coastal Daisybush	
	Senecio	*pinnatifolius*	Variable Groundsel	
	Taraxacum	*officinale*	Common Flatweed Dandelion	*
Brassicaceae	*Cakile*	*maritima*	Sea Rocket	*
	Lobularia	*maritima*	Alyssum	*
	Raphanus	*raphanistrum*	Wild Radish	*
Chenopodiaceae	*Threlkedia*	*diffusa*	Coastal Bone fruit	
	Rhaggodia	*baccata*	Berry Salt bush	
Cyperaceae	*Ficinia*	*nodosa*	Knotted Club Rush	
	Lepdiosperma	*gladiatum*	Coastal Saw Sedge	
Ericaceae	*Leucopogon*	*parviflolius*	Coastal beard	

			heath	
Euphorbiaceae	*Euphorbia*	*paralias*	Sea Spurge	*
	Euphorbia	*terracina*	Geraldton Carnation Weed	*
Fabaceae	*Acacia*	*cochlearis*	Rigid Wattle	
	Acacia	*cyclops*	Coastal Wattle	
	Acacia	*saligna*	Orange Wattle	
Geraniaceae	*Pelargonium*	*capitatum*	Rose Pelargonium	*
Goodeniaceae	*Scaevola*	*crassifolia*	Thick leaved Fan Flower	
Hemerocallidaceae	*Dianella*	*brevicaulis*	Flax or Blueberry Lilly	
Lauraceae	*Cassytha*	sp.	Dodder Laurel	
Myrtaceae	*Melaleuca*	*lanceolata*	Rottnest Tea Tree	
Olacaceae	*Olax*	*phyllanthi*		
Orchidaceae	Sp.			
Pittosporaceae	*Billardiera*	*heterophylla*	Australian Blue bell	
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*
	Eragrostis	*curvula*	African Lovegrass	*
	Lagurus	*ovatus*	Hare's Tail Grass	*
	Spinifex	*hirsutus*	Coastal Spinifex	
	Sp.			
Rhamnaceae	*Spyridium*	*globulosum*	Basket Bush	
Santalaceae	*Exocarpus*	*sparteus*	Native Cherry	
Scrophulariaceae	*Myoporum*	*insulare*	Coastal Boobialla	