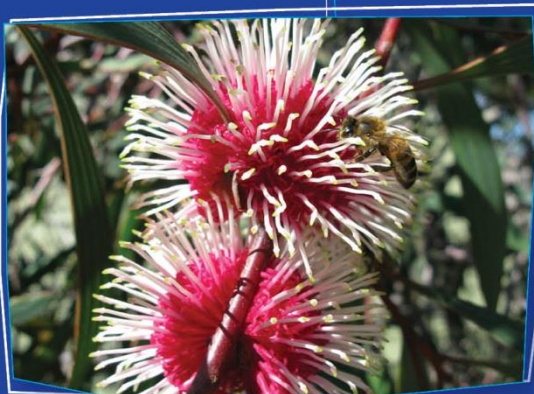


# Dieback and Invasive Weed Management Plan CPS 10158



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## 1 Introduction:

The Shire of Esperance is renowned for its high biodiversity, it contains over 3100 known flora species, and is part of the one of the world's 34 biodiversity hotspots. It contains many endemic and rare and priority flora species, as well as threatened ecological communities (TECs) including large areas of the Proteaceae dominated Kwonkgan Shrublands TEC. Two of the biggest threatening processes to the biodiversity and native vegetation within the Shire of Esperance include invasive weeds and dieback.

The Shire of Esperance mainly consists of two interim biogeographic regions; The Esperance Sandplain and the Esperance Mallee. The Esperance Sandplain biogeographic region consists of sandy and sandy-duplex soils, experiences annual yearly rainfall in the range of 400mm in the north to 600mm in the south and vegetation is dominated by mostly mallee-heath interspersed with granite and wetlands. The Esperance Mallee biogeographic region consists of heavier soils on a level to very gently inclined internally drained landscape, it experiences annual yearly rainfall in the range of 400mm in the south to 300mm in the north and vegetation is dominated by mostly eucalypt-mallee with some Eucalypt woodlands and *Banksia media* heath and well as samphire dominated salt-lake communities. The location of project areas within these two biogeographic regions affects dieback susceptibility and the types of weeds that are also a threat.

The Shire of Esperance manages over 380 reserves and maintains over 4,800km of sealed and unsealed roads and roadside reserves. In 2009, The Shire of Esperance published its Environmental Weeds Strategy. This strategic document was undertaken to assist in the management and control of environmental weeds across the Shire of Esperance. The strategy focused on four main components which were:

- Identification of priority environmental weeds and their management;
- Identification of priority bushland reserves and road reserves and their management;
- Strategic approaches for improved weed management; and
- Financial and human resourcing.

The priority invasive weeds identified through this process were: Spiny Rush, *Juncus acutus*; Geraldton Carnation Weed, *Euphorbia terracina*; Pyp Grass, *Erharta villosa*; Victorian Teatree, *Gaudium laevigatum*; African Boxthorn, *Lycium ferocissimum*; Watsonia species; African Lovegrass, *Eragrostis curvula*; Cumbungi, *Typha sp.*; Caltrop, *Tribulus terrestris*; Golden Wattle, *Acacia pycnantha* and other eastern states Acacia species.

In 2006 a survey of Roadside Conservation Value in the Shire of Esperance, was completed by the Esperance Wildflower Society funded by the Shire of Esperance. This report covered the surveying (from 1999 to 2002) of the weed infestation level and other attributes of vegetation conservation values for all Shire of Esperance roadside reserves in the rural zone (townsite areas excluded, both sides of every road in the Shire). This data was also mapped into a GIS system and is held by DBCA and the Shire of Esperance, and has been recently incorporated into the 2020 updated Esperance Weeds database used by a variety of land managers and not for profit organisations. In the 2006 report the occurrence of specific weeds along roadsides in the Shire of Esperance was found to be:

- African Lovegrass - 4990km
- Veldt Grass - 1 605km
- Victorian Tea Tree - 751 km
- Bridal Creeper - 420km

- African Boxthorn - 91 km
- Other Weeds - 2821km

This report (although the data is now 20 years old) shows the high extent of infestation of some weeds. The only priority invasive weeds that have reduced in extent over the 20 year period is African Boxthorn, *Lycium ferocissimum* and Caltrop, *Tribulus terrestris* as well as Watsonia and Cactus. This is due to targeted control programs undertaken by the Shire of Esperance, Esperance Weeds Action Group and South Coast NRM.

Bridal creeper rust fungus *Puccinia myrsiphylli* was introduced to Australia in 2000. The Shire of Esperance Environmental Officers distribute the rust to uninfested areas during the winter months. Most infested areas now have the rust fungus present and the rate of spread of this weed and the vigour in which it competes with native vegetation has been dramatically improved throughout the shire through this program.

The extent of Victorian Teatree, *Gaudium laevigatum* and some of the grass weeds has increased substantially over the last 20 years. The Shire of Esperance rural slasher that slashes road verges has only had an air compressor on the slasher ute since around 2009 (approx. 12 years). This clean down device has since reduced the rate of spread of these weed seeds being spread by slashing operations which was one of the main spread vectors.

