Peninsula Link

Threatened Species Management Plan Peninsula Link Project

December 2010

LINKING MELBOURNE AUTHORITY

State Government Victoria

Contents

TABLES

1. Introduction

In 2008 an Environmental Effects Statement (EES) was developed for the construction of the Peninsula Link freeway (formerly known as the Frankston Bypass) from Carrum Downs to Mount Martha, Victoria (SEITA 2008). Several technical reports were prepared for the EES, including the *Flora and fauna assessment of the proposed Frankston Bypass, Carrum to Mount Martha, Victoria*, conducted by Biosis Research (Venosta *et al* 2008).

Subsequent to the EES a conditional approval was granted, under the *Environment Protection and Biodiversity Conservation (Cwth) Act 1999* (EPBC Act), for the construction of the freeway (EPBC Act Approval 2007/3480). The approval was granted subject to several conditions, including the development of a Threatened Species Management Plan (TSMP) aimed at the protection and recovery of selected threatened flora and fauna taxa.

This report addresses this condition and outlines threatened species management requirements. The determination of targeted species, the location of suitable habitat for said species, and the location of known and likely populations is largely based on the data and findings of the Biosis Research report (Venosta *et al* 2008) and the EES. Additional expert opinion has also been sought for specific flora and fauna taxa in order to provide a comprehensive management plan for the targeted species. Data sources also include previous TSMP's for the target species where these are available, along with personal communications and documents provided by the Department of Sustainability and Environment (DSE) and the Royal Botanic Gardens.

Much of the Peninsula Link alignment has been cleared for agricultural use or urban development; and little remains of remnant vegetation or habitat. The Pines Flora and Fauna Reserve, and the adjacent orchard area, is the exception, offering 220 hectares of habitat for a range of Federal and State level threatened flora and fauna. The bulk of threatened species identified during the EES process were found in the Reserve. The Pines Flora and Fauna Reserve is a Biosite of State significance.

It will therefore be a requirement of the successful Project Company awarded the construction of the Peninsula Link development to incorporate the threatened species management requirements developed in this report into their Environmental Management Strategy (EMS) and site or activity specific Environmental Management Plans (EMPs) for the project. Once awarded the contract the successful Project Company will be responsible for works within the construction area.

The construction area and the freeway reservation (lease area) are not in some cases the same boundary line. The works will be designed and operated by the Project Company with a maintenance period of 25 years. The maintenance period applies to the freeway reservation. The custody of works outside of the freeway reservation (area between the construction area and freeway reservation), when completed will be transferred as Returned Works to the relevant management authorities; such as DSE, Parks Victoria, Melbourne Water, VicRoads and the City of Frankston.

It should also be noted that only one of the EPBC Act listed flora species covered under this TSMP was recorded throughout EES survey efforts undertaken for the flora and fauna assessment conducted by Biosis Research (Venosta *et al.* 2008); namely River Swamp Wallaby-grass *Amphibromus fluitans*. This significant species has been identified at a wetland site within the Pines Flora and Fauna Reserve. Further targeted surveys are currently underway at sites identified in the flora and fauna assessment (Venosta *et al* 2008). The results of the targeted surveys will be made available as an addendum to this report by February 2010 (subject to seasonal influences) for incorporation into the Project Company's environmental management plans.

1.1 Project area

The proposed Peninsula Link encompasses approximately 25 kilometres of freeway standard road between Carrum Downs and Mount Martha, approximately 45 kilometres east of Melbourne.

This report has identified areas within the construction area to be to be covered by targeted surveys. Search timeframes are based on those most suited to individual threatened species, as identified by Venosta *et al.* (2008) and in conjunction with other expert advice.

The site lies within the Gippsland Plain Bioregion and the Bunyip River Basin (Department of Primary Industries, Victorian Resources (available online at http://www.dpi.vic.gov.au).

1.2 Objectives

This report aims to address the requirements of condition four of the EPBC Approval (EPBC 2007/3480) and targets the threatened flora and fauna listed therein. This report will also address additional threatened species listed under the Flora and Fauna Guarantee (Vic) Act 1988 (FFG Act) that were identified as having potential to be found within the development corridor. The EPBC Approval (EPBC 2007/3480) requirements are as follows:

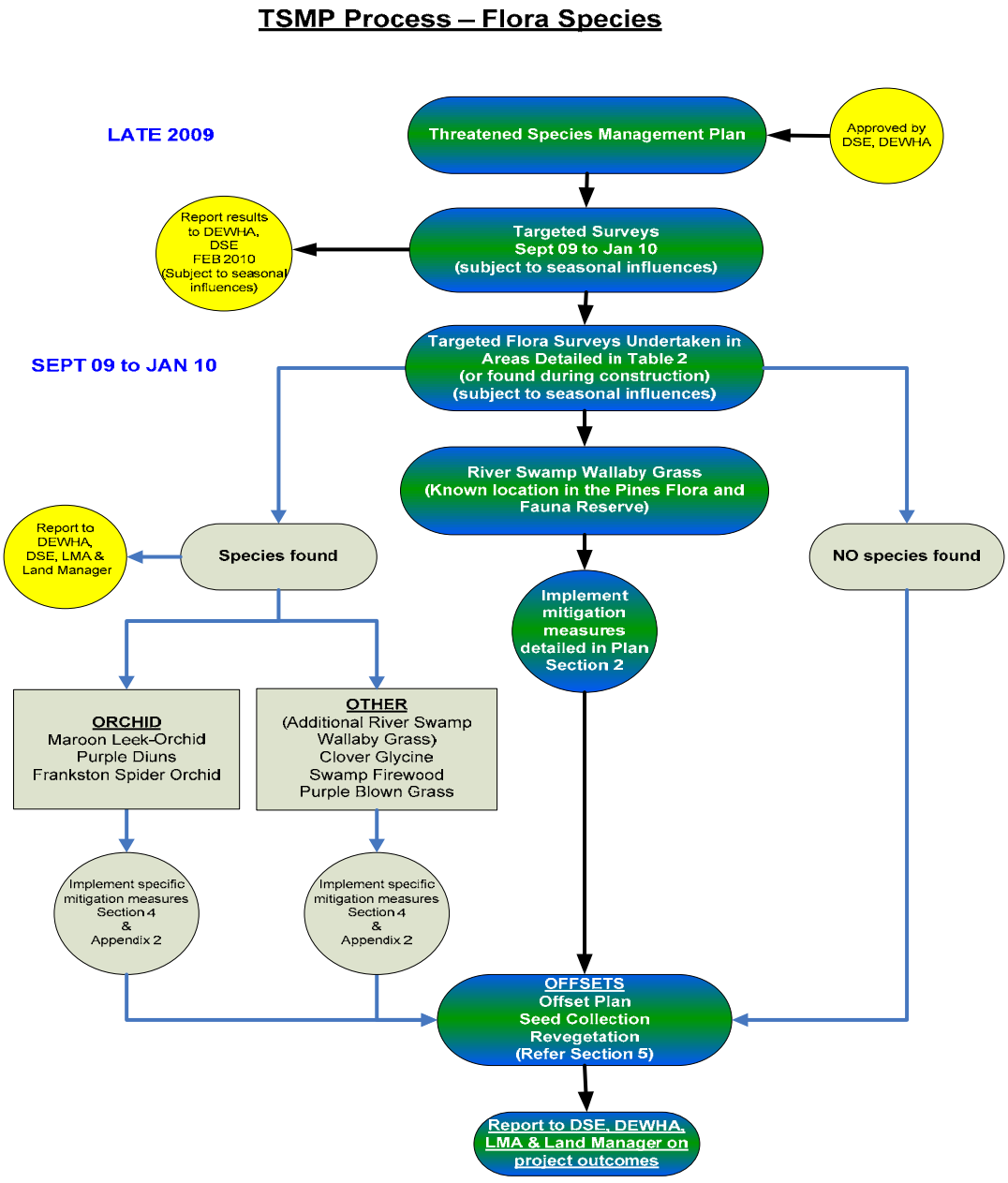
- Conduct pre-construction surveys for targeted threatened flora within patches of suitable habitat within the construction footprint of the proposed development (excluding the Pines Flora and Fauna Reserve);

- Identify, and commit to, measures that avoid and mitigate impacts on any populations of threatened flora species found during the targeted surveys;
- Where impacts on threatened species are identified and cannot be avoided or mitigated, identify, and commit to, appropriate offsets; and
- Develop measures to mitigate and enhance habitat for the Dwarf Galaxias.

Removal of suitable habitat for threatened species may not commence until the TSMP has been approved by the DEWHA.

1.3 Threatened Flora Species Management Plan Process

The following flow chart outlines the process for implementation of the Threatened Species Management Plan for threatened flora species within the Peninsula Link project area.



Pre-construction targeted surveys of threatened flora within suitable habitat within the construction area will be undertaken between September 2009 to January 2010 (subject to seasonal influences). This is discussed further in Section 1.5 of this report.

As noted above, only one EPBC listed threatened species was recorded during the EES flora survey, River Swamp Wallaby-grass, which was found within a wetland at the Pines Flora and Fauna Reserve (Venosta *et al* 2008). A specific species management plan has been written for this population; see Section 2 of this report for details.

In the event that additional threatened flora species are identified during the pre-construction target surveys, specific species management plans have been prepared and will be implemented. Refer to Appendix 2 for details on species and Section 4 for general management requirements.

Regardless of the outcomes of the pre-construction targeted surveys, as part of the Peninsula Link project, extensive measures and offsets will be provided to adequately ameliorate for native vegetation losses due to the construction works. The details are provided in Section 5 of this report.

Section 6 of this report details the measures to mitigate and enhance habitat for the Dwarf Galaxias.

1.4 Recorded and potential Threatened Species

As noted above, only one EPBC listed threatened species was recorded during the EES flora survey, River Swamp Wallaby-grass, which was found within a wetland at the Pines Flora and Fauna Reserve (Venosta *et al.* 2008). A specific species management plan has been written for this population; see Section 2 for details.

In addition, two EPBC listed fauna species were identified during the EES survey: Southern Brown Bandicoot and Dwarf Galaxias *Galaxiella pusilla.*

The Southern Brown Bandicoot is being managed through a separate Southern Brown Bandicoot Management Plan.

The Dwarf Galaxias were found within Boggy Creek at the Pines Flora and Fauna Reserve and Tuerong Creek at the southern end of the alignment (Venosta *et al*. 2008). The Boggy Creek record consisted of a single individual which is likely to be a vagrant representation of a larger upstream population (Venosta *et al*. 2008)(which is outside the Peninsula Link Project Area). The Tuerong Creek population (approximately 900 individuals) is considered within this Threatened Species Management Plan; see Section 6 for details. Table 1 details the species to be covered by this TSMP. It should be noted that, along with the EPBC listed species as set out in the EPBC approval, two FFG listed species are also included. These include Purple Blown Grass *Lachnagrostis punicea* subsp. *filifolia*, and Purple Diuris *Diuris punctata* var. *punctata*. The Frankston Spider Orchid *Caladenia robinsonii* has also been included. Maps detailing the locations for the targeted search areas are shown in Appendix 1.

Table 1. Target Species

Conservation Status			Common Name	Scientific Name	Habitat	Ideal Survey Period (flowering time)
FFG	EPBC	State				
FLORA						
	VU		River Swamp Wallaby-grass	*Amphibromus fluitans*	Swampy areas in grassy ope forest and riparian scrub.	Nov-Mar
L	VU	VU	Clover Glycine	*Glycine latrobeana*	Grasslands and Grassy Woodlands.	Sep-Dec
L	EN	EN	Maroon (Slaty) Leek-orchid	*Prasophyllum frenchii*	Grassland, heathland and grassy woodland.	Oct-Dec
	VU	VU	Swamp Fireweed	*Senecio psilocarpus*	High quality herb-rich wetlands and swamps prone to inundation on volcanic clays or peaty soils.	Nov-Mar
L		R	Purple Blown Grass	*Lachnagrostis punicea* subsp. *filifolia*	Lowland grassy wetlands and damp plains grasslands.	Sep-Dec
L		VU	Purple Diuris	*Diuris punctata* var. *punctata*	Grassland, grassy woodland, and less commonly in open forest.	Oct-Nov
L	EN	EN	Frankston Spider Orchid	*Caladenia robinsonii*	Heathy Woodland, damp Sands Herb-rich Woodland and possibly Grassy Woodland remnants (see species management plan).	Sep-Oct
FAUNA						
L	VU	VU	Dwarf Galaxias	*Galaxiella pusilla*	Ephemeral and permanent habitats. Aquatic margin vegetation in still or gently flowing water of roadside ditches, swamps and creek backwaters. Fish occupying ephemeral water possibly aestivate or shelter in crayfish burrows when surface water evaporates. Eggs are deposited in batches amongst flooded vegetation over a period of a few weeks. See Section 5 for details.	Year round

Conservation Status Codes (EPBC and FFG Acts):

EN – Endangered under the National EPBC Act *(very high risk of extinction in the wild)*

VU – Vulnerable under the National EPBC Act *(high risk of extinction in the wild)*

L - Listed as threatened under the Flora and Fauna Guarantee Act

Victorian Conservation Status Codes (DSE):

EN - Endangered *(at risk of becoming extinct)*;

VU - Vulnerable *(at risk of becoming endangered)*;

R -Rare *(rare but not considered otherwise threatened)*;

K -poorly known *(accurate distribution information is inadequate to allocate to one of the conservation status categories)*;

Source: FIS – Flora Information System; PMST – EPBC Act Protected Matters Search Tool

1.5 Targeted pre-construction surveys

In accordance with condition four (first dot point) of the EPBC Approval, pre-construction surveys for threatened flora species within patches of suitable habitat within the construction area will be undertaken from September 2009 to January 2010 (subject to seasonal influences).

Table 2 below provides background habitat requirements for the targeted species and identifies the potential locations of patches of suitable habitat (as based on the Biosis Research recommendations (Venosta *et al.* 2008)). Maps (Venosta *et al.* 2008) detailing likely sites of suitable habitat for threatened flora species within the Peninsula Link project area are also available in Appendix 1.

A report detailing the findings of the targeted pre-construction surveys (currently underway) is also scheduled for completion by February 2010. Please note however that the completion of this report may be subject to seasonal variance and weather conditions which may affect the flowering season thereby leading to reporting delays. The results of the threatened species targeted surveys will be forwarded to DEWHA and DSE in February 2010 (unless seasonal variance delays report).

Table 2. Species background and search areas for Targeted Flora Surveys

Species	Search areas based on Biosis recommendations
River Swamp Wallaby-grass *Amphibromus fluitans*	
River Swamp Wallaby-grass *Amphibromus fluitans* is a member of the Poaceae family. It is a slender aquatic or semi aquatic perennial with flowering stems that may be longer than 1m, but with half the stem submerged in the water. The individual florets have slender curved bristle and are aggregated into 5–12 flowered spikelets. Flowering and fruiting occurs mainly between November and March (Walsh 1994).	**Photo by Viridians Biological Databases**
Occurring in NSW, Victoria, South Australia and Tasmania, it inhabits both natural and man-made water bodies including swamps, lagoons, billabongs and dams (DSE 2008a).	Venosta *et al.* (2008) recorded a well established population of River Swamp Wallaby-grass as growing at eight locations around the constructed wetland within the Pines Flora and Fauna Reserve (Venosta *et al*. 2008).
Threats include Pastoral development; many suitable habitats are grazed and trampled by stock and the plants are generally very palatable to stock. Changing water regimes such as the directing of water from nearby farmlands into wetlands has resulted in a reduction in the period in which the shores are exposed and a raising of the fertility of the water, producing in turn more vigorous growth of competitive adventive grasses and invasion of remnant habitats by exotic grasses and weeds (DECC 2005, ANRA 2009).	Additional suitable habitat within Plains Grassy Wetland and Aquatic Herbland EVC's were found during field surveys. Page 125 of Venosta *et al.* 2008 recommends targeted searches for this species in the ideal survey period which is November to March, excluding the Pines Flora and Fauna Reserve where extensive survey has already been undertaken.
River Swamp Wallaby-grass is listed as Vulnerable under the Environment Protection and Biodiversity Conservation Act 1999.	Specific areas for targeted searches identified by Venosta *et al.* 2008 as Patches 1a-f, 1j, 2 and 3 which comprise Grassy Wetland Complex and Patches 34 and 47b which are Aquatic Herbland (Venosta *et al.* 2008). See Figures 2a & 2h Appendix 1.
	Targeted searches following the recommendations of Venosta *et al.* 2008 are organised to occur in ideal survey period (November to March 2009). Management protocols will be implemented for the recorded population including any individuals of this species identified during these surveys within the construction footprint. See Appendix 2 for details.

Species	Search areas based on Biosis recommendations
Clover Glycine *Glycine latrobeana*	
Clover Glycine *Glycine latrobeana* is a small perennial herb from the pea family with mauve and purple flowers, which grows up to 10cm. It is found in native grasslands and grassy woodlands (DSE 2005) and less often in dry forests, distribution is widespread but sporadic (DPI 2007). Its Underlying geology is usually sedimentary; however records have shown that it can occur on granitic or basalt soils (DPI 2007). Known populations are in North-east Victoria, Gippsland, Central-Victoria, Western-Victoria and Melbourne and surrounding areas (DSE 2005). It reproduces from seed and is also rhizomatous (DSE 2005), flowering September to December. (Venosta et al. 2008)	**Photo by Viridians Biological Databases**
It is possible that Clover Glycine was rare before European changes to landscape occurred (DSE 2005) but has contracted greatly since European settlement due to heavy grazing and cultivation of habitat (DPI 2007). Major threatening processes include grazing pressure from both introduced herbivores and native animals and habitat loss and fragmentation due to destruction of habitat for urban growth (DSE 2005).	Clover Glycine was not recorded during field assessments for the Frankston Bypass, nor has it been previously recorded within a 5km radius on FIS (Venosta et al. 2008). However, the DEWHA database lists this species as having potential to occur or potential habitat within 5km of the bypass footprint (Venosta et al. 2008).
Propagation levels for this species from seed have been shown to be high by The Royal Botanic Gardens with 100% germination success (Pers. comm. Dermot Molloy). Seed collected can be propagated in a local nursery for planting in the following winter/spring to take advantage of higher moisture levels in the soil. Many Fabaceae species require longer propagation times; however Clover Glycine has a vigorous growth although it has a tap root which requires plant removal from trays early into tubes; seedlings should be ready for winter/spring planting in the same year (Pers. Comm. Dermot Molloy).	Page 127 of Venosta et al. 2008 recommends targeted searches for this species in the ideal survey period which is September to December, excluding the Pines Flora and Fauna Reserve where extensive survey has already been undertaken. Specific areas for targeted searches have been identified by Venosta et al. 2008 as Patch 46a and Patch 45 which comprise good quality Grassy Woodland (Venosta et al. 2008). See Figure 2h Appendix 1.
It is listed as Vulnerable under the Flora and Fauna Guarantee Act 1988 and listed as Vulnerable under the Environmental Protection Biodiversity Conservation Act -1988 (Venosta et al. 2008). It is also listed as vulnerable under the Advisory List of Rare or Threatened Plants in Victoria (DSE 2005).	Targeted searches following the recommendations of Venosta *et al*. 2008 are currently underway (September to December 2009). Management protocols will be implemented for any individuals of populations of this species recorded during these surveys within the construction footprint. See Appendix 2 for details.

Species	Search areas based on Biosis recommendations
Swamp Fireweed *Senecio psilocarpus* Also known as Smooth-fruited Groundsel, Swamp Fireweed *Senecio psilocarpus* is an erect, native, rhizomatous perennial herb. Leaves are alternate, simple, glabrous (hairless) or occasionally sparsely covered with rough hairs along the margin. Flowering occurs between November and March (Belcher & Albrecht, 1994). The more easterly populations grow in grey to black silty clay soils whereas the westerly populations grow on peatier soils (Belcher & Albrecht, 1994). Suitable habitat is present in the study area for Swamp Fireweed however it was not recorded during field surveys; some species have limited flowering periods and may be detected during targeted surveys (Venosta et al. 2008). The threats to Swamp Fireweed are not entirely understood, but grazing pressure by both stock and introduced herbivores and weed invasion are considered to be the main threatening processes for this species. The main potential threats to Swamp Fireweed include trampling by domestic stock and kangaroos and changed hydrology leading to salinity (DSE 2008b). Swamp Fireweed is listed as Vulnerable under the Environment Protection and Biodiversity Conservation Act 1988	 **Photo by Viridians Biological Databases** Swamp Fireweed was not recorded during field assessments for the Frankston Bypass; its presence and significance in the Bypass footprint have been cited by Venosta et al. 2008as not known. However, the FIS database records this species in 2002 as occurring outside the proposed alignment near North Road (Venosta et al. 2008). Potential habitat within the bypass footprint has been identified on page 128 by Venosta et al. (2008) as occurring in patches 1a –f, 1j, 2 & 3 of Plains Grassy Wetland Complex. See Figure 2a & 2f Appendix 1. Venosta *et al.* (2008) recommends targeted searches for this species in the ideal survey period which is November to March, excluding the Pines Flora and Fauna Reserve where extensive survey has already been undertaken. Targeted searches following the recommendations of Venosta et al. 2008 are currently planned to be undertaken in November to March 2009/2010. Management protocols will be implemented for any individuals of populations of this species recorded during these surveys within the construction footprint. See Appendix 2 for details.