The weedy eastern states Acacia species, have substantially increased in distribution in the Esperance Shire over the last 20 years, mostly due to distribution of seeds by birds and farmer roadside vegetation burning. The Shire of Esperance is a key project member on the Esperance Weeds Action Group 2021 State NRM Weedy Wattles project, currently mapping extent and prioritising control of these woody weeds.

All of the project areas except 'site A' under CPS 10158/1 are adjacent to farmland in road reserves ranging from 20m to 100m wide. As a result, agricultural weeds in adjacent paddocks occur in these project areas spread from rural machinery and agricultural operations.

Phytophthora dieback is one of the biggest threats to biodiversity in Western Australia and has now spread throughout the south-west from Eneabba to Esperance. Phytophthora have likely been established in the Shire of Esperance since the 1960's (Massenbauer, 2017). Phytophthora dieback is a deadly, introduced plant pathogen. Scientifically known as the group of *Phytophthora* species, it is classified as a water mould belonging to the new ancestral kingdom Chromista. Strict hygiene and effective management are essential to minimise the risk of dieback spread. In most cases, removing all mud and soil from footwear, vehicles, machinery and equipment minimises the risk of spreading the plant pathogen.

Road maintenance, and construction carries a high risk of spreading Phytophthora dieback and the Shire of Esperance, reduces this risk by adhering to the following hygiene guidelines recommended by Project dieback:

Where possible, the Shire of Esperance will during road maintenance and construction activities:

- Schedule activities in high dieback risk areas for low rainfall months and avoid wet or muddy conditions.
- Be aware of Dieback Free and Infested areas prior to activities commencing.

- Clean all vehicles and equipment prior to starting works at a new location
- Regularly clean all vehicles and equipment, to keep in a clean condition
- Stay on established roads and tracks.

The Shire of Esperance uses a combination of dry clean and wash-down methods. Dry clean is where compressed air or a spade/brush is used to blow weeds and dirt from machinery. Wash-down is where pressurised water spray unit to remove any remaining soil, mud and plant material. Wash-downs need to be done on a hard, well drained surface in low lying areas (e.g. road, ramp or grate). Shire of Esperance Environmental Services staff and Operations Supervisors have completed Dieback Green Card Training.



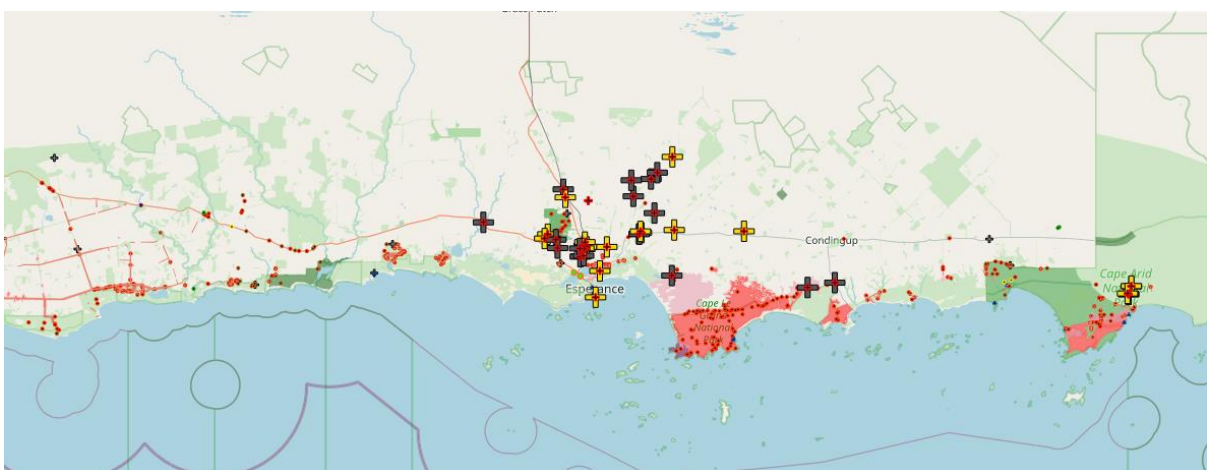
**Figure 1.** Shire of Esperance Depot vehicle washdown bay





**Figure 2.** One of the Shire of Esperance's fleet of mobile washdown facilities

All project sites are checked for the most up to date disease status using Project Dieback's Dieback Information and Delivery Management System (DIDMS). DIDMS is a user registered web-based platform for storage, viewing, basic mapping and sharing of spatial *Phytophthora dieback* information. Environmental Officers also inspect for visual signs of Dieback during flora surveys.



**Figure 3.** DIDMS map of known dieback occurrences within the Shire of Esperance

In 2017, South Coast NRM carried out the 'South Coast Coastal Corridors' Project. Amongst other threatening processes to remnant vegetation within the 15km buffer from the southern coast line, the project developed a Phytophthora Hazard Dispersion Model as part of Project Dieback. This GIS soil borne Phytophthora Hazard Dispersion tool was developed to help quantitatively and qualitatively link hazard spread pathways of a known plant disease occurrence to a susceptible biodiversity value. The model is not a biological disease occurrence model, but a scenario hazard assessment tool. The hazard dispersion tool estimates areas geographically linked to a known soil-borne disease point via spread pathways over time using a cost distance method.