Species	Search areas based on Biosis recommendations
Purple Blown-grass *Lachnagrostis fluitans*	
Purple (or Bristle) Blown-grass *Lachnagrostis punicea* is a Tufted short-lived perennial grass to 65 cm tall with tightly folded leaves to 1 mm wide and to 25 cm long; ligule membranous, obtuse and 2-8 mm long (Curtis & Morris 1975). The stems are circular, smooth to rough, and densely enveloped in tiny rough hairs below the inflorescence. The Inflorescence is pinkish purple in colour. The plant can reproduce vegetatively and the information currently available suggests that disturbance is required for this to occur. This species flowers between December and January (Walsh & Entwhisle 1994). Distributed in Victoria, Queensland, NSW and Tasmania it requires seasonally wet soils. This species' Ecological Vegetation Class (EVC) in Victoria is Grassy wetland and is scattered in wet marshes and slightly saline swamps and depressions across the Victorian Volcanic Plain (Gray & Knight 2001). It has been previously recorded in the Herb-rich Plains Grassy Wetland Community at the far northern end of the proposed alignment area. These species could occur within similar/additional patches of Herb-rich Plains Grassy Wetland within the proposed alignment area (Venosta *et al*. 2008). Purple Blown-grass is listed as *Threatened* under the *Flora and Fauna Guarantee Act* 1988.	**Photo by AJ Brown DSE** This species was not recorded during flora survey by Venosta *et al*. (2008); however suitable habitat is present in patches 1, 2, & 3 which consist of Plains Grassy Wetland where 3 previous records exist for this species (See Page 9 of the summary and page 225 of Venosta et al. 2008). See Figures 2a & 2f Appendix 1. Targeted survey will be undertaken in 2009/2010 in the ideal survey period which is November to January. Management protocols will be implemented for any individuals of populations of this species recorded during these surveys within the construction footprint. See Appendix 2 for details.

Species	Search areas based on Biosis recommendations
Maroon Leek Orchid *Prasophyllum frenchii* The Maroon Leek-orchid *Prasophyllum frenchii* grows up to 60cm tall with up to 60 fragrant flowers arranged in an open spike varying from greenish to reddish tonings to almost entirely reddish (Jeanes & Backhouse 2006). Although poorly studied (Jones et al. 1999), it is suspected to be endemic to Victoria (Coates 2002, Jones *et al*. 1999), widespread but sporadic across southern Victoria, growing in grassland, heath and grassy woodland and mostly restricted to road and rail reserves (Jeanes & Backhouse 2006). Flowering occurs in October to November (Venosta *et al*. 2008). Up until the late 1970s some sites were managed by frequent fire but are now generally degraded. Soils are sandy, or black clay loams, generally damp but well drained although some sites are seasonally waterlogged (Coates 2002). Critical habitat has not been determined but likely to require open conditions to promote flowering and recruitment, and adequate soil moisture (Jeanes & Backhouse 2006). Habitat suitable for the Maroon Leek-orchid is present in some good quality remnants of the Grassy Woodland ecological vegetation class (EVC) at the study area. Threats include weed invasion, grazing both introduced and native herbivores, inappropriate fire regimes, irregular fire regimes and site disturbance (Coates 2002). The Maroon Leek-orchid has been listed as *Endangered* under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (Coates 2002).	 **Photo by Viridians Biological Databases** This species was not recorded during flora survey by Venosta *et al*. (2008); however suitable habitat is present in patches 45 and 46 consisting of Grassy Woodland, patches 6 and 6a consisting of Sand Heathland. and patch 32h consisting of Heathy Woodland. There are no FIS records within 5km of the Bypass footprint however the DEWHA database lists suitable habitat as occurring within the proposed alignment (Venosta et al. 2008). See Figures 2b,2f & 2h Appendix 1 (See page 119 of Venosta *et al*. 2008). Targeted survey will be undertaken in 2009 in the ideal survey period which is October to December. The management protocols in consultation with DEWHA and DSE will be implemented for any individuals or populations of this species recorded during these surveys within the construction footprint. See Appendix 2 for details.

Species	Search areas based on Biosis recommendations
Purple Diuris *Diuris punctata*	
Purple Diuris or Purple Donkey-orchid's *Diuris punctata* flowers are mauve to purple (occasionally blotched) with yellow on the base of the labellum mid-lobe. A deciduous, geophytic herb (in summer it is a dormant underground tuber - Earl & Barlow 2004) it can grow up to 50cm in height (Backhouse & Jeanes 1995). It is distributed widely across lowland areas of Victoria principally in lowland native grasslands, grassy woodlands, heathy woodlands and open heathlands (Earl & Barlow 2004) and less commonly in open forest (Backhouse & Jeanes 1995). It is usually found on fertile loamy soils and periodically inundated areas (Earl & Barlow 2004).	**Photo by Viridians Biological Databases**
Purple Diuris flowers in October and November (Backhouse & Jeanes 1995).Reproduction is vegetative from tuberoids, or from seed and in the wild pollinated by insects. Insect pollination has a variable success rate. Large populations may only have less than a 5% success rate. To further complicate its reproductive success, germination can only occur with the right fungal concentrations and the right fungus. The timing of burns may influence the immediate response of Public Diuris plants after seed has matured (Earl & Barlow 2004). Fifty thousand plants survive in Victoria, 67 populations in 9 bioregions according to information provided in 1999-2000.Once abundant but greatly reduced due to habitat loss it is now highly threatened (Backhouse and Jeanes 1995). Key threats are competition for resources; weed and other native plants including grasses, shrubs or trees, accumulated biomass due to unfavourable fire regimes, grazing by native and introduced herbivores, soil disturbance associated with road/rail maintenance or agricultural practices, recreational damage and illegal collection of plants(Earl & Barlow 2004).	Purple Diuris was not recorded within the proposed alignment during flora survey by Venosta et al. (2008); however there are multiple records for this species listed on FIS within 5km of the proposed alignment and in the Gippsland Plains Bioregion in general (Venosta et al. 2008). Suitable habitat is present in patches 45, 46, 70 and 71 consisting of Grassy Woodland and patches consisting Plains Grassy Woodland (Venosta et al. 2008).See Figures 2h & 7j Appendix 2 (See page 133 of Venosta et al. 2008). Targeted survey will be undertaken in 2009 in the ideal survey period which is October and November.
Venosta et al. (2008) suggest that Purple Diuris is Likely to occur within good quality patches of grassy woodland in the bypass footprint.	The management protocols sections in this report and consultation with DEWHA and DSE will be implemented for any individuals or populations of this species recorded during these surveys within the construction footprint. See Appendix 2 for details.
Purple Diuris is listed as Vulnerable on the Flora and Fauna Guarantee Act 1988 and considered Vulnerable on the Advisory List of Rare or Threatened Vascular Plants in Victoria 2003.	

Species	Search areas based on Biosis recommendations
Frankston Spider-Orchid *Caladenia Robinsonii*	
The Frankston Spider-orchid *Caladenia robinsonii* G.W. Carr is a terrestrial orchid. A slender, hairy, green to reddish flower stem emerges from the base of the leaf and grows to 35 cm tall, bearing a single (occasionally two) creamy yellow flower with variable reddish stripes and suffusions on the sepals and petal. It Flowers in September and October (Jeanes and Backhouse 2006).	**Photo by Viridians Biological Databases**
Flowering occurs from mid September to late October, and flowers may remain open for up to four weeks. No more than 30% of mature plants flower in any given year and by November the leaf has shrivelled. If pollination of the flower has occurred, the seed capsule matures in 25 to 35 days, and several thousand seeds per plant are shed soon after maturation. During summer and early autumn, the orchid is a dormant tuber. Reproduction is from seed, with vegetative propagation generally extremely rare in species of the genus *Caladenia*. Plants reach flowering size within three to five years (Backhouse *et al*., 1999).	This species was not recorded during flora survey by Venosta *et al.* (2008) during targeted searches within the Pines Flora and Fauna Reserve. Venosta *et al.* (2008) recommend no further searches are required for this species. However, DSE has strongly urged the inclusion of the Frankston Spider Orchid in this round of targeted searches. Venosta *et al.* (2008) list suitable habitat as Heathy Woodland and Damp Sands Herb-rich Woodland however DSE highlights detail of the rediscovery of the Frankston Spider Orchid in 1986 by Randall Robinson as being within 1.5km of the bypass alignment in Grassy Woodland. The full ecological habitat of this species may not be known. Pre 1750 mapping for the Frankston site lists the area as Heathy Woodland however there are many areas on the Mornington Peninsula where Heathy Woodland is interspersed with Grassy Woodland. Many previous searches have been sporadic in discrete areas of potential habitat which have taken place over the last decade during severe drought conditions. DSE cites good success for a population of new introductions in the 2008 season with good numbers re-emerging in 2009. Both of these factors suggest more recent rainfall patterns may be favouring the species, which indicate that we are entering a time when habitat searching is more likely to have positive outcomes.
The Frankston Spider-orchid grows in a complex relationship with a mycorrizal fungus. The fungus assimilates some nutrients for the orchid, but the degree of dependence upon the fungus is not known (Backhouse *et al*., 1999).	Taking note of the above LMA has agreed to include the Frankston Spider Orchid in the current targeted surveys. The management protocols in consultation with DEWHA and DSE will be implemented for any individuals or populations of this species recorded during these surveys within the construction footprint. See Appendix 2 for details.
Endemic to Victoria, it is one of the most threatened orchids in Australia; virtually all populations and almost all habitat have been lost to urban residential development. Only one surviving wild population, comprising probably fewer than 100 mature plants, is currently known, growing in a small conservation reserve near Rosebud, on the Mornington Peninsula, about 60 km south of Melbourne. The species is not established in cultivation. (Backhouse *et al*., 1999).	
The Frankston Spider-orchid is listed as Endangered *under the* Environment Protection and Biodiversity Conservation Act *1988 and listed as* Threatened *under the* Victorian Flora and Fauna Guarantee Act *1988*	

1.6 General Timings and Responsibilities

The following table outlines a time and schedule and the agencies responsible for the implementation of this Threatened Species Management Plan.

Table 3. General Timings and Responsibilities

Management Activity	Performance Criteria	Timing	Responsibility
Pre-construction targeted flora surveys.	Identification and mapping of habitat areas for targeted threatened species areas outside the Pines Flora and Fauna Reserve but in the construction area	September 2009 to January 2010	Linking Melbourne Authority
	Reporting of findings.	Report – January 2010	Linking Melbourne Authority
	Reporting of findings to DSE and DEWHA	February 2010	Linking Melbourne Authority
Environmental Management Strategy	Flora and Fauna Management Plan and Site or Activity Environmental Management Plan prepared prior to commencement of works.	Prior to on-site construction commencing – February 2010. To be implemented throughout construction phase and post-construction phase as required.	Project Company
	Site or activity Environmental Management Plan to incorporate recommendations outlined in Section 4 of this report if targeted surveys identify threatened species	Prior to on-site construction commencing – February 2010. To be implemented throughout construction phase and post-construction phase as required.	Project Company
Seed collection River Swamp Wallaby-grass within the Pines Flora and Fauna Reserve.	Located by Venosta *et al.* (2008) as per Section 2	February to March 2010	Project Company
Construction Environmental Management Plan – River Swamp Wallaby-grass the Pines Flora and Fauna Reserve.	As per section 2	Prior to and during construction in the wetland area of the Pines Flora and Fauna Reserve	Project Company

Management Activity	Performance Criteria	Timing	Responsibility
If required - seed collection of threatened species located during targeted searches.	Threatened flora located and mapped during targeted searches and seed collected as outlined in Appendix 2.	September to January as per species specific requirements outlined in Appendix 2	Linking Melbourne Authority
If required - seed collection of threatened species located during construction phase	Threatened flora located and mapped during the construction phase and seed collected as outlined in Appendix 2.	After February 2010 if required.	Project Company
If appropriate – translocation of identified threatened species.	Threatened flora located and mapped during targeted searches.	Prior to on-site construction commencing – in an appropriate timeframe.	Project Company / Linking Melbourne Authority (dependant on timing of translocation)
EVC seed collection 2009	16 Areas mapped as high quality by Venosta *et al.* (2008) See ' Areas recommended for Targeted Searches for EPBC/FFG listed Species' Appendix 3	In the appropriate season i.e. spring/summer 2009/2010 prior to commencement of construction.	Linking Melbourne Authority
Mitigation measures for Dwarf Galaxias	As per Section 6	Prior to construction near Tuerong creek and all other waterway areas.	Project Company
Establishment of Net Gain Offset targets (in accordance with Victoria's Native Vegetation Management Framework) and other offsets	As per Venosta *et al.* (2008)	Prior to the post-construction phase.	Linking Melbourne Authority

2. River Swamp Wallaby-Grass Species Management Plan in the Pines Flora and Fauna Reserve

The following section outlines a species management plan for River Swamp Wallaby-grass *Amphibromus fluitans,* located within the Pines Flora and Fauna Reserve. Venosta *et al* (2008) recorded well established populations of this species growing at eight locations around a constructed wetland within the Pines Flora and Fauna Reserve. It is expected that 0.04 hectares (ha) of this wetland, within the construction footprint, will be impacted by this development.

It will therefore be a requirement of the Project Company to avoid (where practicable) and minimise impacts to this significant species, and to protect the remainder of the River Swamp Wallaby-grass population outside the construction area from impacts of construction works. Practical means to achieve this are outlined in the sections below. Further, general management requirements are outlined in Section 4.

2.1 Construction

The established population of River Swamp Wallaby-grass within the Pines Flora and Fauna Reserve will require sensitive management during and after the construction phase. Overall this population is well established within the wetland. It is expected that 0.04ha coverage of this species is likely to be destroyed during construction, however, it is not expected that these losses will impact on the on-going viability of the remainder of the population (in the order of 0.73ha) (Pers. com. Damian Cook). During the detailed design phase, a review of the construction footprint in this area will be undertaken with the objective to further minimise the impact on River Swamp Wallaby-grass.

It is important therefore that the hydrological flow into the wetland and wetland water levels are maintained throughout the construction phase in order to protect the remaining population and to reduce impact stress.

Tamarisk Creek will be realigned through the Pines Flora and Fauna Reserve in the vicinity of Peninsula Link. The design of the realignment of the creek will consider the hydrological characteristics of the area and the wetting requirements of River Swamp Wallaby-grass. The realignment of Tamarisk Creek may also result in an increased flow into the wetland area, thus improving the habitat for the species.

The following procedures will be implemented and incorporated into the Site Environmental Management Plan to ensure that potential damage due to construction outside the construction area is avoided, and to minimise damage within the construction area.

2.1.1 Pre-construction phase

Prior to construction commencement the wetland area to be destroyed will be surveyed and clearly marked and fenced in the presence of an ecologist familiar with River Swamp Wallaby-grass.

A containment fence will be constructed to clearly define the “no-go” zone and to prevent incursion into the wetland area and River Swamp Wallaby-grass populations that are to be retained (see Section 4.1.4 for further details).

Seed will be collected from the plants that are likely to be impacted during construction over the September 2009 to January 2010 summer period and placed into storage. The seed collected will be used post-construction as the source of plant stock for revegetation and rehabilitation programs (see Appendix 3, EVC Seed Collection, for details). The seed will be stored by a suitably qualified and experienced aquatic flora seed collection company.

Training of the site environmental officer in the identification and protection of the species will be undertaken by a qualified ecologist familiar with the species.

The no-go zones will be clearly marked and fenced and all construction activities will be undertaken within the construction area ensuring that the minimal width of the construction area is identified and maintained. The site environmental officer will supervise the works.

2.1.2 Construction phase

No more than 0.04ha of vegetation containing River Swamp Wallaby Grass (previously identified area in EES) will be removed during construction.

Induction of staff working on the Project will be undertaken by the Environmental Manager (Project wide induction). Induction and training in identification of River Swamp Wallaby-grass will be implemented by the site environmental officer for all staff working in the immediate area of the wetland (see Section 4.1.3 for further details).

Storage of spoil and all movement of construction vehicles and equipment will be conducted within the construction area as per overall site management procedures. There will be no storage of materials or stockpiles outside of the construction area.

Stormwater and sediment will be contained within the construction area. There will be no stormwater or surface water runoff from the construction area into the adjacent wetlands (see Section 4.2.6 for further details).

Hydrological flow into the wetland from Tamarisk Creek, and water levels within the wetland, will be maintained throughout the construction phase. Natural, seasonal fill-and-drain cycles will be maintained within the wetland.

Inspection of no-go zone fencing and other management measures will be undertaken by the site environmental officer as part of regular daily inspections and a report will be included in the weekly environmental checklist (see Section 4.2.7 for further details). Any breaches in the in the no-zone fencing will be remediated promptly (within 48 hours).

The general weed management protocols to inhibit weed distribution into the wetland area during adjacent soil disturbance will be strictly observed, including restriction of unnecessary vehicle and people movement and vehicle washdown procedures (see Section 4.2.3 for further details).

Inspection of protected areas will be undertaken by the site environmental officer for signs of stress of the species as part of regular daily environmental inspections and a report will be included in the weekly environmental checklist.

Plants/populations adjacent to the construction area will be monitored on a weekly basis during construction activity within the immediate vicinity of works by the site environmental officer to assess impacts and to identify possible threatening processes that may impact on the viability of the wetland population.

Where threats or impacts are observed, then these will be reported to DSE, DEWHA and the Land Manager and an amelioration program developed and implemented in consultation with the responsible authorities and a qualified ecologist

Where threats or impacts are observed, appropriate actions to address these will be developed by the site environmental officer and in consultation with the responsible authorities and implemented in cooperation with a qualified ecologist familiar with the species.

Records of impacts and threats will be maintained by the site environmental officer and reported to LMA and DSE as appropriate.

The results of the monitoring and maintenance program will be reported to DSE, DEWHA and LMA annually, or more regularly as required by DSE.

2.1.3 Post-construction phase

The wetland and retained populations of River Swamp Wallaby-grass will be revegetated and rehabilitated as required to offset impacts or threat incidents recorded during the construction phase.

Plant stock will be sourced from the seed-bank established during the pre-construction phase. It may also be necessary to establish companion plants within wetland areas that are in keeping with the Aquatic Herbland EVC. This is in order to establish a natural ecological balance and the on-going viability of the wetland.

A minimum of twice the area being lost of River Swamp Wallaby-grass will be established within the aquatic margin of the Tamarisk Creek wetland. If sufficient area is not available in the aquatic margin the additional sites are to be identified if required in consultation with DSE. Revegetation is to occur at a minimum of 6 plants per square metre, and the site(s) managed to ensure a >70% establishment rate .

Weeds will be eradicated within the construction area immediately adjacent to the River Swamp Wallaby-grass populations.

Protective fencing and sediment fencing will be removed once construction activities are complete. Trapped sediment will be removed and the sites stabilised.

Measures will be taken to ensure that a thriving and sustainable River Swamp Wallaby-grass population is established adjacent to, and within, the construction site, and within the wetlands as a whole. A thriving and sustainable River Swamp Wallaby-grass population is one where there is a minimum >70% establishment rate, and adequate signs of recruitment (Vallee *et al* 2004; see also Section 4.2.8 and Appendix 2A.7 for details).

In the event that the viability of the plants is threatened, an investigation of causes and impacts will be undertaken. . If it is assessed that the decline/viability of the plants is attributable to the construction or operation of the freeway, then an appropriate plan will be prepared and implemented in consultation with DSE, DEWHA and the Land Manager.

The River Swamp Wallaby-grass populations re-established within and adjacent to the construction area will be monitored to ensure that their on-going viability is secured. Monitoring will be undertaken on a fortnightly basis for the first 6 months, a monthly basis for another 6 months and on-going at an appropriate interval for a total of 10 years. The on-going monitoring interval is to be determined based on the results of the first year's monitoring, and in consultation with DSE, DEWHA and the Land Manager.

The results of the monitoring and maintenance program will be reported to DSE, DEWHA and LMA annually, or more regularly as required by DSE.

2.2 Timing and Responsibilities – River Swamp Wallaby Grass at the Pines Flora and Fauna Reserve

Table 4. Timings and responsibilities for River Swamp Wallaby Grass within the Pines Flora and Fauna Reserve

The following table relates to timings and responsibilities for the known population of River Swamp Wallaby-grass at the Pines Flora and Fauna Reserve.

Management Activity	Performance Criteria	Timing	Responsibility
Seed collection of River Swamp Wallaby-grass within the Pines Flora and Fauna Reserve.	Collection and storage of seed from plants identified for removal due to construction activities (identified in Venosta *et al* (2008)) and in accordance with Section 2.	February to March 2010	Linking Melbourne Authority
Pre-construction phase	Develop a Site Environmental Management Plan for the River Swamp Wallaby-grass and wetland within the Pines Flora and Fauna Reserve.	Pre- construction	Project Company
	Train Site Environmental Officer in identification of River Swamp Wallaby-grass and develop a site induction program.	Pre- construction	Project Company working with a suitably qualified ecologist
	Erect fencing and establish a no-go zone to protect remaining River Swamp Wallaby-grass population.	Pre- construction	Project Company working with a suitably qualified ecologist.
	Implement induction of all staff, contractors and sub-contractors.	Pre and during construction in the wetland area of the Pines Flora and Fauna Reserve	Project Company
Construction phase	Survey and clearly mark area of vegetation for removal. Remove no more than 0.04ha of vegetation containing River Swamp Wallaby Grass.	Pre-construction and during construction	Project Company
	Contain spoil, construction materials, stormwater and sediment within the construction area.	During construction	Project Company
	Maintain natural hydrological flows within Tamarisk Creek and the wetland area.	Pre and during construction	Project Company

Management Activity	Performance Criteria	Timing	Responsibility
	Conduct daily inspection of no-go fencing and remediate breaches promptly (within 48 hours).	During construction	Project Company
	Prepare a Weed Management Plan. Implement weed management plan within the construction area and immediately adjacent to the wetland area.	Pre and during construction	Project Company
	Conduct daily inspections of the protected areas of remnant River Swamp Wallaby-grass population. Plants/populations adjacent to construction area to be monitored on a weekly basis during construction activity. Where threats or impacts observed then report impacts to DSE, DEWHA and the Land. Develop and implement mitigation measures as required to ameliorate these.	During construction	Project Company
	Record impacts and report to the Responsible Authorities as appropriate.	During construction	Project Company
	Report results of monitoring and maintenance program to DSE, DEWHA and LMA annually.	During construction	Project Company
Post-construction phase	Revegetate and/or rehabilitate areas adjacent to and within the remnant River Swamp Wallaby-grass population as required to mitigate impacts. A minimum of twice of area taken of River Swamp Wallaby grass to be established within the aquatic margin of Tamarisk Creek (or alternate site).	Prior to completion of construction within the Pines Flora and Fauna Reserve	Project Company
	Implement weed management plan to eradicate weeds within the construction area and immediately adjacent to the wetland area.	During construction and following completion.	Project Company

Management Activity	Performance Criteria	Timing	Responsibility
	Remove protective fencing and establish permanent fencing as required.	At completion of construction activities.	Project Company
	Prepare and implement the remnant River Swamp Wallaby-grass population monitoring and reporting plan; report to DSE, DEWHA and LMA annually.	Monitoring Plan completed prior to completion of construction (early 2013) Implement plan at completion of the construction phase for 10 years.	Project Company, Linking Melbourne Authority and Parks Victoria. (To be determined – dependant on revegetation location and timing)

3. Threatened flora species identified during targeted surveys

In the event that during the targeted surveys threatened flora species are found, the following measures will be implemented:

- The location of the species will be recorded.
- The general site environmental management requirements detailed in Section 4 will be implemented.
- The species specific management plan will be implemented (refer to Appendix 2 for details).