The 15 km buffer Coastal Corridor study area is susceptible to the spread of various species of soil-borne Phytophthora. About 20 per cent of the study area is a Phytophthora dispersion hazard and 88 per cent of the existing road, track, and trail network are linked to a known disease point. Of these roads, tracks and trails 82 per cent are unsealed which poses a major hygiene risk to susceptible vegetation types. The Phytophthora dispersion hazard roads are mapped in DIDMS and this provides a useful reference tool to plan operation risk reduction measures.

**Table 1.** CPS 10158/1 project areas assessed against the Phytophthora dispersion hazard model

Site	PC infested within 50 years as per model	Dieback susceptible vegetation
Site A – Site A – Cascade Road Dog Fence and Gravel Pit	No	Yes
Site B – Myrup Road Blackspot	Yes	Yes
Site C – Rollond Road, SLK 0-15.9	No	Yes
Site D - Farmers Road (SLK 0-2.54)	Yes	Yes
Site E – Fuss Road SLK 0- 4.2	Yes	Yes
Site F – Ridgeland Road, SLK 0-5.69	No	Yes
Site G – Heywood Road, 0 – 6 SLK	No	Yes
Site H – Boydell Road, SLK 0 - 11.83	Yes	Yes

Based on these risk ratings, if there are dieback susceptible vegetation types within a project area and only moderate to no risk of dieback getting there, extreme caution should be taken not to introduce dieback into the site.

Sites with extreme risk, may already have dieback within them and extreme caution regarding moving vehicles and equipment out of that site needs to be implemented.

Regular training is carried out by Environmental Officers to rural maintenance and construction teams on invasive weed and dieback management and risk reduction.

Specific site weed and dieback management at each CPS 10158/1 site is detailed below.

### Site A – Cascade Road Dog Fence and Gravel Pit

Weed invasion at the site was minimal, and there may have only been a single weed species found at the site. A single not confidently identified *Asphodelus fistulosus*. As a result, hygiene prior to and during operations are of utmost importance. Regular wash downs during the course of works to

remove weed seeds or follow up herbicide control of invasive species needs to occur.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2022) data shows no positive *Phytophthora cinnamomi* or other *Phytophthora* sp. Dieback sample results in the area. No signs of dieback were observed at the site. The vegetation is high in Ericaceae and Proteaceae species and would all be susceptible to dieback disease.

## Site B – Myrup Road Blackspot

There was significant weed invasion across the site with *Gaudium laevigatum* being the most serious weed, having formed dense thickets throughout large sections of the road reserve, this is a priority environmental weed in the Shire of Esperance’s Environmental Weed Strategy 2009-2018. To minimise the impact of *Gaudium laevigatum* being spread further it is recommended that the eastern sections of road are done last after the western parts to ensure weed is not spread.

Other serious weeds included *Acacia pycnantha*, *Acacia dealbata*, *Freesia X alba* and *Asparagus asparagoides*. Agricultural weeds such as *Lupinus cosentinii*, *Brassica* sp., *Briza maxima*, *Briza minor*, *Lolium* sp., *Bromus* spp., etc were also a significant problem within the road reserve, with large sections of historically cleared land invaded by these weeds. Overall, 50 invasive species were identified within the project area. Six non-native species had been planted in the road reserve by neighboring landowners, though these do not appear to have naturalized, these include *Callistemon phoeniceus* and *Melaleuca nesophila*.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2022) data shows positive *Phytophthora cinnamomi* Dieback sample 30 metres away from the clearing footprint. Numerous other positive *Phytophthora cinnamomi* samples are present within the general area. Large sections of the site were missing proteaceous species and likely infected by *Phytophthora cinnamomi*. Some sections of the road reserve still have proteaceous species constituting a major vegetative component and would be highly susceptible to any additional spread of dieback.

**Table 2.** Invasive weeds present in Site B Myrup Road Blackspot pre-clearing

Family	Genus	Species	Herbarium Reference
Aizoaceae	<i>Aizoon</i>	<i>pubescens</i>	KSW22422
Aizoaceae	<i>Brassica</i>	<i>sp.</i>	
Asparagaceae	<i>Asparagus</i>	<i>asparagoides</i>	
Asphodelaceae	<i>Chamaescilla</i>	<i>corymbosa</i>	
Asteraceae	<i>Cotula</i>	<i>turbinata</i>	
Asteraceae	<i>Gamochaeta</i>	<i>calviceps</i>	
Asteraceae	<i>Gamochaeta</i>	<i>calviceps</i>	
Asteraceae	<i>Hypochaeris</i>	<i>radiata</i>	
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>	
Asteraceae	<i>Ursinia</i>	<i>anthermoides</i>	
Asteraceae	<i>Vellereophyton</i>	<i>dealbatum</i>	
Brassicaceae	<i>Brassica</i>	<i>sp.</i>	
Brassicaceae	<i>Raphanus</i>	<i>raphanistrum</i>	
Campanulaceae	<i>Wahlenbergia</i>	<i>capensis</i>	