Mitigation measures include seed collection from known populations including translocation of parent plants in some circumstances. Flora translocation is considered a measure of last resort, particularly where the conservation of threatened species are involved (Vallee *et al.* 2004). Success rates are low and there is a notable paucity of scientific research or reporting of successful methodologies from which to determine successful procedures. Translocation of plants will therefore be considered only where alternative protective measures have been ruled out, and permission has been sought from DSE and/or DEWHA. Refer to Appendix 4 for discussion on translocation.

3.1 Other populations of River Swamp Wallaby Grass

The targeted surveys currently underway may identify additional populations of River Swamp Wallaby Grass within the project construction area; other than the known population at the Pines Flora and Fauna Reserve. In the event that this may occur, the mitigation measures outlined in Section 4 and Appendix 2 of this report will be implemented.

4. General site Environmental Management Plan for threatened flora species found during targeted surveys

The following section details environmental management principles required for EPBC and FFG listed species that may be found within the construction area during the targeted surveys or during the construction phase of the project. These principles will be incorporated into the site or activity environmental management plans for the construction of the Peninsula Link Project. Implementation of these management requirements will be the responsibility of the Project Company.

In addition detailed management measures for each EPBC and FFG listed species are attached in Appendix 2 and are to be implemented.

4.1 Pre-construction phase

There are a range of general mitigation measures for protecting the EPBC Act and FFG Act threatened flora. The following mitigation measures will be conducted throughout the 'Planning' phase (before construction and other activities begin on the site) under the instruction of the site environment officer. These will be discussed in greater detail below.

4.1.1 Location of known or possible habitats for threatened flora species

The location of threatened flora species identified during the targeted surveys (currently underway) will form an addendum to this Threatened Species Management Plan. The Project Company environmental project manager, environmental site officers and construction workers will be made aware of these locations.

The Project Company will develop a Flora and Fauna Management Plan in consultation with DSE and Melbourne Water (for waterway/riparian areas) which includes targeted surveys in critical areas for significant species in consultation with DSE.

4.1.2 Avoiding and minimising impacts and disturbance

The overriding approach to mitigating impacts on threatened flora species is to avoid the loss of known or possible habitat, which is defined for River Swamp Wallaby-grass, Clover Glycine, Swamp Fireweed, Purple Blown-grass Maroon Leek-orchid, Purple Diuris, and the Frankston Spider-orchid. Where this is not possible, the aim is to minimise the potential impacts through a comprehensive mitigation strategy.

Substantial efforts to avoid construction in areas of known or possible habitat for threatened flora species will be undertaken during the planning stages of the works. Habitat assessments have identified locations within the construction area where EPBC Act and FFG Act listed flora species are known to occur, or where it is considered likely that they may occur. Known or likely habitat sites will therefore to be flagged for protection.

Where avoidance of known or possible habitat for threatened flora species is not possible, the area of disturbance will be minimised. To minimise potential impacts on threatened flora species, the width of the construction area will be kept as narrow as possible, particularly in areas of known or possible habitat. This will be achieved through the following measures:

- No-go zones will be clearly marked and fenced and all construction activities will be undertaken within the construction area ensuring that the minimal width of the construction area is identified and maintained;

- The site environmental officer will supervise maintenance of the no-go zones;
- Access routes for vehicles and machinery will be restricted to specific, ecologically-safe locations that are identified prior to construction; and
- All vehicles, machinery and construction activities are prohibited in areas of known or possible habitat areas outside the construction area.

4.1.3 Induction process

Prior to the commencement of construction, the Project Company Environmental Manager will conduct an induction for all personnel accessing or working within the construction area. The purpose of the induction is to inform individuals of their obligations to protect threatened flora and fauna species. As part of this process:

- Awareness posters and flyers will be developed and distributed to the Project Company personnel and sub-contractors and others as necessary, highlighting the presence or potential presence of River Swamp Wallaby-grass, Clover Glycine, Maroon Leek-orchid, Purple Diuris, Purple Blown-grass, Swamp Fireweed and the Frankston Spider-orchid within the construction area;
- Information on the posters and flyers will include descriptions of their size and appearance;
- Awareness posters and flyers will include the obligations under the EPBC Act and FFG Act of the Project Company, its personnel and sub-contractors regarding these species; and
- The Induction will include protocols on what actions to take if EPBC Act or FFG Act listed flora species and other threatened species are found within the construction area.

4.1.4 Construction fencing

Prior to construction or commencement of activity within the construction area, construction fencing will be installed around the boundary of the construction area to clearly define the no-go areas and to restrict construction activities to the approved footprint. Amongst other reasons, this will be done to protect areas of known or possible habitat for EPBC Act and FFG Act listed flora species.

In areas of known or possible habitat for EPBC Act and FFG Act listed flora species, access will be restricted from the construction area.

4.1.5 Rehabilitation protocol for construction area

When all construction activities are complete, sites between the freeway reservation and construction area will be rehabilitated to their original condition. A design plan for landscaping between the freeway reservation and construction area will be developed during the planning phase of the project. The protocol will include aspects such as revegetation (how, when, which species to use) and ongoing weed management (up to and beyond the point where native vegetation becomes established).

4.2 Construction phase

A range of general measures will be undertaken during the construction phase to minimise the likelihood of impacts on EPBC Act or FFG Act listed flora species in known or possible habitats within the construction area.

The following mitigation measures will be implemented during the 'construction' phase under the instruction of the site environment officer:

- Maintain minimal width of the construction area in all known or possible habitats for threatened flora species;
- Maintain and clearly mark no-go areas for all known or possible habitats for threatened flora species;
- Implement management measures if EPBC Act or FFG Act listed species are found during construction, and at sites for all known or possible habitats for threatened flora species;
- Implement weed management protocols at all known or possible habitats for threatened flora species within the construction area;
- Undertake top soil management at all known or possible habitats for threatened flora species within the construction area;
- Undertake as part of regular daily inspections of the protected areas and include these in the weekly environmental checklist.
- Undertake reporting to DSE, DEWHA, LMA and the responsible Land Managers as required.

4.2.1 Perimeter of Construction Zone

Construction activities will be confined within the fenced areas and must not occur outside of the construction area. This includes activities such as the storage of spoil and construction materials, and the movement and storage of construction vehicles and equipment. Construction fencing will indicate the perimeter of the construction area which is to be kept at a minimum. The site environmental officer will check fenced areas daily during the construction period to identify and rectify any damage within fenced areas promptly (within 48 hours), and to ensure that the protective fencing remains intact.

4.2.2 Management of additional threatened species identified during construction

If any additional EPBC Act or FFG Act listed flora species are found within the construction area (other than those identified during the targeted surveys), the following actions will be taken:

- The Site Environment Officer will be notified immediately;
- The plants will be protected from construction works immediately;
- The site will be fenced via the methods outlined above; and
- A qualified ecologist will be informed and a site inspection arranged as soon as possible;
- DSE (and DEWHA as appropriate) will be notified

Subsequent to the site inspection, appropriate site-specific mitigation measures will be implemented as detailed in this plan and in consultation with DSE/DEWHA and LMA. The mitigation program will be subject to review by DSE and DEWHA as appropriate.

4.2.3 Weed management

A weed management program will be developed and implemented for the construction and post-construction phases of the project to prevent the introduction of noxious and environmental weeds into the construction area. This program will outline steps to prevent the introduction and spread of weed species, and will outline control mechanisms aimed at their eradication and/or control on-site.

The program will also include preventative measures, such as vehicle wash-down procedures and the restriction of vehicle and personnel movements within and around sites, and measures to control weed establishment on soil stockpiles (see Phytophthora and topsoil management protocols below).

4.2.4 *Phytophthora cinnamomi* management guidelines

The spread of Phytophthora (*Phytophthora cinnamomi*) (also known as Root Rot Fungus) from infected sites into parks and reserves (including roadsides under the control of a state or local government authority) and use of Phytophthora-infected gravel for the construction of roads, bridges and reservoirs is considered a potentially threatening process under the FFG Act and therefore must be managed.

It will be necessary for the Project Company to ensure that Phytophthora is not introduced to the construction area, and that, if it is detected within the construction area, that quarantine measures are instigated to ensure that it is contained. This is particularly important in areas that are adjacent to Heathy Woodland remnants (which is highly susceptible to Phytophthora) and in particular, within the Pines Flora and Fauna Reserve.

All soils and construction materials introduced to the construction area will be free from Phytophthora. Similarly, any soils to be transported from site-to-site within the construction area will also be free from Phytophthora before being disturbed. The Project Company will maintain vehicle hygiene (particularly in relation to all earth-moving equipment) to prevent the spread of Phytophthora between infested and uninfected sites.

If Phytophthora is detected on site then the following actions will be taken:

- The site environment officer will be notified immediately;
- All works within the vicinity are to cease;
- Infected areas are to be quarantined and fenced off;
- Soil containment protocols are to be implemented; and
- A decontamination and eradication program is to be developed in conjunction with qualified experts.

4.2.5 Topsoil management

A large component of the construction works will be the reinstatement of indigenous flora and revegetation/landscape works within the construction area. These works will require the temporary stockpiling of topsoil removed prior to construction activities for reinstatement on batters and within the revegetation/landscape sites.

The topsoil removed from areas within the construction area that have remnant vegetation cover is of particular importance as these soils will contain a seedbank of indigenous plants (in some cases these may include threatened species). Therefore, where topsoils are removed from remnant vegetation in the vicinity of The Pines Flora and Fauna Reserve, it will be placed directly into the orchard area in order to enhance revegetation efforts in this area. Specific areas for topsoil placement within the orchard will be located by a qualified ecologist to ensure that no significant species of flora or fauna are present.

4.2.6 Sediment control

Any construction will need to be undertaken in a methodical and sensitive manner in order to avoid creating stormwater runoff and sediment problems. Care must be taken during any activities likely to create soil disturbance. Where there is danger of sediment washing into retained areas of native vegetation adjoining the construction area the following measures will be included within the construction footprint:

- Design and construct Temporary Works to isolate construction run-off from catchment run-off and treat it prior to discharge to receiving waters;
- Develop an erosion and sediment control plan; and
- Manage construction in accordance EPA Publication 480 (Environmental Guidelines for Major Construction Sites).

4.2.7 Daily monitoring conducted by Site Environment Officer

All management measures outlined in this report will be addressed as part of routine daily inspections by the Site Environment Officers during the construction phase. A native vegetation and threatened flora species management form will be created which will enable the site environmental officers to record their findings and sign-off on a daily basis. This is to acknowledge that the appropriate tasks for the protection of each of the above-mentioned threatened flora species have been completed.

Any non-conformance which does not pose any risk and which can be rectified immediately will be recorded on the daily checklist and reported to the project environment manager as part of the weekly environmental checklist. Any non-conformances which pose a risk will be communicated to the project environment manager immediately.

4.2.8 Reporting to DSE, DEWHA, LMA and Land Managers

In the event that threatened species are identified during targeted surveys or during construction, it will be necessary to report the results of the maintenance and monitoring program to the various management agencies on an annual basis (and as outlined for specific species in Appendix 2).

The agencies include DSE and DEWHA on matters involving threatened species, as well as LMA and the Land Manager on matters involving threatened species and regular management requirements. Any matters requiring consultation with DSE will be referred to the General Manager of Environmental Services (GM) by telephone and follow-up email. Resolutions developed in consultation with the GM will be implemented promptly and incorporated into the CEMP and SEPMs. Other matters will be reported promptly to the relevant authorities and the resolutions are to be acted upon in a timely fashion.

4.3 Post-Construction

Two general measures will be undertaken after the construction phase to minimise the likelihood of impacts from the construction of the freeway on native vegetation and flora species listed under the EPBC Act and FFG Act. These include:

- Rehabilitation and re-vegetation measures will be implemented at known or possible habitat sites for threatened flora species within the construction area; and
- Weed management will be implemented at known or possible habitat sites for threatened flora species within freeway reservation.

These requirements are outlined in more detail in the sections below.

4.3.1 Site rehabilitation and revegetation

As soon as the construction phase is complete the vegetation, topography and habitat features of all sites *previously* supporting patches of native vegetation will be rehabilitated within the construction area. Rehabilitation will be undertaken to a standard and timeframe in consultation with DSE and the land manager.

Topsoil excavated during construction will also be used to rehabilitate sites that were known to support, or considered likely to support, threatened flora species. Regeneration of the indigenous topsoil seedbank is to be encouraged, with supplementary planting as required to ensure the re-establishment of pre-European EVC cover. It will also be necessary to control weeds during the regeneration period.

If native vegetation re-colonisation is not successful simply by returning the retained (indigenous) topsoil, then areas of known or possible threatened flora species habitat disturbed by construction will be either revegetated or direct-seeded with the appropriate suite of EVC flora species. The advice of experienced ecologists will be sought during this process.

4.3.2 Fencing and weed management

The following measures will be implemented in order to minimise post-construction threats to threatened species, or populations of threatened species, that are to be retained in-situ. Potential threats include pedestrian impacts and vandalism, weed invasion, rabbit or herbivore impacts, erosion or other threatening ecological processes. The following management requirements will be implemented:

- Rehabilitation of damaged areas in the vicinity of threatened species will be implemented – this may include revegetation with suitable companion flora species;
- A GPS location of the plants/population will be taken and recorded on construction site plans to assist in location identification;
- Permanent fencing will be established to minimise pedestrian damage, and to protect the site from construction or maintenance vehicles;
- Sites will be monitored and maintained for 10 years as part of the Roadside Management Plan.

A weed management plan will be developed and implemented for the post-construction phase of the project. The weed management plan will be implemented for the freeway reservation in conjunction with revegetation / landscaping programs and as part of the Roadside Management Plan.

A weed management plan will be prepared and implemented post construction between the freeway reservation and construction area for a period of 10 years to assist during the regeneration period.

4.4 Timing and Responsibilities – Threatened Species Found During Targeted Surveys or During Construction

Table 5. (if found) River Swamp Wallaby-grass, Clover Glycine, Swamp Fireweed and Purple Blown-grass timings and responsibilities

The following table relates to timings and responsibilities for River Swamp Wallaby-grass, Clover Glycine, Swamp Fireweed and Purple Blown-grass identified during the targeted searches or during construction (see Table 4 above for management of the known population of River Swamp Wallaby-grass). Further detail on the management requirements summarized in this table is available in Appendix 2 of this report (see below). Please note that if none of these threatened flora are identified within the construction area during the targeted surveys or during construction then these items listed below will not require implementation.

Management Activity	Performance Criteria	Timing	Responsibility
Targeted searches	Conduct targeted searches to identify additional populations of threatened flora taxa, register populations/ individuals on site maps, and establish protective fencing.	September 2009 to January 2010 as per species specific requirements outlined in Appendix 2	Linking Melbourne Authority
	If required, implement seed collection and/or translocation programs of threatened species located during targeted searches.	September 2009 to January 2010 as per species specific requirements outlined in Appendix 2	Linking Melbourne Authority
Pre-construction phase	No-go zones around threatened flora to be clearly marked and fenced and all construction activities are to be undertaken within construction area.	Pre-construction	Project Company
	Train Site Environmental Officer in identification of threatened species and develop a site induction program.	Pre- construction	Project Company
	Implement induction of all staff, contractors and sub-contractors.	Pre-construction	Project Company

Management Activity	Performance Criteria	Timing	Responsibility
Construction phase	Undertake targeted surveys in critical areas for significant species in consultation with DSE prior to construction to identify any additional populations of threatened flora taxa within the construction footprint and erect temporary protective fencing. Report any findings of site surveys to LMA and DSE / DEWHA.	Pre-construction	Project Company
	Establish management protocols for any populations to be managed in-situ; incorporate into Site Environmental Management Plans.	Pre-construction	Project Company
	Contain spoil, construction materials, stormwater and sediment within the construction area.	Pre and during construction	Project Company
	Conduct daily inspection of no-go fencing and remediate breaches promptly (within 48 hours).	During construction	Project Company
	Establish a suitable recipient site for plants to be translocated and/or plants propagated from seed.	During construction	Project Company / Linking Melbourne Authority (depending on timing)
	Conduct translocation program and establish propagated plants. Establish a >70% translocation success rate.	During construction	Project Company / Linking Melbourne Authority (depending on timing)
	Establish maintenance and reporting programs for translocation and propagated populations.	Implement at completion of the translocation phase or establishment phase	Project Company / Linking Melbourne Authority (depending on timing)
	Record impacts and report results of the monitoring program to the Responsible Authorities.	Pre and during construction	Project Company / Linking Melbourne Authority (depending on timing)

Management Activity	Performance Criteria	Timing	Responsibility
Post-construction phase	Eradicate weeds around translocation / in-situ sites.	During construction and following completion	Project Company (within road reservation) Land Manager (elsewhere)
	Maintain translocated/ propagated populations.	As required for up to 10 years	Project Company (within road reservation) Land Manager (elsewhere)
	Maintain in-situ populations.	As required for up to 10 years	Project Company (within road reservation) Land Manager (elsewhere)
	Implement the translocation population monitoring and reporting program; report to DSE, DEWHA and LMA.	Implement at completion of the construction phase for 10 years	Project Company, Linking Melbourne Authority, Land Manager as appropriate

Table 6. (if found) Maroon Leek Orchid, Purple Diuris or Frankston Spider Orchids timings and responsibilities

The following table relates to timings and responsibilities for any Maroon Leek Orchid, Purple Diuris or Frankston Spider Orchids identified during the targeted searches. Further detail on the management requirements summarized in this table is available in Appendix 2 of this report (see below). Please note that if none of these threatened flora are identified within the construction area during the targeted surveys or during construction then these items listed below will not require implementation.

Management Activity	Performance Criteria	Timing	Responsibility
Targeted searches	Conduct targeted searches to identify additional populations of threatened flora taxa, register populations/individuals on site maps, and establish protective fencing.	September 2009 to January 2010 as per species specific requirements outlined in Appendix 2	Linking Melbourne Authority
	If required, implement seed collection and/or translocation programs of threatened species located during targeted searches.	September 2009 to January 2010 as per species specific requirements outlined in Appendix 2	Linking Melbourne Authority working with a suitably qualified orchid specialist and the Royal Botanic Gardens

Management Activity	Performance Criteria	Timing	Responsibility
Pre-construction phase	No-go zones around threatened flora to be clearly marked and fenced and all construction activities are to be undertaken within construction area	Pre-construction	Project Company
	Train Site Environmental Officer in identification of threatened species and develop a site induction program.	Pre-construction	Project Company
	Implement induction of all staff, contractors and sub-contractors.	Pre-construction	Project Company
Construction phase	Undertake targeted surveys in critical areas for significant species in consultation with DSE prior to construction to identify any additional populations of threatened flora taxa within the construction footprint and erect temporary protective fencing. Report any findings of site surveys to LMA and DSE / DEWHA.	Pre-construction	Project Company
	Establish management protocols for any populations to be managed in-situ; incorporate into Site Environmental Management Plans.	Pre-construction	Project Company
	Contain spoil, construction materials, stormwater and sediment within the construction area.	Pre and during construction	Project Company
	Conduct daily inspection of no-go fencing and remediate promptly (within 48 hours).	Pre and during construction	Project Company
	Establish a suitable recipient site for plants to be translocated and/or plants propagated from seed.	During construction	Project Company/ Linking Melbourne Authority (depending on timing) working with a suitably qualified orchid specialist and the Royal Botanic Gardens

Management Activity	Performance Criteria	Timing	Responsibility
	Conduct translocation program and establish propagated plants. Establish a >70% translocation success rate.	During construction phase	Project Company/ Linking Melbourne Authority (depending on timing) working with a suitably qualified orchid specialist and the Royal Botanic Gardens
	Establish maintenance and reporting program for translocation and propagated populations.	Implement at completion of the translocation phase or establishment phase	Project Company/ Linking Melbourne Authority (depending on timing) working with a suitably qualified orchid specialist and the Royal Botanic Gardens
Post-construction phase	Eradicate weeds around translocation / in-situ sites.	During construction and following completion	Project Company (within road reservation) Land Manager (elsewhere)
	Control weeds at translocation / in-situ sites.	During construction and following completion	Project Company (within road reservation) Land Manager (elsewhere)
	Maintain translocated / propagated populations.	As required for up to 10 years	Project Company (within road reservation) Land Manager (elsewhere)
	Maintain in-situ populations.	As required for up to 10 years	Project Company (within road reservation) Land Manager (elsewhere)
	Remove protective fencing and establish permanent fencing as required.	At completion of construction activities	Project Company
	Implement the translocation population monitoring and reporting program; report to DSE, DEWHA and LMA.	Implement at completion of the construction phase for 10 years	LMA and/or Project Company, Land Manager as appropriate

5. Offsets for impacted threatened species

The priority option for protection and enhancement of any endangered species is through the protection and enhancement of its natural habitat. As stated, pre-construction targeted flora surveys are being undertaken between September 2009 and January 2010 (seasonal variance notwithstanding). Currently, only one of the listed threatened flora species (River Swamp Wallaby-grass) has been recorded in the Peninsula Link project area; this despite the comprehensive survey work conducted as part of the EES survey. Therefore there is a possibility that targeted searches may not record any further threatened species within the area.