Caryophyllaceae	<i>Petrorhagia</i>	<i>dubia</i>	
Caryophyllaceae	<i>Polycarpon</i>	<i>tetraphyllum</i>	
Caryophyllaceae	<i>Silene</i>	<i>gallica</i>	
Casuarinaceae	<i>Casuarina</i>	<i>obesa</i>	
Cyperaceae	<i>Cyperus</i>	<i>tenellus</i>	
Fabaceae	<i>Acacia</i>	<i>dealbata</i>	
Fabaceae	<i>Acacia</i>	<i>iteaphylla</i>	KSW19622 ACC9857
Fabaceae	<i>Agonis</i>	<i>flexuosa</i>	
Fabaceae	<i>Chamaecytisus</i>	<i>palmensis</i>	
Fabaceae	<i>Lupinus</i>	<i>cosentinii</i>	KSW16022 ACC9841
Fabaceae	<i>Ornithopus</i>	<i>sativus</i>	
Fabaceae	<i>Ornithopus</i>	<i>compressus</i>	
Fabaceae	<i>Trifolium</i>	<i>sp.</i>	
Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>	
Iridaceae	<i>Freesia</i>	<i>alba X</i>	
Iridaceae	<i>Romulea</i>	<i>rosea</i>	
Campanulaceae	<i>Monopsis</i>	<i>debilis</i>	
Lythraceae	<i>Lythrum</i>	<i>hyssopifolia</i>	
Myrtaceae	<i>Callistemon</i>	<i>phoeniceus</i>	
Myrtaceae	<i>Corymbia</i>	<i>porrecta</i>	
Myrtaceae	<i>Eucalyptus</i>	<i>forrestiana</i>	
Myrtaceae	<i>Leptospermum</i>	<i>laevigatum</i>	
Myrtaceae	<i>Melaleuca</i>	<i>nesophila</i>	
Myrtaceae	<i>Metrosideros</i>	<i>excelsa</i>	
Myrtaceae	<i>Metrosideros</i>	<i>polymorpha</i>	
Onagraceae	<i>Oenothera</i>	<i>drummondii</i>	
Onagraceae	<i>Oenothera</i>	<i>stricta</i>	
Orchidaceae	<i>Disa</i>	<i>bracteata</i>	
Orobanchaceae	<i>Orobanche</i>	<i>minor</i>	
Pinaceae	<i>Pinus</i>	<i>pinaster</i>	
Poaceae	<i>Briza</i>	<i>maxima</i>	
Poaceae	<i>Briza</i>	<i>minor</i>	
Poaceae	<i>Bromus</i>	<i>diandrus</i>	
Poaceae	<i>Bromus</i>	<i>diandrus</i>	
Poaceae	<i>Bromus</i>	<i>hordeaceus</i>	
Poaceae	<i>Ehrharta</i>	<i>calycina</i>	
Poaceae	<i>Lolium</i>	<i>sp.</i>	
Poaceae	<i>Pennisetum</i>	<i>clandestinum</i>	
Poaceae	<i>Schismus</i>	<i>barbatus</i>	
Scrophulariaceae	<i>Dischisma</i>	<i>Sp.</i>	KSW22522



Solanaceae	<i>Solanum</i>	<i>nigrum</i>	
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### Site C – Rollond Road, SLK 0-15.9

Agricultural weeds were the most significant issue within ‘Site C – Rollond Road, SLK 0-15.9’ area. Overall, 29 invasive species were identified within the project area (Appendix 8.1). Of these, the most extensive and of serious concern were invasive grasses such as *Avena barbata*, *Hordeum leporinum*, *Lolium sp.* It is highly likely that proposed works will increase the distribution of weeds and degrade vegetation along the entire road reserve where works occur. Ideally, regular wash downs during the course of works to remove weed seeds or follow up herbicide control of invasive species needs to occur.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2022) data shows no *Phytophthora cinnamomi* or other *Phytophthora sp.* dieback sample results in the immediate area. No signs of dieback were present within the reserve. Vegetation type ‘C’ had a moderate number of proteaceous species present, and could be susceptible to dieback. Proposed works will be conducted using appropriate hygiene measures to limit spreading of the disease, including clearing in dry conditions and clean down of vehicles and machinery before entering the site.