The impact of Peninsula Link on the known River Swamp Wallaby-grass population within the Pines Flora and Fauna Reserve is being mitigated, as outlined in Section 2 above. Seed collected from plants scheduled for removal due to construction (as identified in Venosta *et al.* 2008) will be used to propagate tubestock for the revegetation and in-fill planting of the aquatic margin of the Tamarisk Creek wetland. Additional sites will be identified if more area is required to accommodate the River Swamp Wallaby-grass tubestock. Planting will be at a minimum of 6 plants per square metre, to a total area of 0.08ha (double the area being lost). These revegetation works will be in addition to the security of Net Gain Offsets in accordance with Victoria's *Native Vegetation Management Framework* (DNRE 2002).

Targeted surveys may however identify further threatened species populations and there may potentially be instances where EPBC and FFG species cannot be avoided during construction. In these cases it is important to note that extensive measures are being undertaken elsewhere as part of the project to restore similar habitats and offset losses, thereby providing amelioration for native vegetation losses due to the works.

Offsets, detailed below, include (but are not limited to):

- Achieving a Net Gain, in accordance with *Victoria's Native Vegetation Management Framework* (see Section 5.1 below for details), through the acquisition or management of suitable offset sites within the bioregion;
- The collection of seed from impact sites and the propagation of local provenance, indigenous tubestock for revegetation and rehabilitation programs (refer to Appendix 3);
- Revegetation of approximately 16ha of the Orchard precinct within the Pines Flora and Fauna Reserve and the establishment of pre-European EVC habitat for Southern Brown Bandicoot and regionally significant flora and fauna taxa (this is detailed further in the Southern Brown Bandicoot Management Plan);
- Re-alignment of the Tamarisk Creek to improve wetland habitat opportunities and to secure the habitat conditions of sites known to support significant flora species;
- Revegetation of River Swamp Wallaby-grass within the Tamarisk Creek wetlands (minimum 6 plants/m^2 to twice the area taken);
- Extensive revegetation works within the roadway corridor utilising local provenance, indigenous flora.

These Offset mechanisms are discussed in more detail below.

5.1 Victoria's Native Vegetation Management Framework

The Peninsula Link project is subject to Victoria's *Native Vegetation Management Framework* which provides a systematic approach to providing offsets for impacted vegetation. A principle tenet of the *Native Vegetation Management Framework* is the objective of retention and management of native vegetation (DNRE 2002). According to the DSE (DNRE 2002) the goal of native vegetation management in Victoria is to achieve:

> *A reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain.*

Four individual actions to achieve the above goal are outlined in the DSE's (DNRE 2002) Framework. These are:

- active improvement of the quality of existing vegetation,
- avoidance or minimisation of further permanent losses through clearing,
- strategic increase in the cover of native vegetation through biodiverse revegetation, and
- the flexibility that is required to support landholders as they move towards more sustainable land use.

To achieve the most strategic outcome for native vegetation across Victoria the Framework embraces a system of classification determining both the land protection and conservation significance of any given site. This is intended to provide a systematic approach that ensures the conservation of the majority of remnant vegetation across Victoria. The DSE (DNRE 2002) has established a three step approach to use when applying the Net Gain process:

- avoid adverse impacts, particularly through vegetation clearance; and
- if impacts cannot be avoided, to minimise impacts through appropriate consideration in planning processes and expert input to project design or management; and
- identify appropriate offset options for the mitigation of unavoidable losses.

A Net Gain Assessment will be undertaken for the construction impact of Peninsula Link on native vegetation and an appropriate offset plan will be developed. Factors that will determine the type and extent of offset that will be provided are:

- the conservation significance of the native vegetation being removed;
- the quality and extent of native vegetation removal proposed;
- the offset criteria in the Framework;
- the conservation significance of the proposed offset area;
- the expected gains from the offset;
- any relevant approved Regional Native Vegetation Plan.

An offset plan for the Peninsula Link project will be developed in consultation with DSE. Please note however that the plan cannot be developed in full until the total impact of Peninsula Link on native vegetation can be determined. A preliminary plan will be prepared by June 2010, with a final offset plan being available in June 2013.

5.2 Offset rehabilitation and revegetation programs

Consolidation of land tenure surrounding the Pines Flora and Fauna Reserve will bring as much public land as possible into a larger conservation reserve offering long-term protection of existing habitat and creating the opportunity to improve conditions through revegetation and regeneration programs. This will include 16 hectares of revegetation and regeneration of pre-European EVC habitat in the Orchard area.

Linking Melbourne Authority has commenced discussions with the Department of Primary Industries for the acquisition of KTRI land with the objective to then include it as part of the Pines Flora and Fauna Reserve.

The Pines Flora and Fauna Reserve is managed by Parks Victoria. The KTRI land is managed by the Department of Primary Industries. Consolidation of the KTRI site will therefore require that DPI declares some of the land surplus to its needs, and that Parks Victoria accepts management responsibility for the site as part of an extended Pines Flora and Fauna Reserve. LMA will continue to pursue this outcome. The extent of KTRI land transferred to Parks Victoria will be subject to a separate negotiation between DPI, DSE and Parks Victoria.

Currently Parks Victoria and Linking Melbourne Authority are working to finalise the draft master plan for the Pines Flora and Fauna Reserve; which was developed as part of the EES process. Linking Melbourne Authority is also working with Parks Victoria to develop a revegetation plan for the former Orchards area. The scope of works and a program for implementation will be finalised once the draft master plan is complete. It is anticipated that the draft master plan will be finalised by March 2010 and the specific details and timeframes for the rehabilitation of the orchards will be available by June 2010.

The consolidation and restoration of the Pines Flora and Fauna Reserve is primarily a direct mitigation requirement for the loss of habitat along the construction area, but may also form part of offset requirements triggered under the Victoria's Native Vegetation Management Framework (DNRE 2002).

The 'value' of the Offset gain will be in accordance with the Framework (DNRE 2002) and like-for-like requirements. The extent of the revegetation program, and the Offsets generated, will be determined once the Peninsula Link design is finalised and the Offset Plan is developed. The Offset Plan will be developed by LMA and is subject to DSE review and approval. This offset plan will incorporate the offset requirements for the Rivers-Swamp Wallaby Grass in the Pines Flora and Fauna Reserve.

The instigation of EVC based seed collection this season will provide opportunity to secure a substantial seed bank which will assist in the provision of high quality EVC based revegetation works in the Pines Flora and Fauna Reserve and elsewhere (refer also to Appendix 3 for EVC Seed Collection discussion).

It should also be noted that the provision of the Victoria's Native Vegetation Management Framework (DNRE 2002) offset requirements will ensure the protection of several hectares of native vegetation for every habitat hectare of loss. These offsets will also need to meet like-for-like requirements of the Framework. Consequently, there is a high likelihood that the habitat protected offsite will provide similar ecological function to that being lost, and that it will provide high quality habitat opportunities for a similar suite of flora and fauna taxa being impacted within the construction area.

The re-alignment of Tamarisk Creek overland through part of the Pines Flora and Fauna Reserve into the wetland area will include sensitive revegetation works that will enhance native vegetation values in this area. This overland flow will reinstate a more natural drainage regime that is expected to provide more permanent water to wetland systems that are at present is largely ephemeral; this in turn will increase both Dwarf Galaxias and Swamp Skink habitat availability (Venosta et al. 2008).

Finally, it is considered likely that targeted searches may not record any further threatened species within the construction footprint. However the offset details mentioned above will still be implemented as part of the Peninsula Link Project. In the event that threatened flora species are identified, the proposed offset requirements (other than for the River Swamp Wallaby Grass in the Pines Flora and Fauna Reserve) will be developed in consultation with DSE and DEWHA. An offset plan specific to the identified threatened flora species will be prepared by LMA and approved by DSE and DEWHA. This specific plan (if required) will be prepared, approved and implemented prior to completion of Peninsula Link (anticipated to be early 2013).

6. Measures to mitigate and enhance habitat for Dwarf Galaxias

Photo by Rudie Kuiter – male Dwarf Galaxias (*Galaxias pusilla*)

6.1 Introduction

The following section provides information on the Dwarf Galaxias (*Galaxias pusilla*) and outlines management requirements for this threatened species within the Peninsula Link project area. Specifically this report addresses the EPBC Approval condition for measures to mitigate and enhance habitat for the Dwarf Galaxias. A monitoring program is also outlined for specific sites.

The mitigation measures provide for the preservation of a known Dwarf Galaxias population in Tuerong Creek, protection of former habitat of the species, and provides potential methods for enhancing Dwarf Galaxias habitat along the alignment of the Peninsula Link.

Attainment will be achieved by:

- Monitoring before, during and after construction of the Peninsula Link (known Dwarf Galaxias population in Tuerong Creek and possible other selected locations that formerly supported the species);
- Implementing mitigation controls for the protection of Dwarf Galaxias habitat; and the
- Establishment of new roadside habitat that can be used for future colonisation by Dwarf Galaxias.

6.2 Background information

The Dwarf Galaxias is considered of National significance and is listed as vulnerable under the EPBC Act. In Victoria, the Dwarf Galaxias is considered a threatened species (DNRE 2007) and is listed for protection under the FFG Act.

Although the Dwarf Galaxias has a natural range extending throughout south-eastern Australia, the species has a fragmented distribution throughout. With the exception of secure populations in places like Discovery Bay National Park and the Grampians National Park, most populations in Victoria are under threat. Many wetland habitats throughout the range of the species have been destroyed or modified as part of agriculture development.

The Dwarf Galaxias is historically expected to occur in all of the waterways that will be traversed by the Peninsula Link. Clearing of swamp vegetation, draining of low lying areas and the piping of watercourses have contributed to the loss of Dwarf Galaxias populations and the degradation of Dwarf Galaxias habitat on the Mornington Peninsula. Linking of wetlands to watercourses that contain the noxious Eastern Gambusia (*Gambusia holbrooki*), a species which can out-compete Dwarf Galaxias for food and habitat, has also been detrimental.

The recent drought has further added to the demise of Dwarf Galaxias populations, as many known Dwarf Galaxias habitats have dried out. Survival of Dwarf Galaxias populations are linked to waters that do not dry out, or if they do, it is only for short periods (days or weeks, not months or years). Furthermore, as flood events are primarily responsible for the spread of Dwarf Galaxias, no opportunity for potential re-colonisation has been possible during the drought.

The only location that Dwarf Galaxias were known to occur and recorded during the Environmental Effects Statement (EES) investigations were at Tuerong Creek. However, new locations have since been identified, including a tributary of Balcombe Creek, Devilbend Creek and Watsons Creek (see Appendix 5: *Fish Passage and Impact Mitigation Approaches for Dwarf Galaxias, Peninsula Link Project, Biosis Research, 2010*).

Photographs of waterways crossings to be traversed by Peninsula Link have been provided in Appendix 9.

6.2.1 Definitions

In this section of the TSMP where reference is made to consultation with DSE and Melbourne Water, this should be read as consultation with:

DSE: Department of Sustainability and Environment (Port Philip Area Biodiversity Services, State-wide Services) and

MW: Melbourne Water Corporation (Waterways, River Health Group).

The appropriate personnel within these organisations will be consulted, including personnel from each organisation experienced in Dwarf Galaxias and their habitat.

6.3 Important waterways for the Dwarf Galaxias

The proposed Peninsula Link alignment traverses a number of farm dams, wetlands, drains and waterways across the Balcombe, Watsons and Boggy Creek catchments, catchments which all support populations of Dwarf Galaxias (Venosta *et al* 2008).

Priority waters for the preservation of Dwarf Galaxias populations and Dwarf Galaxias habitat along the Peninsula Link can be divided into three types of waters:

- Waters which currently support Dwarf Galaxias populations;
- Waters which are connected to waters that still support Dwarf Galaxias; and

- Waters which have habitat which could potentially support Dwarf Galaxias (but there is no known record of a Dwarf Galaxias population).

6.3.1 Waters which currently support the Dwarf Galaxias

At the time of the EES investigations, Tuerong Creek was the most important waterway for Dwarf Galaxias that was being crossed by the Peninsula Link. The Tuerong Creek (Melway Map 152 B1) Dwarf Galaxias population consists of very large numbers within a very small section of the creek that offers refuge habitat for the species (Venosta *et al* 2008).

Targeted surveys were undertaken by Biosis in June 2010. The results of the targeted survey of Dwarf Galaxias in the Boggy, Watsons and Balcombe Creek catchments are attached in Appendix 6.

The recent 2010 surveys have shown that the distribution and abundance of this species in the vicinity of Peninsula Link is likely to change markedly, and this has been the case with the species recorded at multiple locations including Watsons Creek and Balcombe Creek (Biosis Research, 2010). Previous studies showed Dwarf Galaxia in Devilbend Creek. Figure 1 shows the changes in Dwarf Galaxia distribution, based on surveys completed during the EES as well as recent pre-construction surveys. Further investigation was warranted, particularly in these locations where Dwarf Galaxias had not been recorded during the EES, and also following periods of high rainfall and high flow/flood conditions to assist the design process meet fish passage requirements.

As a result of these further investigations, a Fish Passage Report was prepared by Biosis for the Peninsula Link Project which provides an update on the Dwarf Galaxia distribution within the project alignment and proposes measures to mitigate the impact of the project as well as offsetting the impacts with enhanced habitat creation. Refer to Appendix 5 for the Fish Passage and Impact Mitigation Approaches for Dwarf Galaxia Report.

6.3.2 Waters which are connected to waters that still support Dwarf Galaxias

The fauna assessment conducted for the Peninsula Link (Venosta *et al* 2008) did record Dwarf Galaxias at a new location on Boggy Creek within the Pines Flora and Fauna Reserve, however, the location is not on the proposed Peninsula Link. At the alignment, Boggy Creek is piped underground (Melway Map 100 B4). Consequently, the road crossing of Boggy Creek is irrelevant to Dwarf Galaxias, even though there is a known upstream population of the species.

6.3.3 Waters which have habitat which could potentially support Dwarf Galaxias

These waters include locations which have potential for Dwarf Galaxias establishment and may have been former habitat for the species.

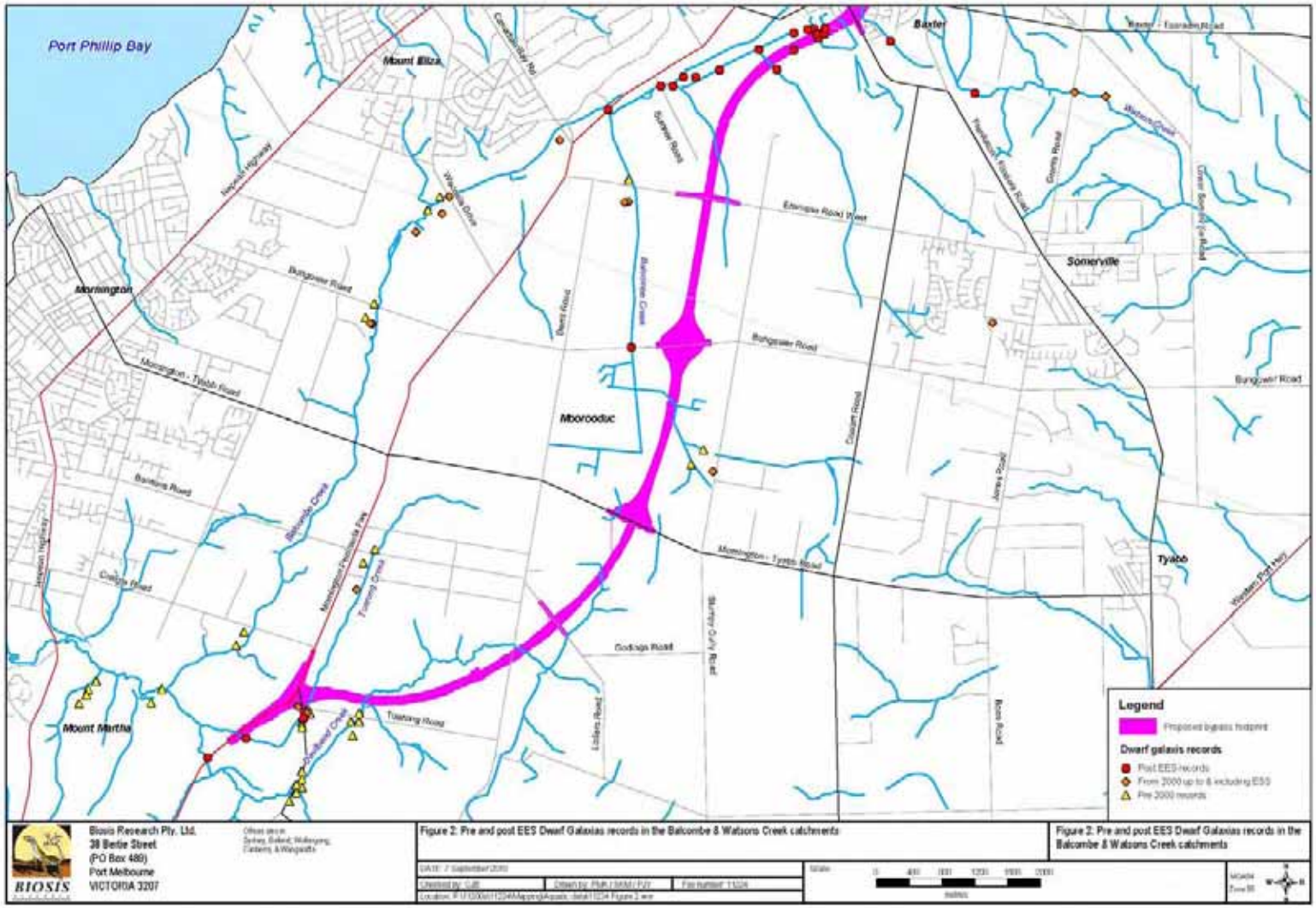
Although potential habitat for the Dwarf Galaxias could include all low lying wetland areas throughout the length of the Peninsula Link, three specific areas were identified in the fauna investigation (Venosta *et al* 2008). The areas are the wetlands at Willow Road Reserve (Melway Map 103 A5), waters between Robinson Road and Golf Links Road (Melway Map 103 B12) and a constructed wetland in the Pines Flora and Fauna Reserve (Melway Map 100 D7).

The wetlands within the proposed alignment area at Willow Road Reserve and within the woodland south of Robinsons Road provide suitable habitat for the Dwarf Galaxias (Venosta *et*

al 2008). However, based on the EES surface water assessment, it appears that there is no direct connection from these water bodies to waterways which may or still support Dwarf Galaxias.

The constructed wetland within the Pines Flora and Fauna Reserve is associated with a low lying area adjacent to Tamarisk Creek. This habitat could potentially support Dwarf Galaxias if the hydrological regime is suitable, but the degree of connectivity with permanent waterbodies is not particularly clear at this time (Venosta *et al* 2008).

Figure 1: Pre and post EES Dwarf Galaxias records in the Balcombe & Watsons Creek catchments



6.4 Dwarf Galaxias mitigation measures

6.4.1 Tuerong Creek

It is recommended that the crossing of Tuerong Creek is such that no disturbance to the population of Dwarf Galaxias occurs and so that remnant habitat is protected. At present, the ongoing viability of the Tuerong Creek Dwarf Galaxia population is precariously balanced due to its isolation, small area of habitat and susceptibility to summer desiccation (Biosis Research, 2010). The design of Peninsula Link in the vicinity of Tuerong Creek has resulted in the requirement to undertake minor creek realignment to achieve an appropriate hydraulic outcome (see Appendix 5, Section 4 for further information). Any impacts to Tuerong Creek upstream of the existing Dwarf Galaxia population site will be offset by the creation of Dwarf Galaxia refuge habitat upstream of the Peninsula Link freeway (Appendix 5, Section 4). Dwarf Galaxia habitat creation will consist of the following:

- An artificial anabranch (i.e. a parallel second channel) which would be created to convey low flows (the existing channel would become a high flow channel only)
- Within the anabranch there would be three deep pools interspersed by ephemeral habitat
- The pools would be steep sided and deep to allow for moderate to heavy shading by fringing Swamp Paperbark (to be planted). The shading and depth is intended to ensure permanence and provide relatively cool summer temperatures which should suppress the size of the Eastern Gambusia population (one will inevitably establish).
- The slope between pools would be gentler to allow for establishment of more extensive areas of aquatic vegetation. An assortment of appropriate submerged and ephemeral aquatic plants with varying hydrological requirements would be planted on pool slopes and interspersing ephemeral zones. The ephemeral zones would typically be inundated over winter/spring and provide an extension of suitable spawning habitat for Dwarf Galaxias.
- A sediment basin and rain garden would be strategically located to convey treated road runoff directly to the middle pool. This would supplement the low summer flows typically experienced by this system and help to increase the permanence of the created habitat in two of the three pools.

See Figures 2 -7 which detail the concept design for habitat creation at Tuerong Creek.

The following requirements will be incorporated into the site or activity environmental management plans for the Project.

Construction will:

- Maintain upstream or downstream fish passage under the vast majority of flow conditions.
- Undertake construction within the smallest possible area.
- Temporary roads needed for construction will be removed and area re-instated.
- The movement of vehicles in the vicinity of waterways will be minimised during road construction. Passage of vehicles will occur within the smallest amount of easement possible. Sediment fences (adopting the EPA best practices sediment control measures guidelines) will be installed to prevent unnecessary erosion and sedimentation.
- A no-go zone will be established both upstream and downstream of the construction zone. This no-go zone will encompass the 1 in 100 year flood boundary with an adjacent 20m buffer. Works within the 1 in 100 year portion of the no-go zone will be limited to habitat creation, together with revegetation and works required to connect the created habitat with the rain garden (see Figure 7 of Appendix 5, Fish Passage Report, Biosis Research, 2010b).

All road designs in the vicinity of the important population of Dwarf Galaxias inhabiting Tuerong Creek in the vicinity of Tuerong Road will be developed in close consultation with a suitably qualified aquatic ecologist to ensure this population is protected (Venosta *et al* 2008).

Further to this, the proposed methods to be used for construction, determination of no-go zones and measures to minimise the footprint of the works both during construction and after completion of the road is to be undertaken in consultation with a suitably qualified aquatic ecologist, Melbourne Water and DSE.

Figure 2: Tuerong Creek Crossing – Construction and No Go Zones

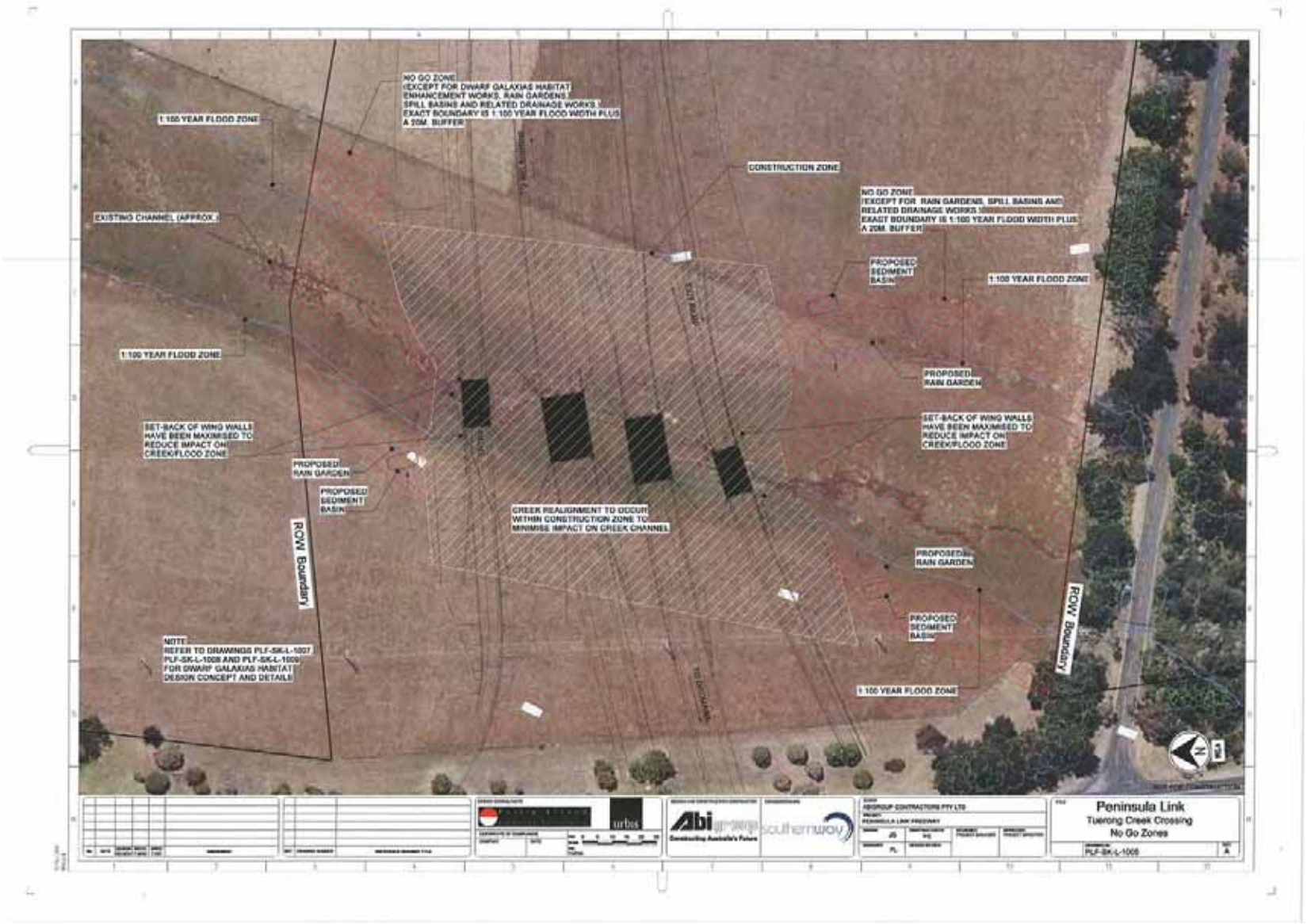


Figure 3: Concept Sketch for Dwarf Galaxia habitat creation and revegetation of Tuerong Creek

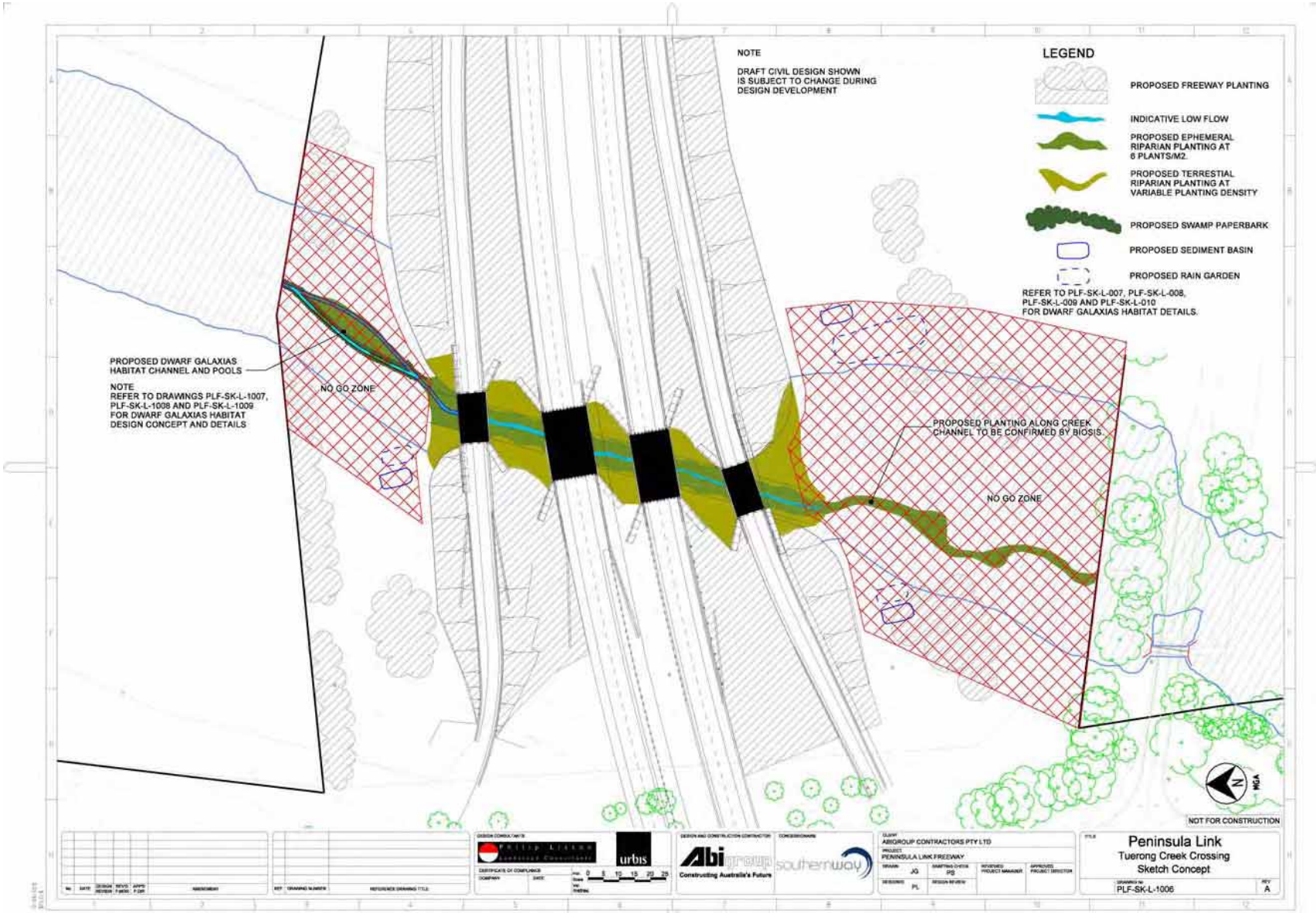


Figure 8: Concept sketch for Dwarf Galaxias habitat creation and revegetation of Tuerong Creek.

Figure 4: Concept sketch of proposed Dwarf Galaxia habitat creation for Tuerong Creek

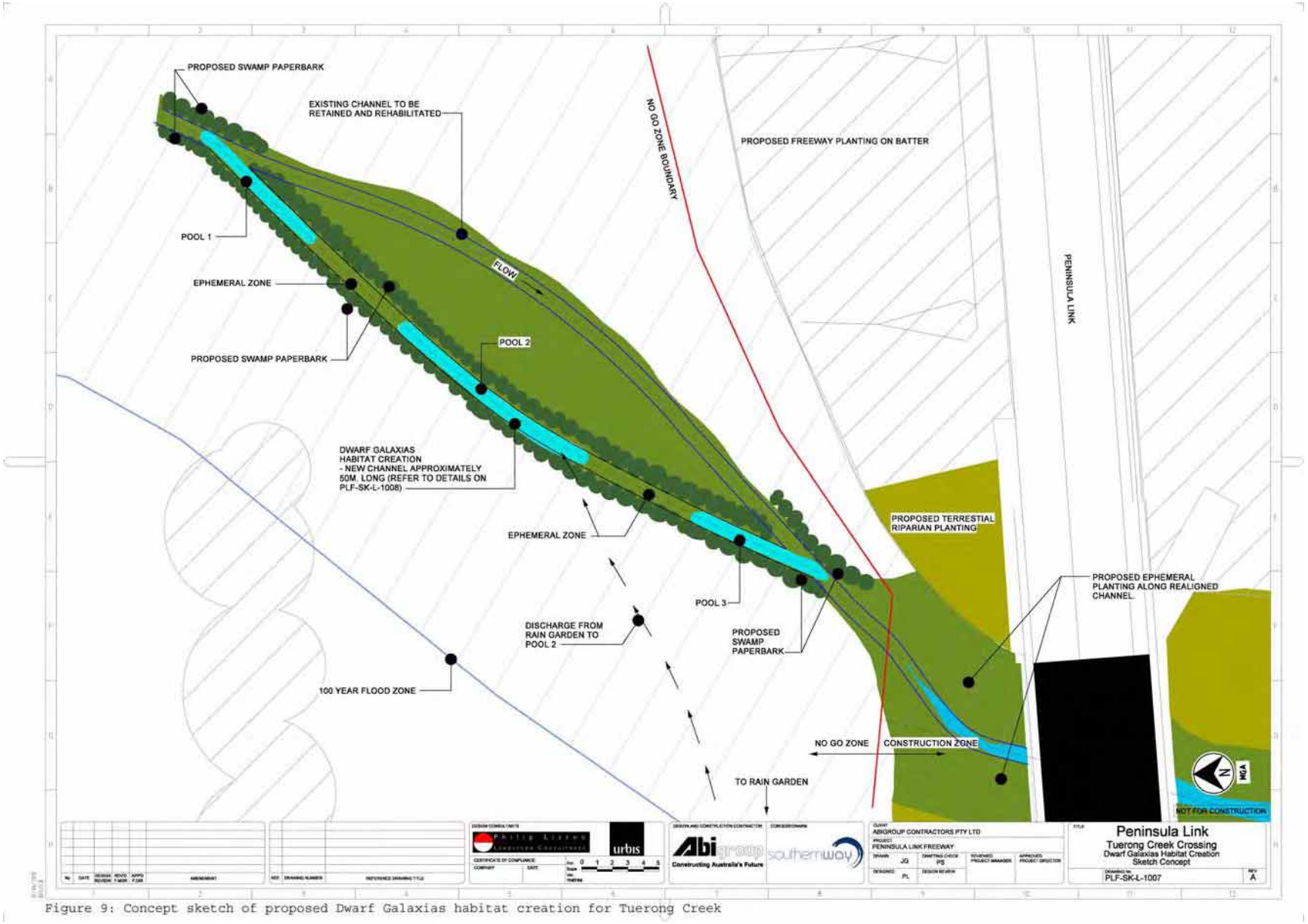


Figure 9: Concept sketch of proposed Dwarf Galaxias habitat creation for Tuerong Creek

Figure 5: Cross Section Designs for Dwarf Galaxia habitat pools

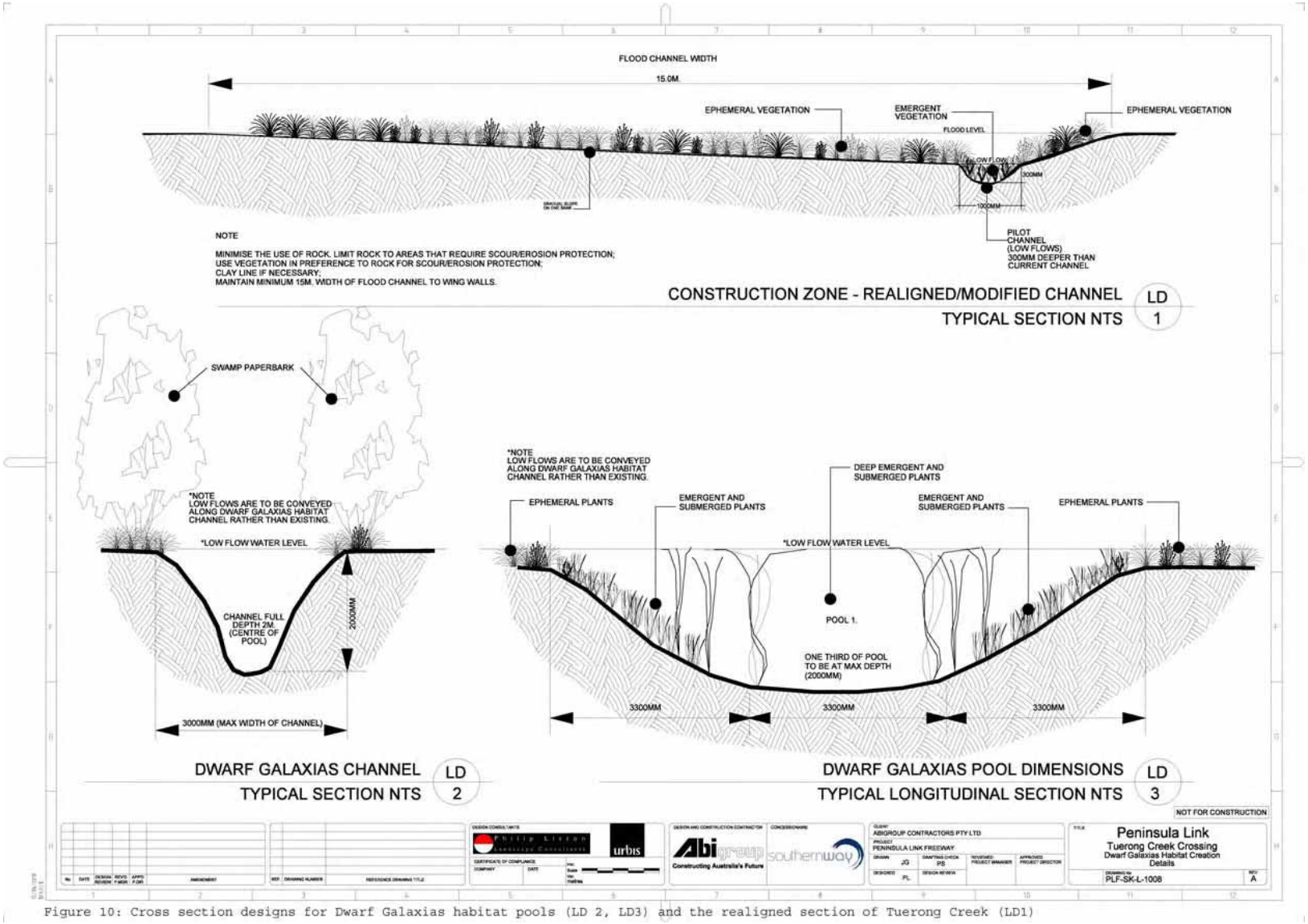


Figure 10: Cross section designs for Dwarf Galaxias habitat pools (LD 2, LD3) and the realigned section of Tuerong Creek (LD1)

Figure 6: Cross Section of Proposed Dwarf Galaxia Habitat Channel

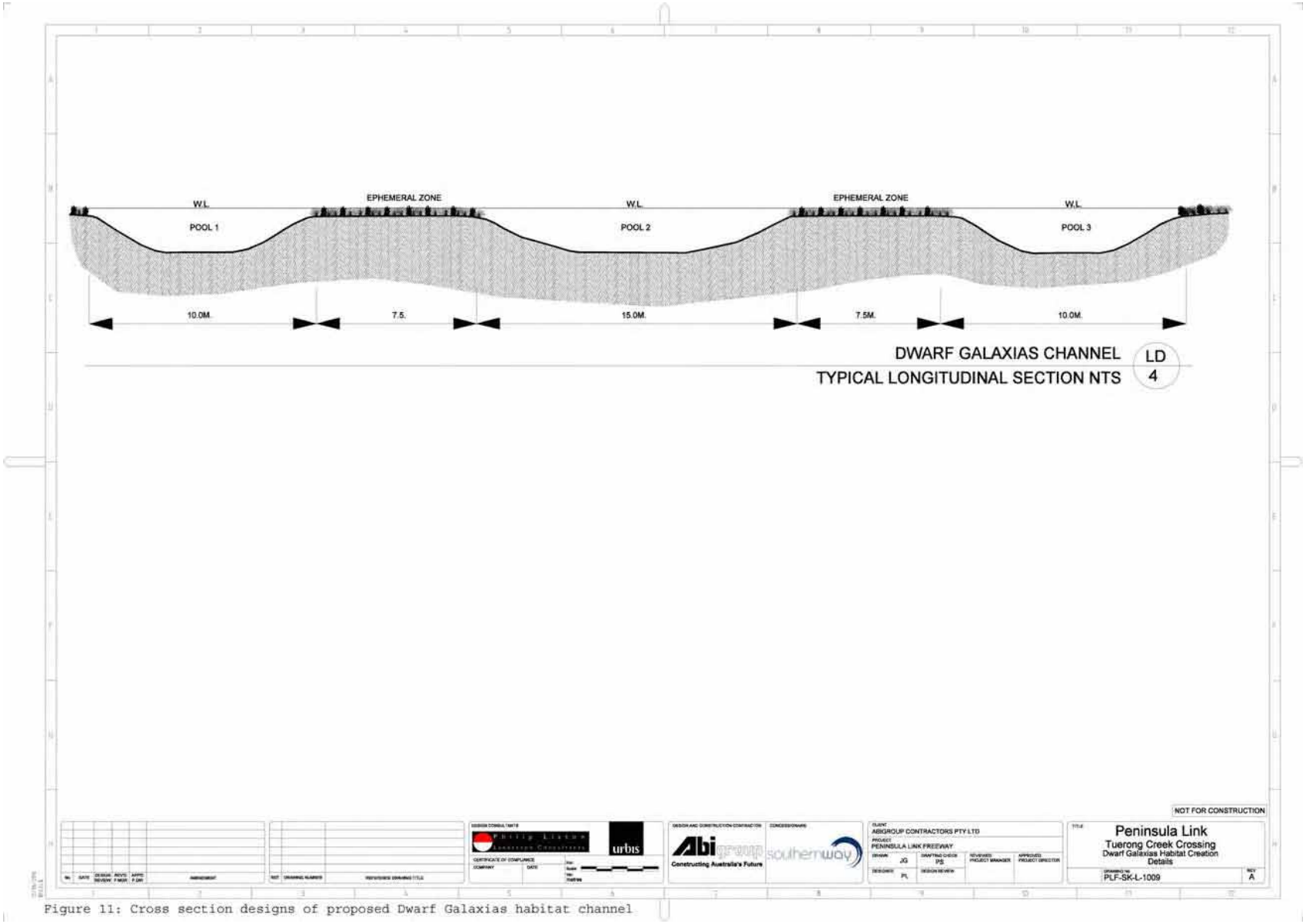


Figure 11: Cross section designs of proposed Dwarf Galaxias habitat channel

Figure 7: Preliminary designs for Tuerong Creek Crossing Structures

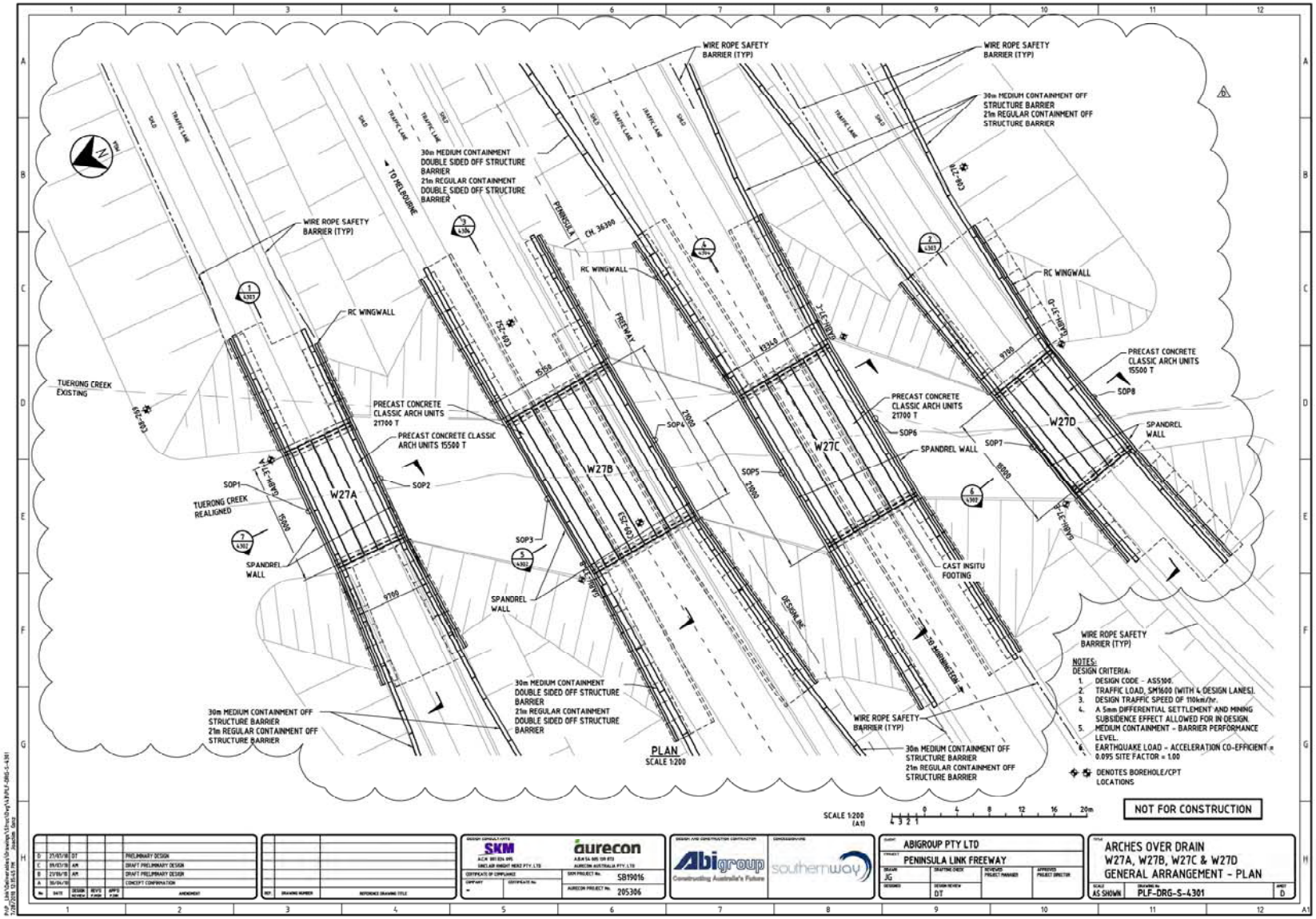


Figure 12: Preliminary Designs for Tuerong Creek crossing structures (Bebo Arches)

6.4.2 Waterway crossings (with the exception of Tuerong Creek)

The crossings of Devilbend Creek (W26) and the unnamed headwater tributary of Balcombe Creek (W22) will be bridge crossings. During the construction of the bridges, upstream and downstream fish passage under all flow conditions will be maintained. The construction footprint will be minimised.