**Table 3.** Weeds present in Site C – Rollond Road, SLK 0-15.9

Family	Genus	Species
Aizoaceae	<i>Mesembryanthemum</i>	<i>crystallinum</i>
Aizoaceae	<i>Mesembryanthemum</i>	<i>nodiflorum</i>
Asphodelaceae	<i>Asphodelus</i>	<i>fistulosus</i>
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>
Asteraceae	<i>Cirsium</i>	<i>vulgare</i>
Asteraceae	<i>Erigeron</i>	<i>bonariensis</i>
Asteraceae	<i>Monoculus</i>	<i>monstrosus</i>
Asteraceae	<i>Onopordum</i>	<i>acaulon</i>
Asteraceae	<i>Pseudognaphalium</i>	<i>luteoalbum</i>
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>
Brassicaceae	<i>Brassica</i>	<i>napus</i>
Brassicaceae	<i>Brassica</i>	<i>tournefortii</i>
Brassicaceae	<i>Carrichtera</i>	<i>annua</i>
Brassicaceae	<i>Lepidium</i>	<i>africanum</i>
Brassicaceae	<i>Rapistrum</i>	<i>rugosum</i>
Caryophyllaceae	<i>Silene</i>	<i>nocturna</i>
Fabaceae	<i>Medicago</i>	<i>tornata</i>
Fabaceae	<i>Pisum</i>	<i>sp</i>
Fabaceae	<i>Vicia</i>	<i>sativa</i>
Malvaceae	<i>Malva</i>	<i>parvifolia</i>
Pinaceae	<i>Pinus</i>	<i>pinaster</i>
Plumbaginaceae	<i>Limonium</i>	<i>lobatum</i>
Poaceae	<i>Avena</i>	<i>barbata</i>

Poaceae	<i>Hordeum</i>	<i>leporinum</i>
Poaceae	<i>Lolium</i>	<i>sp.</i>
Poaceae	<i>Triticum</i>	<i>aestivum</i>
Primulaceae	<i>Lysimachia</i>	<i>arvensis</i>
Solanaceae	<i>Solanum</i>	<i>nigrum</i>

#### Site D - Farmers Road (SLK 0-2.54)

There was moderate weed invasion across the entirety of the proposed 'Site D – Farmers Road (SLK 0 – 2.54)' area. In most parts, just the edge of the road is highly weedy and the weeds did not spread far into the roadside vegetation. Overall, 33 invasive species were identified within the project area (Appendix 1). Of these, the most extensive and of serious concern were African Love Grass (*Eragrostis curvula*) which is present along the whole site. *Acacia pycnantha* was also planted around the private property driveway at SLK 2.49 and spreading from here. *Acacia pycnantha* is a priority environmental weed in the Shire of Esperance's Environmental Weed Strategy 2009-2018.

Several non-native species had been planted by neighboring landowners, these include Tagasaste (*Chamaecytisus palmensis*), Swamp Sheoak (*Casurina obesa*) and River Red Gum (*Eucalyptus camaldulensis*). However, these species did not appear to be naturalizing.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2022) data shows a positive *Phytophthora cinnamomi* (PC) sample approximately 1km from the north of the 'Site D - Farmers Road' project area. No dieback mapping has occurred on this road in the past however there are numerous other positive PC and one *P. indundata* samples within 10km of the site.

Despite the very close positive *P. cinnamomi* records on the Dieback Information Delivery and Management System, the Site D – Farmers Road area does not appear to be infested with *P. cinnamomi*. All *Xanthorrhoea platyphylla* and *Lambertia inermis* plants appear very healthy and these are frequently first species to show signs of dieback if present.

**Table 4.** Weeds present in Site D - Farmers Road (SLK 0-2.54)

Family	Genus	Species
Asparagaceae	<i>Asparagus</i>	<i>asparagoides</i>
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>
Asteraceae	<i>Cirsium</i>	<i>vulgare</i>
Asteraceae	<i>Cotula</i>	<i>coronopifolia</i>
Asteraceae	<i>Erigeron</i>	<i>bonariensis</i>
Asteraceae	<i>Hypochaeris</i>	<i>radicata</i>
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>
Asteraceae	<i>Ursinia</i>	<i>anthemoides</i>
Brassicaceae	<i>Raphanus</i>	<i>raphanistrum</i>
Campanulaceae	<i>Monopsis</i>	<i>debilis</i>

Campanulaceae	<i>Wahlenbergia</i>	<i>capensis</i>
Caryophyllaceae	<i>Petrorhagia</i>	<i>dubia</i>
Caryophyllaceae	<i>Polycarpon</i>	<i>tetraphyllum</i>
Casuarinaceae	<i>Casuarina</i>	<i>obesa</i>
Fabaceae	<i>Acacia</i>	<i>pycnantha</i>
Fabaceae	<i>Chamaecytisus</i>	<i>palmensis</i>
Fabaceae	<i>Ornithopus</i>	<i>compressus</i>
Iridaceae	<i>Romulea</i>	<i>rosea</i>
Juncaceae	<i>Juncus</i>	<i>bufonius</i>
Lythraceae	<i>Lythrum</i>	<i>hyssopifolia</i>
Malvaceae	<i>Malva</i>	<i>parviflora</i>
Myrtaceae	<i>Eucalyptus</i>	<i>camaldulensis</i>
Myrtaceae	<i>Leptospermum</i>	<i>laevigatum</i>
Onagraceae	<i>Oenothera</i>	<i>stricta</i>
Orobanchaceae	<i>Orobanche</i>	<i>minor</i>
Poaceae	<i>Briza</i>	<i>maxima</i>
Poaceae	<i>Briza</i>	<i>minor</i>
Poaceae	<i>Ehrharta</i>	<i>calycina</i>
Poaceae	<i>Eragrostis</i>	<i>curvula</i>
Poaceae	<i>Lolium</i>	<i>sp.</i>
Poaceae	<i>Vulpia</i>	<i>sp.</i>
Primulaceae	<i>Lysimachia</i>	<i>arvensis</i>
Solanaceae	<i>Solanum</i>	<i>nigricans</i>

## Site E – Fuss Road SLK 0- 4.2

Significant invasion of the site by agricultural weeds had occurred, with historically cleared areas being heavily invaded by agricultural weeds, a majority of the weed species present were herbaceous, only 3 woody weed species were present within the road reserve. Overall, 30 invasive species were identified within the project area (Appendix 1).