The Project Company will undertake the detailed design of any other waterway crossings in consultation with an aquatic ecologist, DSE and Melbourne Water to ensure habitat connectivity is protected and maintained. The design of the waterway crossings will allow for unimpeded fish passage and will ensure all waterway and floodplain crossings allow for unimpeded Dwarf Galaxia dispersal under majority of flood conditions (where appropriate, in consultation with Melbourne Water and DSE). For further information see Appendix 5, Section 4.

The Project Company has undertaken targeted searches in critical areas in consultation with DSE. The Project Company will train (by a suitably qualified aquatic ecologist) the Site Environmental Officer in identification of Dwarf Galaxias and develop a site induction program which includes the induction of all staff, contractors and sub-contractors.

The approved Threatened Species Management Plan - Peninsula Link Project (December 2009) outlined specific fish-passage requirements for Watsons Creek crossings (W12 and W13). Further investigations of Watsons Creek have been undertaken during the design process, and the aquatic specialist report (Biosis Research 2010) advises against providing fish passage at Watsons Creek (W12 crossing) given the lack of connected habitat (Appendix 5, Section 3). Furthermore, the Watsons Creek W13 crossing will be removed and flows redirected to WBT1 and W15 crossing which will also incorporate the creation of wetland and refuge habitats to offset for this redirection at W13 (Appendix 5, Section 3). Melbourne Water has advised that due to residential flooding issues in Baxter and in consideration of the local hydraulics and hydrology, the W13 crossing is no longer required and flows are to be redirected towards W15.

Redirected flows from W13 to WBT1 and W15 will discharge into the same tributary, but with a discharge point now being 450m upstream of the current discharge point. There will be no net increase or decrease in flow volume or rate as a result of this flow redirection (only a change in the direction the flows are coming from within the piped network).

It is important that fish passage with connected waters which support Dwarf Galaxias be preserved. With floodplain hydrology maintained, Dwarf Galaxias recolonisation from nearby populations will still be possible.

6.4.2.1 Habitat Creation for other waterways

As a result of recent investigations and further study of the hydrology of the area, fish passage is not required at Watsons Creek crossings W12 and W13 as proposed in the approved Threatened Species Management Plan - Peninsula Link Project (December 2009). However, fish passage will be provided at several other creek crossings that will be traversed by Peninsula Link. This will also include the creation of fish habitat at 9 locations, in addition to Tuerong Creek. The creation of habitat at Boggy Creek, Tamarisk Creek, Watsons Creek, Balcombe and Devilbend Creeks will be designed in close consultation with a suitably qualified aquatic ecologist and in consultation with Melbourne Water and DSE.

Table 7 provides an overview of the fish passage and habitat creation requirements for Peninsula Link, incorporating the following:

- *Realignment :* A number of waterway crossings will require realignment for various reasons including accommodating Melbourne Water requirements for minimum distance setback, reducing the potential for scour/erosion and to minimise the length of waterway under or through a structure. The realignments will be designed in consultation with DSE and Melbourne Water, and will be designed to improve current bed and bank morphology. It should be noted that all of the waterways that are

proposed for realignment are currently highly modified and disturbed (eg little riparian vegetation, low diversity of aquatic vegetation, high cover of weeds, existing erosion issues, etc).

- *Fish Passage:* A detailed assessment has been undertaken by the Project Ecologists (Biosis Research), involving additional surveys to ascertain Dwarf Galaxia distribution. The requirement for the provision of fish passage at each crossing was determined by Biosis Research using relevant guidelines (Fairfull and Witheridge 2003, Witheridge 202), together with mapping, aerial photography, fish database searches and fish survey results and on the ground assessment and knowledge of these crossings obtained from Frankston Bypass EES investigations and during more recent survey and investigations.

- *Priority for Fish Passage:* For waterway crossings that were determined to warrant fish passage, a relative importance/priority of high, medium or low has been assigned to ensure a concordant amount of effort is applied to incorporating design features required to ensure fish passage. For the lowest priority crossings, it is proposed that these crossings be designed with some regard for fish passage, but the focus will be on ensuring the crossings do not pose an obvious physical barrier that would preclude fish passage. For medium and high priority crossings, fish passage will be provided.

- *Habitat Creation:* Habitat creation will be required as an offset measure at certain waterway crossings. This will be designed in consultation with Melbourne Water and DSE, and will consist of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Habitat creation will incorporate an in-line habitat pool, where fish passage and habitat creation are required (see habitat pool concept design in Figure 8). The design of this pool will be developed in consultation with Melbourne Water and DSE and will include ephemeral riparian planting along creek banks, and ephemeral marsh planting within creek channels

Table 7 will be implemented and where indicated that habitat creation is a performance criteria, then the Project Company will be undertake habitat creation works and realignment works as described above.

Once established, the proposed waterway realignments and habitat creation will not only offer suitable habitat to Dwarf Galaxias and other native aquatic fauna species, but will also represent a localised improvement to the condition of these waterways.

Appendix 7 (Waterway Crossings and Mitigation Measures) provides further information for waterway crossings where treatments are required to mitigate impacts to Dwarf Galaxias.

Figure 8: Dwarf Galaxias habitat pool concept plan

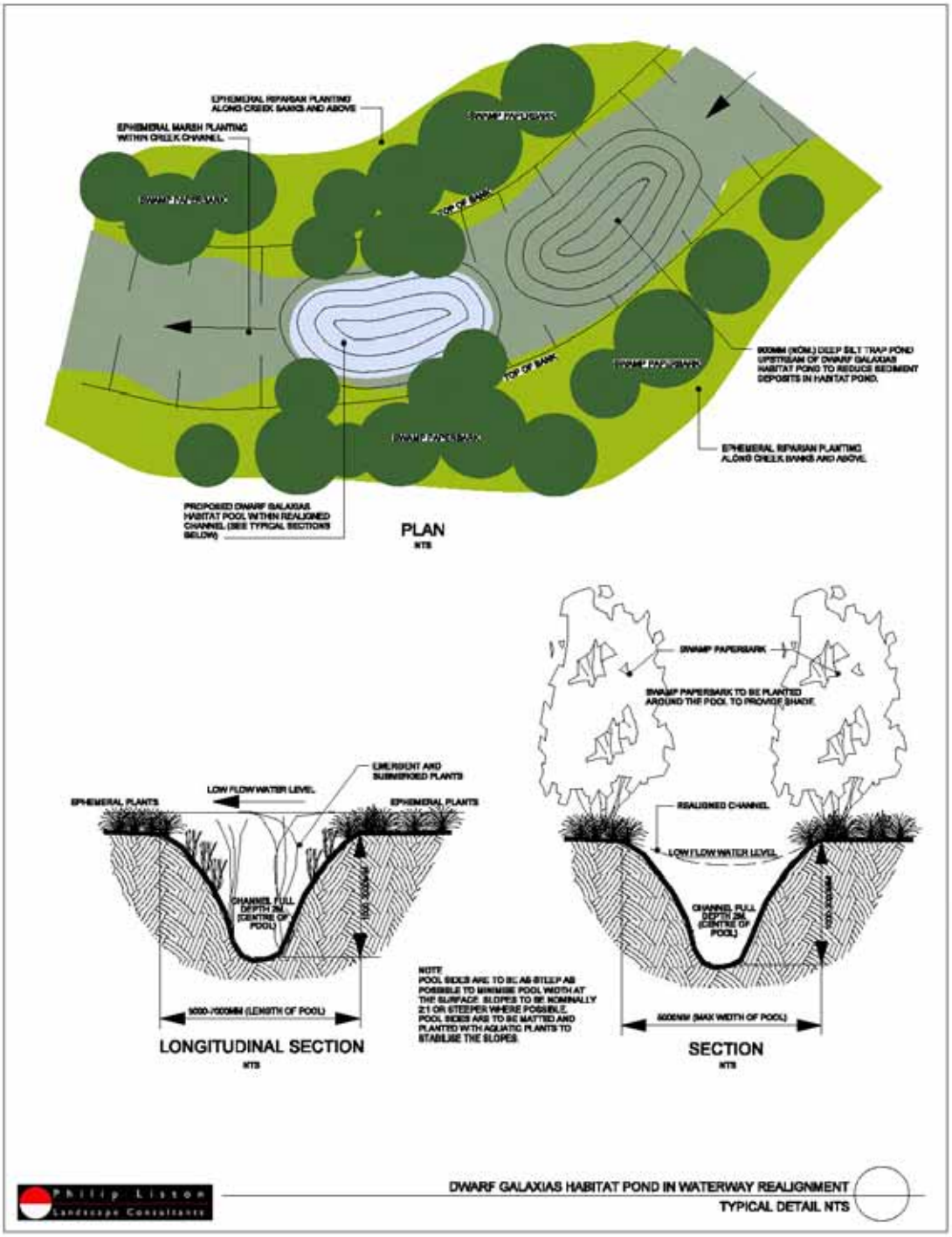


Table 7. Dwarf Galaxia Fish Passage requirements for Peninsula Link waterway crossings*

*This table has been extracted from Appendix 5: *Fish Passage and Impact Mitigation Approaches for Dwarf Galaxias, Peninsula Link Project, Biosis Research, 2010*).

Crossing #	Crossing type	Catchment	Realignment required?	Fish Passage required?	Priority for Fish Passage	Habitat creation required?	Performance Criteria
W1	Culvert	Boggy	No	Yes	M	No	Maintain existing connectivity for amphibians
W2	Culvert	Boggy	No	No	-	No	Maintain existing connectivity for amphibians
W2A	Culvert	Boggy	No	No	-	No	Maintain existing connectivity for amphibians
W2B	Culvert	Boggy	No	No	-	No	Maintain existing connectivity for amphibians
W3	Bridge	Boggy	Yes	Yes	M	Yes*	*For native fish other than Dwarf Galaxia. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians
W4	Culvert	Boggy	Yes	Yes	M	Yes*	*For native fish other than Dwarf Galaxias. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians
W5	Culvert	Boggy	Yes	No	-	No	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians
W6	Culvert	Boggy	Yes	Yes	L	No	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians
WFD1	Culvert	Boggy	No	Yes	L	No	Existing culvert extension Maintain existing connectivity for amphibians
W7	Culvert	Tamarisk	No	Yes*	L	No	*Appropriateness of this crossing will be further investigated in consultation

Crossing #	Crossing type	Catchment	Realignment required?	Fish Passage required?	Priority for Fish Passage	Habitat creation required?	Performance Criteria
							with DSE, MW and PV
W8A	Culvert	Tamarisk	No	No	-	No	Maintain existing connectivity for amphibians
W8	Bridge	Tamarisk	No	Yes	M	Yes	Maintain existing connectivity for amphibians and reptiles. Fauna furniture to provide ground cover
W8B	Arch	Tamarisk	No	Yes	M	Yes	Maintain existing connectivity for amphibians and reptiles Fauna furniture to provide ground cover
W9	Bridge	Tamarisk	Yes	Yes	M	Yes	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians and reptiles
W-SK-1	Culvert	Skye Road	Yes	No	-	No	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.
W-SK-2	Culvert	Skye Road	Yes	No	-	No	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.
U-KH-1	Culvert	Karingal Hub	No	No	-	No	
U-WR-1	Culvert	Willow Rd WL	No	No	-	No	
W10	Culvert	Watson	Yes	Yes	L	No	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians

Crossing #	Crossing type	Catchment	Realignment required?	Fish Passage required?	Priority for Fish Passage	Habitat creation required?	Performance Criteria
W11A	Culvert	Watson	No	Yes	L	No	
W12	Culvert	Watson	No	No	-	No	
W13	Culvert	Watson	No	No*	-	No	*Crossing to be removed
WBT1	Culvert	Watson	Yes	Yes	L	Yes	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE.
W15	Culvert	Watson	Yes	Yes	L	Yes	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE.
W18	Culvert	Watson	No	Yes	M	No	Connected to W18A/W19 during flood. Maintain existing connectivity for amphibians
W18A	Culvert	Watson	No	Yes	H	No	Maintain existing connectivity for amphibians
W18B – Access Rd	Culvert	Watson	No	Yes	H	No	
W19	Culvert	Watson	No	Yes	H	No	Maintain existing connectivity for amphibians
W19A	Culvert	Watson	No	Yes	H	No	Proposed to be split into two crossings:W19A and W19C Maintain existing connectivity for amphibians
W19B-Access Rd	Culvert	Watson	No	Yes	H	No	
W19C	Culvert	Watson	No	Yes	H	No	

Crossing #	Crossing type	Catchment	Realignment required?	Fish Passage required?	Priority for Fish Passage	Habitat creation required?	Performance Criteria
W20	Bridge	Balcombe	No	Yes	H	No	Maintain existing connectivity for amphibians
W21	Arch	Balcombe	Yes	Yes	H	Yes	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE
W22	Bridge	Balcombe	Yes	Yes	H	Yes	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE
W23	Culvert	Balcombe	Yes	No	-	No	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.
WER1	Culvert	Balcombe	No	Yes*	H*	No	*Extension of an existing culvert which may already pose a barrier to fish. Maintain existing connectivity for amphibians
W24	Culvert	Devilbend	No	No	-	No	Maintain existing connectivity for amphibians
W25	Bridge	Devilbend	Yes	Yes	M	Yes	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians/ and other terrestrial species Will be designed in consultation with Melbourne Water and DSE
W25A	Culvert	Devilbend	No	No	-	No	
W26	Bridge	Devilbend	Yes	Yes	M	Yes	Combination of small, purpose-built Dwarf

Crossing #	Crossing type	Catchment	Realignment required?	Fish Passage required?	Priority for Fish Passage	Habitat creation required?	Performance Criteria
							Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians/ and other terrestrial species Will be designed in consultation with Melbourne Water and DSE
W27	Arch	Tuerong	Yes	Yes	H	Yes	Habitat creation will include an artificial anabranch to convey low flows, and incorporate three deep pools interspersed by ephemeral habitat (see Appendix 5 for further details including additional habitat creation measures and design measures to minimise/offset impacts). Maintain existing connectivity for amphibians/ and other terrestrial species Will be designed in consultation with Melbourne Water and DSE

6.4.3 General mitigation measures

The following mitigation measures are based on the Venosta *et al* (2008) report.

1. Offset the required modification to aquatic habitats within and adjacent to Tamarisk Creek within the Pines Flora and Fauna Reserve, by creating and enhancing habitats to the benefit of the Dwarf Galaxias.

The suggested measure will be implemented to create a more natural drainage regime through the Pines Flora and Fauna Reserve by allowing a diversion of Tamarisk Creek to reinstate the natural overland flow within the reserve (i.e. not an artificial channel as is currently the case). This measure would increase the permanence of the constructed wetland. When full it is proposed that the wetland discharge from the north-eastern corner back into Tamarisk Creek.

The design and modification of Tamarisk Creek will be undertaken by the Project Company and will incorporate revegetation and other appropriate measures that provides habitat favourable to Dwarf Galaxias.

2. Use water sensitive road designs (Wong et al. 2000) to avoid/minimise alterations to receiving stream hydrology and water quality.

The Project Company will undertake detailed design of any waterway crossing in consultation with DSE and Melbourne Water to ensure habitat connectivity is protected and maintained.

The Project Company will protect and minimise impacts on riparian in-stream native vegetation and existing wetlands.

The Project Company will comply with Environment Protection Authority SEPP (Waters of Victoria), Water Sensitive Road Design Standards and Melbourne Water requirements.

The Project Company will design the Freeway so that road run-off is isolated from catchment run-off and treated using 'water sensitive' design practices prior to discharging into receiving waterways.

Additional considerations will include procedures mentioned in the VicRoads Environment Strategy 2005-2015 (VicRoads 2005) and standard work practices adopted by Melbourne Water (Melbourne Water 2002).

3. Revegetate riparian zones of most waterways in the immediate vicinity of waterway crossings (i.e. within the road reserve) to increase shade and reduce water temperature.

This measure by itself is not specifically needed for protecting or enhancing Dwarf Galaxias habitat. However, revegetation of waterway crossings is designed to enhance existing and potential Dwarf Galaxia habitat, and will improve waterway condition and likelihood that the habitat can be utilised by Dwarf Galaxias.

The Project Company will revegetate riparian zones within the road reserve in the immediate vicinity of waterway crossings to increase shade and reduce water temperature, in consultation with Melbourne Water and DSE. Indigenous riparian plant species from the area will be used where possible in reinstating conditions suitable for the Dwarf Galaxias.

4. Design and strategically locate proposed stormwater treatment/retention ponds offline in close consultation with a suitably qualified aquatic ecologist and DSE.

There is potential that the ponds could be constructed in a manner which may provide habitat for Dwarf Galaxias. It will be necessary to secure permanent water supply to constructed habitat elements. The design will address risks in relation to water quality and potential impacts to Dwarf Galaxias. The Project Scope and Requirements set surface water quality objectives, including treating road run-off prior to discharge into receiving waterways.

The Project Company will design stormwater treatment/retention ponds (where practicable) to create an aquatic habitat that favours Dwarf Galaxias. As stated above, a secure permanent water supply is required for the constructed habitat and this will be dependent on location of the waterway, the road design, proximity to underlying groundwater as well as land availability.

The ponds will be designed with shallow water fringes that can support aquatic vegetation that typically supports Dwarf Galaxias. Levees may be used to avoid water inflows from nearby waterways that might support exotic fish. Fringe planting with endemic native vegetation will further enhance the suitability of the habitat for stocked Dwarf Galaxias.

5. Design waterway crossings to allow for unimpeded fish passage and ensure all waterway and floodplain crossings allow for unimpeded Dwarf Galaxias dispersal under flood conditions.

Constructed wetlands and in-stream waterway habitats will be designed by the Project Company in consultation with a qualified aquatic ecologist and Melbourne Water. If appropriate, structures will incorporate design elements that facilitate upstream migration as well as downstream dispersal during flood conditions. Emphasis will be placed on the establishment of wetland (billabong) chain systems adjacent to the main waterway and within the floodplain that facilitate upstream migration (if appropriate). Riffle systems, with steep grades and turbulent, fast flowing water, are to be avoided as these do not facilitate upstream migration of this 'non-salmonoid' species.

Fish passage requirements have been assessed and determined, and where fish passage is warranted designs will ensure Dwarf Galaxia dispersal under the vast majority of flow conditions. Waterway and floodplain crossings are being designed to facilitate fish passage under low flow and most flood conditions where appropriate and also in consultation with Melbourne Water and DSE.

6. Further surveys for Dwarf Galaxias within water bodies traversed by the proposed bypass footprint should occur. The important Tuerong Creek population will be monitored during and post construction.

Additional pre-construction surveys have been undertaken during 2010. Further targeted surveys were also undertaken and the results are provided in Appendix 6: *Results from the Follow up targeted survey of Dwarf Galaxias Galaxiella pusilla in the Boggy, Watsons and Balcombe Creek catchments, Victoria*. Details of the monitoring program are discussed in the following section.

In the event that surveys identify Dwarf Galaxias within water bodies in the construction footprint, then those individuals will be translocated to the nearest suitable permanent water body. This translocation will be undertaken in consultation with a qualified aquatic ecologist, Melbourne Water, DSE and DPI (Fisheries Victoria). Any relocation of Dwarf Galaxias will only be undertaken if approved by DSEWPaC.

6.4.4 Monitoring Program

The Project Company will undertake targeted searches in critical areas in consultation with DSE.

6.4.4.1 Tuerong Creek

Monitoring will be undertaken in Tuerong Creek, as detailed in the original TSMP (December 2009). Procedures for monitoring the Dwarf Galaxias population at Tuerong Creek during and post construction will be incorporated into the Project Company Flora and Fauna Management Plan and will be implemented by the Project Company.

Monitoring will be performed by a suitably qualified aquatic ecologist or by the site environment officer trained by a suitably qualified aquatic ecologist. An interpretative report will be prepared for each monitoring exercise and distributed to DSE, Melbourne Water and other interested parties. The monitoring program will be subject to review by DSE and DEHWA.