Of these, the most extensive and of serious concern were *Gaudium laevigatum*. This species was present along most of the project area, and well established at this site. Also, of concern was *Acacia baileyana* an invasive eastern state acacia which 4 large plants were present at SLK 3.72. Both are priority environmental weeds in the Shire of Esperance's Environmental Weed Strategy 2009-2018.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2022) data shows positive *Phytophthora multivora* samples 1km from the project area on South Coast Highway and positive *Phytophthora cinnamomi* samples 4.5km from the project area on Farmers Road. There were large sections of the road reserve with high proportions of proteaceous species that were healthy and appeared unaffected by *Phytophthora* dieback. Due to the high proportion of proteaceous, myrtaceous and ericaceous species within Fuss Road the vegetation is highly vulnerable

to *Phytophthora* infection.

**Table 5.** Weeds present in Site E – Fuss Road SLK 0- 4.2

Family	Genus	Species	Herbarium Reference
Asparagaceae	<i>Asparagus</i>	<i>asparagoides</i>	
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	
Asteraceae	<i>Carduus</i>	<i>pycnocephalus</i>	
Asteraceae	<i>Cotula</i>	<i>coronopifolia</i>	
Asteraceae	<i>Cotula</i>	<i>turbinata</i>	
Asteraceae	<i>Osteospermum</i>	<i>ecklonis</i>	
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>	
Asteraceae	<i>Ursinia</i>	<i>anthemoides</i>	
Asteraceae	<i>Vellereophyton</i>	<i>dealbatum</i>	
Brassicaceae	<i>Rapistrum</i>	<i>rugosum</i>	
Campanulaceae	<i>Monopsis</i>	<i>debilis</i> var. <i>Depressa</i>	
Campanulaceae	<i>Petrorhagia</i>	<i>dubia</i>	
Campanulaceae	<i>Wahlenbergia</i>	<i>capensis</i>	
Caryophyllaceae	<i>Spergularia</i>	<i>diandra</i>	
Crassulaceae	<i>Crassula</i>	<i>natans</i>	
Fabaceae	<i>Acacia</i>	<i>baileyana</i>	KSW15222 Acc 9783
Fabaceae	<i>Ornithopus</i>	<i>compressus</i>	
Fabaceae	<i>Ornithopus</i>	<i>sativus</i>	
Iridaceae	<i>Moraea</i>	<i>flaccida</i>	
Juncaceae	<i>Juncus</i>	<i>articulatus</i>	
Myrtaceae	<i>Leptospermum</i>	<i>laevigatum</i>	
Onagraceae	<i>Oenothera</i>	<i>stricta</i>	
Orobanchaceae	<i>Orobanche</i>	<i>minor</i>	
Pinaceae	<i>Pinus</i>	<i>pinaster</i>	
Poaceae	<i>Ehrharta</i>	<i>calycina</i>	
Poaceae	<i>Vulpia</i>	<i>myuros</i>	
Polygonaceae	<i>Rumex</i>	<i>acetosella</i>	
Polygonaceae	<i>Rumex</i>	<i>crispus</i>	
Primulaceae	<i>Lysimachia</i>	<i>arvensis</i>	
Solanaceae	<i>Solanum</i>	<i>nigricans</i>	

### Site F – Ridgeland Road, SLK 0-5.69

There was significant weed invasion along large sections of the site, with large proportions of herbaceous weeds such as *Ornithopus compressus*, *Disa bractea*, *Rumex vesicarius*. Overall, 33 invasive species were identified within the project area (Appendix 8.1). Of these, the most extensive



and of serious concern was *Gaudium laevigatum*, which was present throughout a majority of the site. This is a priority environmental weed in the Shire of Esperance's Environmental Weed Strategy 2009-2018. *Eucalyptus cladocalyx* was present at the site, this species had been planted as a windbreak and had spread into nearby bushland.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2022) data shows no *Phytophthora cinnamomi* or other *Phytophthora* sp. sampling in the immediate area, with the closest positive *P. cinnamomi* sample on Fisheries road 5.2km east of the site.

Some vegetation within the site is highly susceptible to the disease having a high proportion of proteaceous species present. The project area contained a series of minor hills and valleys, the local hydrology and topography will accelerate the spread of dieback if introduced. Whilst no qualified dieback interpreters visited the site, it was noted that SLK 0-0.82 contained mixed heath which would typically have been expected to have numerous proteaceous species, however proteaceous species were conspicuously absent from this section of road reserve and were present from SLK 0.82 onwards. SLK 0-0.82 was along a moderate decline with the possibility that dieback may have been spread downhill by water runoff after an initial introductory event.