Monitoring at Tuerong Creek will be undertaken during construction and for five years post construction. Monitoring will include routine monitoring on a monthly basis during construction and will be increased to a weekly basis when works are being undertaken that directly impact the Tuerong Creek population. Routine monitoring will occur on a monthly basis for two years post construction, and at an interval to be determined, based on the results of the previous two years and in consultation with DSE and a qualified aquatic ecologist, for a further three years. Monitoring following high flow events and following an incident will also be included at an interval to be determined in consultation with DSE and a qualified aquatic ecologist.

During works, a clear indication will be made to construction personnel of the mitigation measures expected at each waterway. Compliance of mitigation practices during the construction period will be randomly checked by a qualified aquatic ecologist or by the site environment officer trained by a qualified aquatic ecologist. Non compliance issues will be addressed. The post construction survey should show that no Dwarf Galaxias population or Dwarf Galaxias habitat has been lost or declined in extent or number as a result of the road construction. If the monitoring during construction or post construction shows a decline in the extent of habitat or number of population of Dwarf Galaxias then an investigation by a qualified ecologist of causes and impacts will be undertaken. If it is assessed that the decline/viability of the species is attributable to the construction or operation of the freeway, then an appropriate plan will be prepared and implemented in consultation with DSE, DEWHA and Melbourne Water.

Monitoring following high flow events is necessary to show whether any distributional change in Dwarf Galaxias have resulted from the event.

The Project Company will be required to have contingency for reporting accidents that may have impacts on waterways. A chain of command between construction personnel, LMA and a qualified ecologist is required to report problems and to provide appropriate on-ground responses.

Monitoring following an incident will comprise a survey and appropriate sampling to confirm the nature and extent of the contamination and is to be conducted as soon as practicable (within 24 hours or earlier) after the spillage or disturbance to aquatic habitat. Post incident monitoring will be repeated at weekly intervals until the contaminant is no longer considered to be a threat.

Reference photograph points established prior to works commencing could be useful in showing that floodplain hydrology has remained unchanged by road construction.

A flora and fauna management plan will be developed by the Project Company which will include the frequency and methodology of monitoring and the credentials of the monitoring organisation.

It should be noted that all rainfall run-off from Peninsula Link will be isolated from catchment run-off and treated using water sensitive design practices prior to discharging into receiving

waterways. The roadway stormwater system will have the capacity to temporarily contain the equivalent of a tanker load (50,000 litres) of toxic material from an incident at any point along the Freeway.

Should there be a pollution incident and/or a significant variation in the Dwarf Galaxias population, it will be investigated to ascertain the probable cause and the appropriate mitigation measures will be implemented.

Further monitoring of Dwarf Galaxias is suggested for other potential habitat sites as determined with DSE, in conjunction with Melbourne Water, LMA and an aquatic ecologist.

6.4.4.2 Watsons, Balcombe and Devilbend Creeks

Procedures for monitoring the Dwarf Galaxias population within catchments where Dwarf Galaxias have recently been found (see Appendix 6), including Watsons Ck, Balcombe Ck and Devilbend Ck, during and post construction will be developed in consultation with DSE, Melbourne Water and DEWHA and incorporated into the Project Company Flora and Fauna Management Plan.

Recent monitoring has identified a significant population at Balcombe Creek. This population will be monitored on a monthly basis as per the same frequency as the Tuerong Creek population.

Given Dwarf Galaxias distribution can change markedly and rapidly following flooding and drying events, annual surveys are proposed to occur during the construction phase for other waterways. The sites to be surveyed as part of the annual monitoring program would be selected on the basis of previous survey results, in consultation with DSE and Melbourne Water, to provide an overview of Dwarf Galaxias distribution within and in the vicinity of the alignment. The annual surveys would provide an overview of Dwarf Galaxias distributional changes in the vicinity of Peninsula Link throughout the construction period, therefore assisting the Project Company to implement appropriate mitigation measures where required.

For any additional Dwarf Galaxias populations that may be discovered in the vicinity of Peninsula Link during the construction monitoring period, the size and extent of this population and the potential for this population to be impacted by construction and operation of Peninsula Link will be investigated and the requirement for regular monitoring would be determined in consultation with DSE, Melbourne Water and DSEWPaC.

During the construction period and for two years after construction a yearly Dwarf Galaxia monitoring report will be provided to DSE, Melbourne Water and DSEWPaC for information.

6.5 Benefits of revised measures

At the time of the original submission of the TSMP, the only known population of Dwarf Galaxias was at Tuerong Creek. The TSMP and various mitigation measures were developed to mitigate impacts to the Tuerong Creek population. Additional surveys undertaken during 2010 as a result of the Peninsula Link Project have revealed that the distribution of Dwarf Galaxias has changed and spans across several creek to be traversed by the Peninsula Link Project. These surveys have increased the knowledge of Dwarf Galaxias distribution in the region, and has also resulted in discoveries of new populations and increased knowledge of habitat usage. Flood modelling, in conjunction with recent surveys, has indicated that locations where crossings were previously considered to be important (eg W12 and W13) are no longer required. However, other crossings (eg W19) are of greater priority for fish passage.

A number of waterways will require realignment for various reasons including reducing the potential for scour and erosion. As a result, a series of habitats and enhancements will be created along the Peninsula Link alignment. Such enhancements will include improving the existing bed and bank morphology in consultation with Melbourne Water and DSE. In some instances, habitat will be created to include a combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate and in consultation with Melbourne Water and DSE.

It should also be noted that all of the waterways that are proposed for realignment are currently highly modified/disturbed (eg little riparian vegetation, low diversity of aquatic vegetation, high cover of weeds, existing erosion issues, etc). Once established, the proposed waterway realignments will not only offer suitable habitat to Dwarf Galaxias and other native aquatic fauna species, but will also represent a localised improvement to the condition of these waterways (Biosis Research, 2010a).

Overall, there will be additional refuge pools and habitat created for Dwarf Galaxias, as a result of the Peninsula Link Project.

6.6 Timing and Responsibilities – Dwarf Galaxias

Table 8. Dwarf Galaxias timings and responsibilities

The following table relates to timings and responsibilities for the known population of Dwarf Galaxias at Tuerong Creek, southern end of the alignment, and any additional populations identified during the targeted surveys or during the construction phase (see also Section 5 for further details).

Management Activity	Performance Criteria	Timing	Responsibility
Pre-construction phase	Undertake targeted searches in critical areas, in consultation with DSE.	Pre-construction	Project Company
	Undertake detailed design of any waterway crossing in consultation with DSE and Melbourne Water to ensure habitat connectivity is protected and maintained.	Pre-construction	Project Company
	Develop a Site or Activity Specific Environmental Management Plan for the Dwarf Galaxias population at Tuerong Creek (and any additional populations found as a result of the targeted searches).	Pre-construction	Project Company

Management Activity	Performance Criteria	Timing	Responsibility
	Design the freeway so that run-off is isolated from catchment run-off and treated using 'water sensitive' design practices prior to discharging into receiving waterways.	Pre-construction	Project Company
	Design of the waterway crossing is to allow for unimpeded fish passage and ensure all waterway and floodplain crossings allow for unimpeded Dwarf Galaxia dispersal under flood conditions (where appropriate, in consultation with MW and DSE).	Pre-construction	Project Company
	Train Site Environmental Officer in identification of Dwarf Galaxias and develop a site induction program.	Pre-construction	Project Company
	Implement induction of all staff, contractors and sub-contractors.	Pre and during construction at waterway and wetland areas	Project Company
Construction phase	Reinstate natural overland flows and establish favourable habitat for Dwarf Galaxias at the existing wetland and the realigned sections of the Tamarisk Creek within the Pines Flora and Fauna Reserve.	During and after construction	Project Company
	Revegetate riparian zones within the road reserve in the immediate vicinity of waterway crossings to increase shade and reduce water temperature in consultation with Melbourne Water. Endemic riparian plants from the area will be used where possible in reinstating conditions suitable for Dwarf Galaxias.	During and after construction	Project Company

Management Activity	Performance Criteria	Timing	Responsibility
	Design stormwater/retention ponds (where practicable) to create an aquatic habitat that favours Dwarf Galaxias. The design of stormwater treatment/retention ponds will address risks in relation to water quality and potential impacts to Dwarf Galaxias.	During and after construction	Project Company
	A no-go zone will be established both upstream and downstream of the construction zone. This will encompass the 1 in 100 year flood boundary with an adjacent 20m buffer. Works inside the 1 in 100 year zone will be limited to habitat creation and revegetation (section 6.4.1)	Construction	Project Company
	Maintain upstream or downstream fish passage under vast majority of flow conditions at Tuerong Creek	Construction	Project Company
	Additional crossings to provide fish passage, habitat creation and improvements in bed and bank morphology, where creek realignments are required, as per Table 7, in consultation with MW and DSE. Fish passage no longer required at W12. Crossing for W13 is to be removed.	Construction	Project Company
	Implement the Dwarf Galaxia monitoring and reporting program.	During and after construction	Project Company
	In the event that surveys identify Dwarf Galaxias within water bodies in the construction footprint, then those individuals will be translocated to the nearest suitable permanent water body. This translocation will be undertaken in consultation with a qualified aquatic ecologist, Melbourne Water, DSE and DPI (Fisheries Victoria). Any relocation of Dwarf Galaxias will only be undertaken if approved by DSEWPaC.	During construction	Project Company

Management Activity	Performance Criteria	Timing	Responsibility
	For any additional Dwarf Galaxias populations to be discovered in the vicinity of Peninsula Link during the construction monitoring period, the size and extent of this population and the potential for this population to be impacted by construction and operation of Peninsula Link will be investigated and the requirement for regular monitoring would be determined in consultation with DSE, Melbourne Water and DSEWPaC	During construction	Project Company
	Design and implement fish passage requirements, and meet the specified performance criteria, as identified In Table 7,	During construction	Project Company
	Habitat creation will incorporate an inline habitat pool, where fish passage is given a high priority and where habitat creation is required as identified in Table 7.	During construction	Project Company
	Implement habitat creation requirements as specified for Tuerong Creek (Section 6.4.1) to include the following: ▪ Anabranch with 3 deep pools ▪ Steep sided pools, allowing for shading for cool summer temperatures ▪ Assortment of appropriate submerged and ephemeral aquatic vegetation ▪ Sediment basin to convey treated road run-off to the middle pool.	During construction	Project Company

Management Activity	Performance Criteria	Timing	Responsibility
Post-construction phase	Implement the monitoring and reporting program; report to DSE, DEWHA and LMA. (See section 6.4.4)	Implement at completion of the construction phase	Project Company

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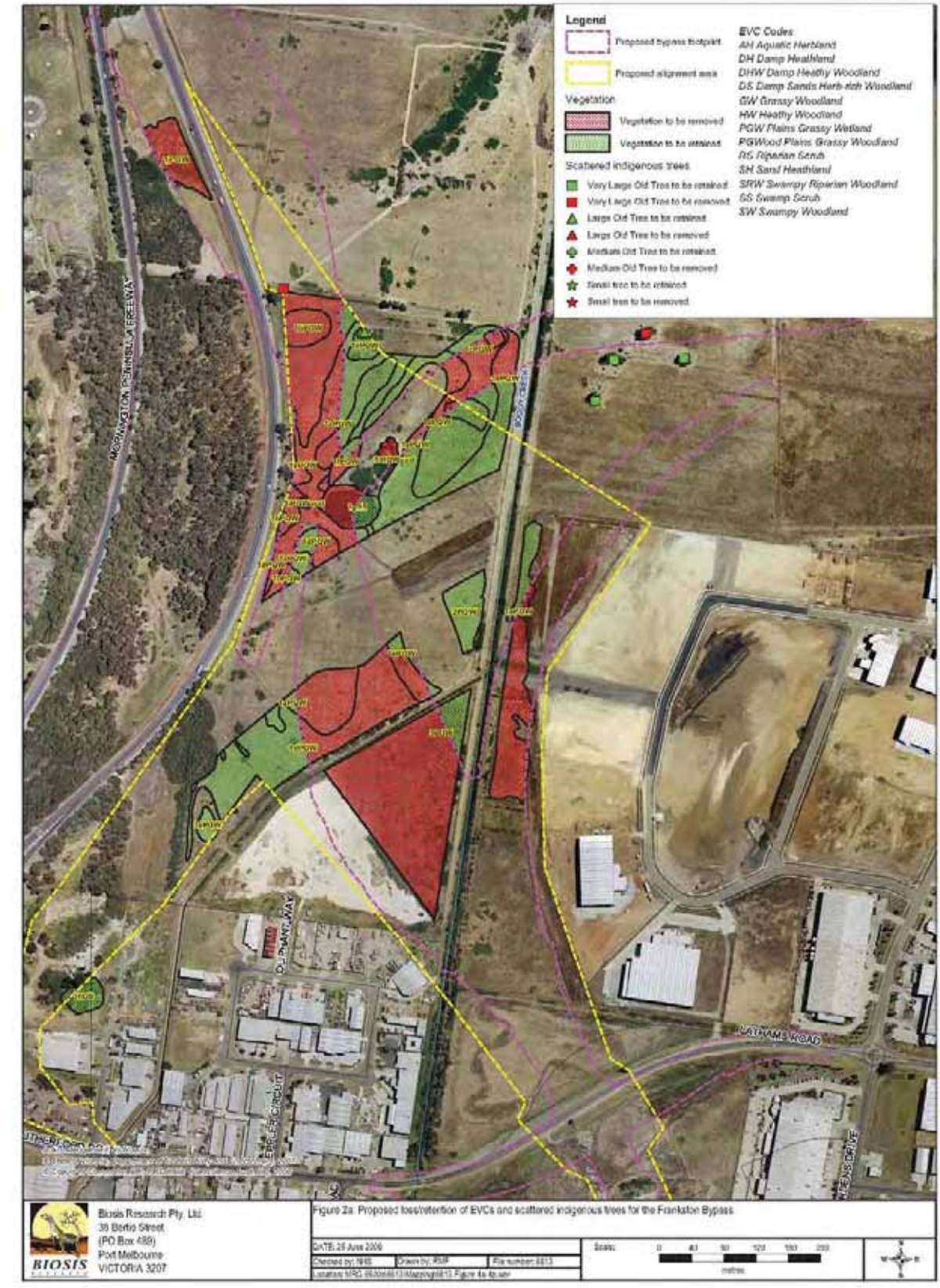
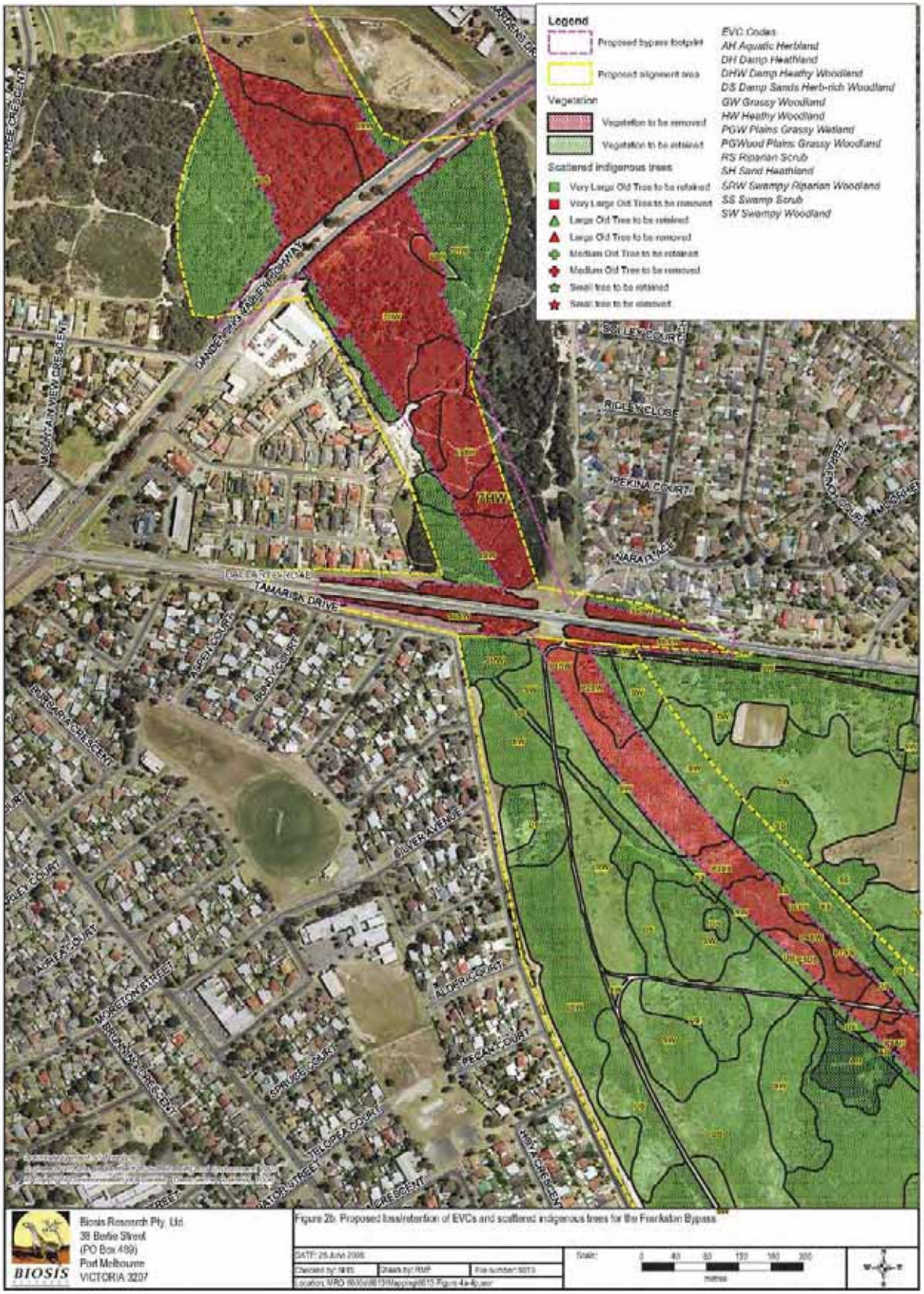
APPENDIX 1. Maps




Legend
Proposed bypass footprint
Proposed alignment area
Vegetation
Vegetation to be removed
Vegetation to be retained
Scattered indigenous trees
Very Large Old Tree to be retained
Very Large Old Tree to be removed
Large Old Tree to be retained
Large Old Tree to be removed
Medium Old Tree to be retained
Medium Old Tree to be removed
Small tree to be retained
Small tree to be removed
EVC Codes
AH Aquatic Herbland
DH Damp Heathland
DHW Damp Heathy Woodland
DS Damp Sands Herb-rich Woodland
GW Grassy Woodland
HW Heathy Woodland
PGW Plains Grassy Wetland
PGWood Plains Grassy Woodland
RS Riparian Scrub
SH Sand Heathland
SRW Swampy Riparian Woodland
SS Swamp Scrub
SW Swampy Woodland
DANDENONG-FRANKSTON FREEWAY
MONTAIR VIEW CRESCENT
SCILLEY COURT
RIDLEY CLOSE
PEKINA COURT
NARAPA PLACE
FRANKSTON-DANDENONG ROAD
TAMARISK DRIVE
ASPEN COURT
BOND COURT
EUCALYPTUS CRESCENT
SILVER AVENUE
ALDER COURT
MORETON STREET
BRUNSWICK CRESCENT
SPRUCE COURT
PECAN COURT
TELOPEA COURT
WATTLE CRESCENT
BATON STREET
LAKE CRESCENT
Biosis Research Pty. Ltd
38 Bevington Street
(PO Box 439)
Port Melbourne
VICTORIA 3207
BIOSIS
Figure 2b: Proposed loss/retention of EVCs and scattered indigenous trees for the Frankston Bypass
DATE: 26 June 2006
Checked by: NHS
Drawn by: RMP
File number: 5013
location: N:\PG 06\5013\Mapping\5013 Figure 4a-4b.aprx
Scale:
0 40 80 120 160 200
metres