**Table 6.** Weeds present in Site F – Ridgeland Road, SLK 0-5.69

Family	Genus	Species	Herbarium Reference
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	
Asteraceae	<i>Carduus</i>	<i>pycnocephalus</i>	
Asteraceae	<i>Erigeron</i>	<i>bonariensis</i>	
Asteraceae	<i>Pseudognaphalium</i>	<i>luteoalbum</i>	
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>	
Asteraceae	<i>Ursina</i>	<i>anthemoides</i>	
Asteraceae	<i>Vellereophyton</i>	<i>dealbatum</i>	
Brassicaceae	<i>Rapistrum</i>	<i>raphanistrum</i>	
Campanulaceae	<i>Wahlenbergia</i>	<i>capensis</i>	
Cyperaceae	<i>Cyperus</i>	<i>congestus</i>	
Cyperaceae	<i>Cyperus</i>	<i>tenellus</i>	
Fabaceae	<i>Medicago</i>	<i>polymorpha</i>	
Fabaceae	<i>Ornithopus</i>	<i>compressus</i>	
Fabaceae	<i>Ornithopus</i>	<i>pinnatus</i>	
Fabaceae	<i>Ornithopus</i>	<i>sativus</i>	
Geraniaceae	<i>Erodium</i>	<i>cicutarium</i>	
Juncaceae	<i>Juncus</i>	<i>capitatus</i>	
Juncaceae	<i>Juncus</i>	<i>microcephalus</i>	
Lythraceae	<i>Lythrum</i>	<i>hyssopifolia</i>	
Myrtaceae	<i>Eucalyptus</i>	<i>cladocalyx</i>	KSW22322 ACC10048
Myrtaceae	<i>Leptospermum</i>	<i>laevigatum</i>	
Orchidaceae	<i>Disa</i>	<i>bracteata</i>	
Pinaceae	<i>Pinus</i>	<i>pinaster</i>	
Poaceae	<i>Briza</i>	<i>maxima</i>	

Poaceae	<i>Briza</i>	<i>minor</i>	
Poaceae	<i>Dactylis</i>	<i>glomerata</i>	
Poaceae	<i>Ehrharta</i>	<i>calycina</i>	
Poaceae	<i>Eragrostis</i>	<i>curvula</i>	
Poaceae	<i>Lagurus</i>	<i>ovatus</i>	
Poaceae	<i>Lolium</i>	<i>sp.</i>	
Poaceae	<i>Vulpia</i>	<i>myuros forma myuros</i>	
Polygonaceae	<i>Rumex</i>	<i>vesicarius</i>	
Primulaceae	<i>Lysimachia</i>	<i>arvensis</i>	
Solanaceae	<i>Solanum</i>	<i>nigricans</i>	

### Site G – Heywood Road, 0 – 6 SLK

There was some weed invasion across the entirety of the proposed 'Site G – Heywood road - SLK 0 - 6' area. Overall, 24 invasive species were identified within the project area (Appendix 1). These were mostly agricultural grass weeds.

A single *Acacia pycnantha* plant was found at the driveway at SLK 2.69. This was removed on 15/11/2022. This is a priority environmental weed in the Shire of Esperance's Environmental Weed Strategy 2009-2018. The site will be monitored for new seedlings.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2022) data shows no positive or negative *Phytophthora cinnamomi* or other *Phytophthora* sp. Dieback sample results in the immediate area. No visual signs of dieback were observed during field work. There were a large number of susceptible species within the project area, none of which were showing signs of disease.

**Table 7.** Weeds present in Site G – Heywood Road, 0 – 6 SLK

Family	Genus	Species
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>
Asteraceae	<i>Dittrichia</i>	<i>graveolens</i>
Asteraceae	<i>Hypochaeris</i>	<i>radicata</i>
Asteraceae	<i>Pseudognaphalium</i>	<i>luteoalbum</i>
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>
Boraginaceae	<i>Echium</i>	<i>plantagineum</i>
Brassicaceae	<i>Lepidium</i>	<i>africanum</i>
Brassicaceae	<i>Raphanistrum</i>	<i>raphanistrum</i>
Campanulaceae	<i>Monopsis</i>	<i>debilis var. depressa</i>
Caryophyllaceae	<i>Petrorhagia</i>	<i>dubia</i>
Caryophyllaceae	<i>Polycarpon</i>	<i>tetraphyllum</i>
Crassulaceae	<i>Crassula</i>	<i>natans</i>

Fabaceae	<i>Acacia</i>	<i>pycnantha</i>
Geraniaceae	<i>Erodium</i>	<i>cicutarium</i>
Juncaceae	<i>Juncus</i>	<i>microcephalus</i>
Lythraceae	<i>Lythrum</i>	<i>hyssopifolia</i>
Malvaceae	<i>Malva</i>	<i>parvifolia</i>
Orchidaceae	<i>Disa</i>	<i>bracteata</i>
Poaceae	<i>Avena</i>	<i>barbata</i>
Poaceae	<i>Briza</i>	<i>maxima</i>
Poaceae	<i>Cynodon</i>	<i>dactylon</i>
Poaceae	<i>Eragrostis</i>	<i>curvula</i>
Poaceae	<i>Lolium</i>	sp.
Poaceae	<i>Pentameris</i>	<i>airoides</i>

### Site H – Boydell Road, SLK 0 - 11.83

There was significant weed invasion across the entirety of the proposed 'Site H – Boydell Road, SLK 0 - 11.83' area. Overall, 51 invasive species were identified within the project area (Appendix 8.1). Of these, the most extensive and of serious concern were *Acacia pycnantha* and *Godium laevigatum*, both weeds are priority environmental weeds in the Shire of Esperance's Environmental Weed Strategy 2009-2018. Ideally, regular wash downs during the course of works to remove weed seeds or follow up herbicide control of invasive species needs to occur.

Dieback Information Delivery and Management System (DIDMS; GAIA Resources, SCNRM & State NRM 2022) data shows no *Phytophthora cinnamomi* or other *Phytophthora* sp. Dieback sampling in the immediate area. No signs of dieback presence were obvious within the project area, proteaceous species were present though not in high quantities, the proteaceous plant within the project area were healthy.

**Table 8.** Weeds present in Site H – Boydell Road, SLK 0 - 11.83

Family	Genus	Species
Asparagaceae	<i>Asparagus</i>	<i>asparagoides</i>
Asphodelaceae	<i>Asphodelus</i>	<i>fistulosus</i>
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>
Asteraceae	<i>Centaurea</i>	<i>melitensis</i>
Asteraceae	<i>Cirsium</i>	<i>vulgare</i>
Asteraceae	<i>Cotula</i>	<i>coronopifolia</i>
Asteraceae	<i>Erigeron</i>	<i>bonariensis</i>
Asteraceae	<i>Hypochaeris</i>	<i>radicata</i>
Asteraceae	<i>Osteospermum</i>	<i>ecklonis</i>
Asteraceae	<i>Pseudognaphalium</i>	<i>luteoalbum</i>
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>
Asteraceae	<i>Ursinia</i>	<i>anthemoides</i>
Brassicaceae	<i>Lepidium</i>	<i>africanum</i>
Brassicaceae	<i>Raphanus</i>	<i>raphanistrum</i>

Brassicaceae	<i>Rapistrum</i>	<i>rugosum</i>
Campanulaceae	<i>Monopsis</i>	<i>debilis var depressa</i>
Campanulaceae	<i>Wahlenbergia</i>	<i>capensis</i>
Casuarinaceae	<i>Casuarina</i>	<i>obesa</i>
Fabaceae	<i>Acacia</i>	<i>pycnantha</i>
Fabaceae	<i>Chamaecytisus</i>	<i>palmensis</i>
Fabaceae	<i>Medicago</i>	<i>polymorpha</i>
Fabaceae	<i>Ornithopus</i>	<i>compressus</i>
Fabaceae	<i>Ornithopus</i>	<i>sativus</i>
Fabaceae	<i>Trifolium</i>	<i>arvense</i>
Fabaceae	<i>Trifolium</i>	<i>hirtum</i>
Fabaceae	<i>Trifolium</i>	<i>repens</i>
Fabaceae	<i>Vicia</i>	<i>benghalensis</i>
Geraniaceae	<i>Erodium</i>	<i>cicutarium</i>
Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>
Iridaceae	<i>Freesia</i>	<i>x alba</i>
Iridaceae	<i>Romulea</i>	<i>rosea</i>
Myrtaceae	<i>Eucalyptus</i>	<i>camaldulensis</i>
Myrtaceae	<i>Leptospermum</i>	<i>laevigatum</i>
Myrtaceae	<i>Melaleuca</i>	<i>armillaris</i>
Onagraceae	<i>Oenothera</i>	<i>stricta</i>
Orchidaceae	<i>Disa</i>	<i>bracteata</i>
Orobanchaceae	<i>Orobanche</i>	<i>minor</i>
Poaceae	<i>Avena</i>	<i>barbata</i>
Poaceae	<i>Avena</i>	<i>sativa</i>
Poaceae	<i>Briza</i>	<i>maxima</i>
Poaceae	<i>Bromus</i>	<i>diandrus</i>
Poaceae	<i>Bromus</i>	<i>hordeaceus</i>
Poaceae	<i>Ehrharta</i>	<i>calycina</i>
Poaceae	<i>Ehrharta</i>	<i>longifolia</i>
Poaceae	<i>Eragrostis</i>	<i>curvula</i>
Poaceae	<i>Hordeum</i>	<i>sp.</i>
Poaceae	<i>Vulpia</i>	<i>sp.</i>
Polygonaceae	<i>Rumex</i>	<i>acetosella</i>
Primulaceae	<i>Lysimachia</i>	<i>arvensis</i>
Solanaceae	<i>Solanum</i>	<i>hoplopetalum</i>
Solanaceae	<i>Solanum</i>	<i>nigricans</i>