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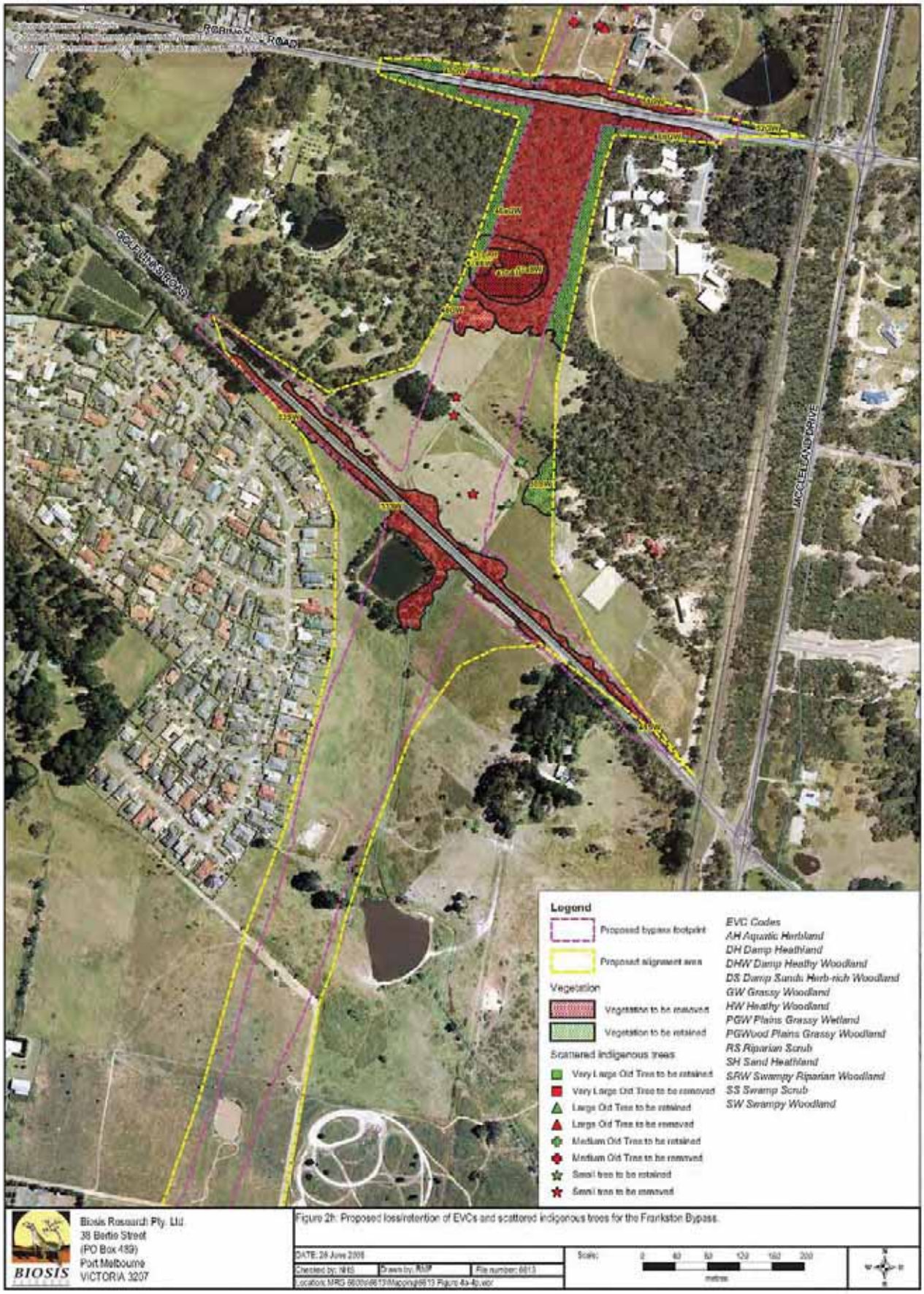
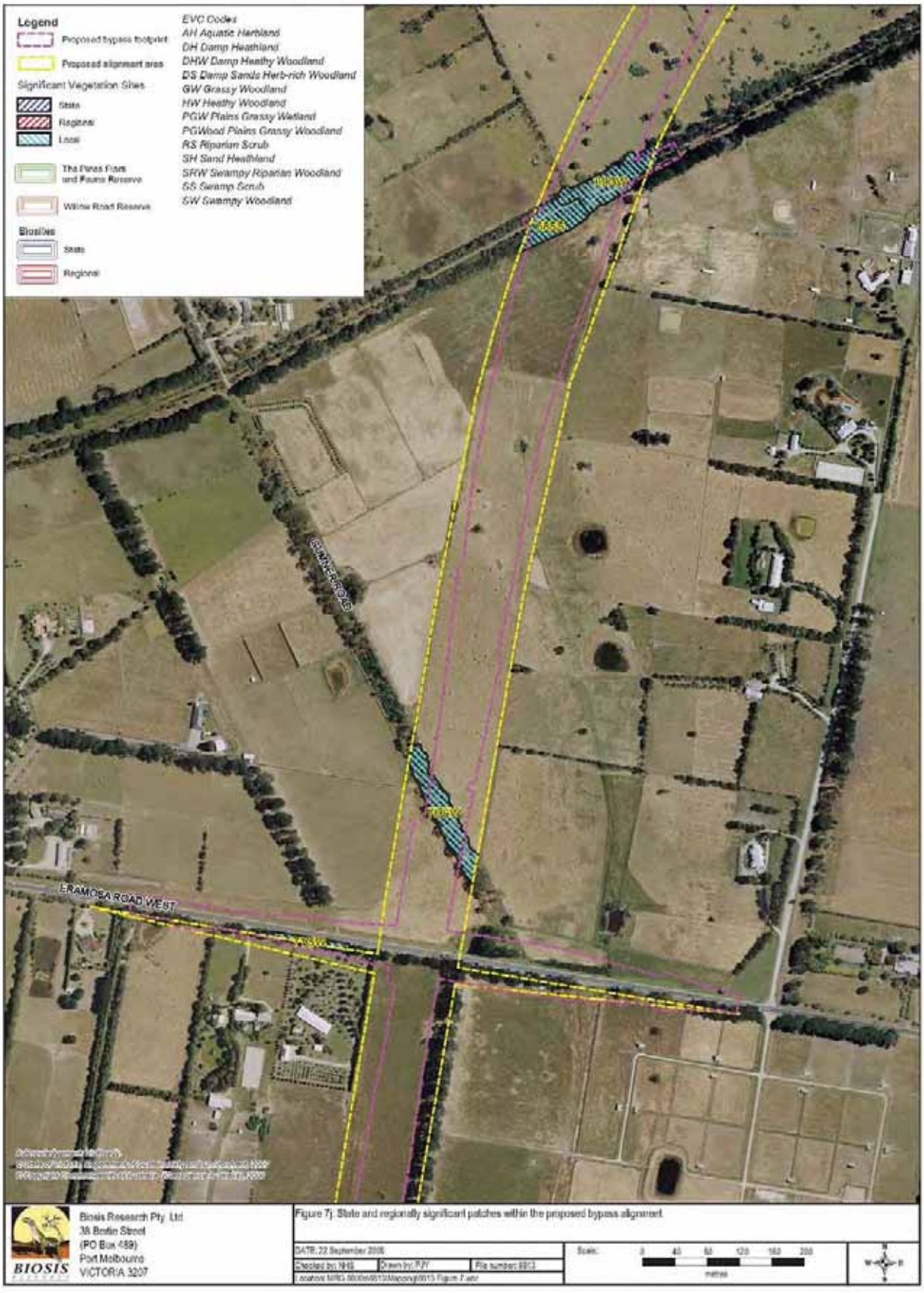
(PO Box 489)
Port Melbourne
VICTORIA 3207

Figure 2f Proposed loss/retention of EVCs and scattered indigenous trees for the Frankston Bypass

DATE: 28 June 2006
Checked by: NHS | Drawn by: RMF | File number: 6913

Scale: 0 40 80 120 160 200 metres


Legend
Proposed bypass footprint
Proposed alignment area
Vegetation
Vegetation to be removed
Vegetation to be retained
Scattered indigenous trees
Very Large Old Tree to be retained
Very Large Old Tree to be removed
Large Old Tree to be retained
Large Old Tree to be removed
Medium Old Tree to be retained
Medium Old Tree to be removed
Small tree to be retained
Small tree to be removed
EVC Codes
AH Aquatic Herbland
DH Damp Heathland
DHW Damp Heathy Woodland
DS Damp Sands Herb-rich Woodland
GW Grassy Woodland
HW Heathy Woodland
PGW Plains Grassy Wetland
PGWood Plains Grassy Woodland
RS Riparian Scrub
SH Sand Heathland
SRW Swampy Riparian Woodland
SS Swamp Scrub
SW Swampy Woodland
COUNTRY SQUIRE
MCCLELAND DRIVE
BIOSIS
Biosis Research Pty. Ltd
38 Bertie Street
(PO Box 439)
Port Melbourne
VICTORIA 3207
Figure 2h: Proposed loss/retention of EVCs and scattered indigenous trees for the Frankston Bypass.
DATE: 26 June 2008
Checked by: NHS
Drawn by: MSP
File number: 6813
Location: M:\BS 6600\6613\Mapping\6613 Figure 4a-4p.wor
Scale:
0
40
80
120
160
200
metres


Legend
Proposed bypass footprint
Proposed alignment area
Significant Vegetation Sites
State
Regional
Local
The Pines Flora and Fauna Reserve
Willine Road Reserve
Biosites
State
Regional
EVC Codes
AH Aquatic Herbland
DH Damp Heathland
DHW Damp Heathy Woodland
DS Damp Sands Herb-rich Woodland
GW Grassy Woodland
HW Heathy Woodland
PGW Plains Grassy Wetland
PGWood Plains Grassy Woodland
RS Riparian Scrub
SH Sand Heathland
SRW Swampy Riparian Woodland
SS Swamp Scrub
SW Swampy Woodland
GUNNERS ROAD
ERAMOSA ROAD WEST
Biosis Research Pty. Ltd
38 Bretin Street
(PO Box 489)
Port Melbourne
VICTORIA 3207
BIOSIS
Figure 7j: State and regionally significant patches within the proposed bypass alignment
DATE: 22 September 2008
Checked by: NHS
Drawn by: PJV
File number: 6913
Scale:
0
40
80
120
160
200
metres

APPENDIX 2. Specific Measures for Recorded Threatened Flora Species

Appendix 2A - Species Management Plan – River Swamp Wallaby-Grass, Clover Glycine, Swamp Fireweed and Purple Blown-Grass

This section gives general mitigation measures should River Swamp Wallaby-grass, Clover Glycine, Swamp Fireweed and Purple Blown-grass, should they be recorded during the targeted searches currently underway. Further general management requirements and guidelines are provided in Section 4 above.

Appendix 2A.1 Management requirements for species to be managed in-situ

In the event that an individual/population of the threatened species listed is located within the construction area but not impacted by physical construction works, a decision will be made as to the feasibility of implementing protection measures in-situ that can assure plant survival and the long term viability of the plant/population (see below for details).

If this is deemed not to be the best possible amelioration for this species the translocation options set out below will be instigated. Please note however that preference is to be given to avoidance, with translocation offered as a final measure.

Appendix 2A.2 Construction Phase guidelines for species to be managed in-situ

In order to minimise any possible impacts the following procedures will be implemented where any plant/populations of the threatened species listed located during targeted searches are to remain in-situ.

During construction, any plants/populations of the threatened species listed located outside of the physical construction works that are to remain in-situ will require the following management:

- Appropriate areas surrounding plants/populations are to be clearly fenced off, gated for maintenance access and protected;
- While physical construction in the immediate area is underway, plants/populations will be inspected on a weekly basis by the site environmental officer (trained by a qualified ecologist) to assess any possible threatening processes that may impact on plant health;
- Records of impacts and threats are to be maintained by the site environmental officer;
- Where threats are observed appropriate actions to address these are to be implemented immediately.

Appendix 2A.3 Post construction rehabilitation for species to be managed in-situ

The following measures will be implemented in order to minimise post-construction threats to threatened species, or populations of threatened species, that are to be retained in-situ.

Potential threats include pedestrian impacts and vandalism, weed invasion, rabbit or herbivore impacts, erosion or other threatening ecological processes. The following management requirements will be implemented:

- Rehabilitation of damaged areas in the vicinity of threatened species are to be implemented – this may include revegetation with suitable companion flora species;
- A GPS location of the plants/population is to be taken and recorded on construction site plans to assist in location identification;
- Permanent fencing should be established to minimise pedestrian damage, and to protect the site from construction or maintenance vehicles;
- Sites will be monitored and maintained for 10 years as part of the Roadside Management Plan..

The in-situ sites are to be managed until the target species are considered stabilised and well established, i.e. at the >70% survival rate and evidence of in-situ recruitment (Vallee *et al* 2004; see also Appendix 2A.7 for details). The need for further management in subsequent years will be reviewed at the end of the 10 year management stage in consultation with DSE (and DEWHA as appropriate) and a plan will be prepared if required.

Appendix 2A.4 Seed collection and propagation

Translocation of threatened plants is generally seen as a difficult and risky process (see Appendix 4 for details). In some cases it may be more appropriate to collect seed from the plants that are likely to be lost due to construction works, and propagate these in a nursery for revegetation within an appropriate site outside of the impact area. The aim of translocation is to ameliorate the loss of the genetics of significant species from sites where permits have been issued for development in present habitat areas. In the case of River Swamp Wallaby-grass, Clover Glycine, Swamp Fireweed and Purple Blown-grass collection of seed may be the most successful method to preserve the genetics of any individuals or populations of these species that may be located in targeted searches.

Where seed collection and propagation is considered the optimum method of translocation, any individuals/populations will be monitored closely for seed collection opportunities from November to December 2009. Seed collection and propagation will be overseen by LMA and subcontracted to a specialist company with experience in projects of this nature.

Seed collection will follow the guidelines set down in the Florabank Code of Practice which provides benchmarks for collection of native seed. (Florabank 2000). Permission will also be sought from both DEWHA and DSE.

Seed collection methods in general will endeavour to achieve the following:

- Collection of seed only from healthy parent plants (Florabank 2000);
- Maximise the genetic quality of seed collected by collecting from as many widely spaced plants as possible (Florabank 2000);
- Collection only from plants separated from others by at least two times the plant height in order to avoid collecting from related plants (Florabank 2000);
- Retention of seeds in paper bags noting species and collection date to be placed in a warm place to encourage drying (Ian Taylor Pers. comm.);
- Placement of seed with a local indigenous nursery for storage and/or propagation over January to April of 2010 to ensure planting in spring 2010; and
- Retention of an adequate number of seedlings in the nursery to be grown on for seed which will provide contingency should the planted population fail.

Revegetation of the targeted threatened taxa will commence once the seed has been successfully collected from the parent plants and 'replacement' tubestock propagated in the nursery. The following planting regime will be followed for planting of seedlings:

- ground to be worked with hand tools to minimise collateral damage;
- seedlings to be placed in close proximity to encourage regeneration;
- seedlings to be watered in to remove any air pockets within the soil;
- identification tags installed for individual plants providing species name, date planted and contact phone number of land manager;
- watering will occur weekly for at least the first month - this should be continued if no significant rainfall occurs until plants are well established;
- plants will be watered at least bi-weekly (for the first month) then weekly (if no significant rainfall) for the first six months after transplanting, using soil wetting agents if required. The watering program, where practicable, is to match as closely as possible seasonal rainfall patterns.

It will be essential to ensure that the seedlings are planted in an appropriate habitat. Ideally, this would be a site that has retained a good cover of groundstorey species that are appropriate to the site's remnant EVC. It will be important therefore to ensure that the recipient sites are not disturbed by this propagation and establishment process (see Appendix 2A.6 below for details).

Appendix 2A.5 Parent plant translocation

Parent plant translocation has not been deemed necessary for Clover Glycine, Swamp Fireweed and Purple Blown-grass.

In the case of River Swamp Wallaby-grass it is advised that several parent plants be removed from each population if located during targeted searches; with the exception of the known population at the Pines Flora and Fauna Reserve where the majority of the plants are to remain in-situ. These parent plants are to be taken to a nursery to be potted up and maintained for seed production as a contingency measure.

A tracking program is to be developed for each of the parent plants selected for transfer to the nursery in order to follow their progress through the collection site - nursery - recipient site transfer process. The tracking program will be used to identify plants and monitor their progress and health during the translocation process.

The following methodology for plant removal is to be followed:

- an ecologist is to be present;
- if dry, plants are to watered the previous day to allow easy excavation and to minimise shock;
- plants are to be removed in summer when they can be easily identified and soils are likely to be dry;
- individual plants will be excavated by hand ensuring that a substantial portion of the rhizome is attached to the aerial shoot;
- the tracking program is to be implemented for each plant collected in the field;
- plants are to be placed in labelled containers indicating species, collection site and the ecologist responsible (with contact details) for their immediate transport to the nursery;
- plants will be potted up in the nursery and grown on for seed collection – labels will be transferred from the collection containers to the potted containers in the nursery.

Appendix 2A.6 Recipient sites

Locations that are floristically, hydrologically and topographically similar to that of the in-situ sites containing threatened species will be made available as recipient sites for the propagated material. Ideally, these would also be sites that have retained a good cover of groundstorey species that are appropriate to the remnant EVCs. It will be important therefore to ensure that the recipient sites are not disturbed by this propagation and establishment process.

The recipient site should also offer protection from threatening processes and should therefore, where possible, be on land already being managed for conservation.

Appendix 2A.7 On-going management of in-situ and translocated plants

Long term maintenance is imperative to translocation success and in-situ threatened species population survival (Vallee *et al.* 2004). This will involve hand weeding and spot spraying. Hand weeding will be done in close proximity to salvaged plants (within one metre) to prepare a buffer zone against spray drift in the event that spot-spraying is required in areas nearby. Any weed spraying would be undertaken with a low pressure back-pack spray unit and a spray nozzle that allows large droplets (less likely to drift onto desirable plants). Spraying is prohibitted during windy conditions.

The recipient sites are to be managed until the target species are considered well established (>70% translocation establishment success and evidence of recruitment (Vallee *et al* 2004); see also Appendix 2A.8 for details). Monitoring and weed control actions will be implemented over a 10 year term as part of the Roadside Management Plan. The need for further management in subsequent years will be reviewed at the end of this stage and a plan will be prepared if required.

Glyphosate would be the herbicide of choice in most instances, as it can be used to control many weeds under label requirements. The method and rate of application makes it a selective herbicide that targets specific species. If broad-leaf weeds are present, an appropriate herbicide for these species will be selected and used as directed. Any chemicals will be used according to label directions.

Maintenance for weed control will be in response to seasonal rains and weed growth. One round will be implemented at the end of the autumn break (June) to address cool season weeds. A second round will be implemented in late winter (August) to address any further weed growth. The last round for each year will occur in late spring (November) to prevent any cool season weeds seeding and/or the establishment of any warm season weeds. Once the summer drought period settles in weed levels will be minimal and little if any maintenance will be required.

For in-situ species the following monitoring information will also be collected:

- Collection of plant survival data for in-situ plants and translocated seedlings;
- Comparison of numbers of germinants between the natural populations and any new populations present;
- Weed cover at each site and the success of the weed control program;
- Identification of threats and actions required / taken to ameliorate these.

Any actions taken to ameliorate threats to in-situ plants are to be developed by LMA and the Site Environmental Officer in consultation with the DSE, DEWHA and the Land Manager.

Translocated plants are to be clearly labelled in the field using fire/rust-resistant tags placed within close proximity of the plants (but far enough away to ensure that the root systems are protected). A consistent system of labelling is to be adopted, for example, labels on spikes to the north of the plants showing species, ecologist responsible (and contact details), GPS coordinates of the plant, and a reference number to the nursery tracking system.

For translocated species the following monitoring information will also be collected:

- Collection of plant survival data for the translocated populations;
- Survival rates of translocated plants and any evidence of recruitment;
- Weed cover at each site and the success of the weed control program;
- Identification of threats and actions required / taken to ameliorate these.

Any actions taken to ameliorate threats to translocated plants are to be developed by LMA and the Site Environmental Officer in consultation with the DSE, DEWHA and the Land Manager.

The results of the monitoring programs will be reviewed by the Site Environment Officer, the Land Manager and LMA and reported to DSE (and DEWHA as appropriate). Actions required to improve the translocation and in-situ management programs will then be formulated and incorporated in the CEMP and SEMPs or instigated by the Land Manager.

Appendix 2A.8 Evaluation

Vallee *et al.* (2004) defines a successful translocation program as one that achieves a > 70% establishment rate within the translocated individuals; this is referred to as the > 70% translocation success threshold. In some instances (where the translocation threshold is not achieved) it may be necessary to supplement the translocation program with revegetation utilising tubestock generated from stored seed sources.

The monitoring regime will be required to determine progress measured against the translocation threshold, and to inform an appropriate response through the delivery of maintenance to ameliorate losses in the translocated plant populations. Ameliorative planting will occur as soon as seedlings can be produced in response to losses in order to ensure that at the cessation of the two year monitoring regime the 70% success threshold has been achieved. Information regarding survival percentages will be delivered both in initial and interim reports, as well as the final overview report. Finally, the GPS location of all threatened species are to be referred to DSE for inclusion in the Flora Information System (FIS).

Table 9. Timelines for translocation program (if appropriate) - River Swamp Wallaby-grass *Amphibromus fluitans*

Timelines for translocation program - River Swamp Wallaby-grass Amphibromus fluitans												
2009 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ideal survey period												
2010 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ideal survey period												
Collection of seed												
Propagation of seed - tubestock												
Reintroduce River Swamp Wallaby-grass seedlings												
2011/2012 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitor translocation plots and/or in-situ sites												
Maintenance translocation plots and/or in-situ sites												
Subsequent 8 years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitor translocation plots and/or in-situ sites	As required											
Maintain translocation plots and/or in-situ sites	As required											
Control weeds	As required											

Table 10. Timelines for translocation program (if appropriate) - Clover Glycine *Glycine latrobeana*

Timelines for translocation program - Clover Glycine *Glycine latrobeana*

2009 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ideal survey period												
Collection of pods/seed												
Identify suitable nursery to propagate material												
2010 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Propagation of seed-tubestock												
2011 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reintroduce Clover Glycine seedlings												
2011/2012 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitor translocation plots and/or in-situ sites												
Maintenance translocation plots and/or in-situ sites												
Subsequent 8 years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitor translocation plots and/or in-situ sites	As required											
Maintain translocation plots and/or in-situ sites	As required											
Control weeds	As required											

Table 11. Timelines for translocation program (if appropriate) - Swamp Fireweed *Scenecio psilocarpus*

Timelines for translocation program - Swamp Fireweed Scenecio psilocarpus

2009 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ideal survey period												
Identify suitable nursery to propagate material												
2010 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ideal survey period												
Collection of seed												
Propagation of seed												
Reintroduce Swamp Fireweed seedlings												
2011/2012 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitor translocation plots and/or in-situ sites												
Maintenance translocation plots and/or in-situ sites												
Subsequent 8 years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitor translocation plots and/or in-situ sites	As required											
Maintain translocation plots and/or in-situ sites	As required											
Control weeds	As required											

Table 12. Timelines for translocation program (if appropriate) - Purple Blown-grass *Lachnagrostis punicea*

Timelines for translocation program - Purple Blown-grass Lachnagrostis punicea

2009 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ideal survey period												
2010 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ideal survey period												
Collection of seed												
Propagation of seed - tubestock												
Reintroduce Purple Blown Grass seedlings												
2011/2012 Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitor translocation plots and/or in-situ sites												
Maintenance translocation plots and/or in-situ sites												
Subsequent 8 years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitor translocation plots and/or in-situ sites	As required											
Maintain translocation plots and/or in-situ sites	As required											

Appendix 2B – Species Management Plan – Maroon Leek-Orchid, Purple Diuris and Frankston Spider Orchid

Three orchid species are covered by this TSMP; the Maroon Leek Orchid, the Purple Diuris and the Frankston Spider Orchid. These target species, and orchids in general, are now threatened in the region due to habitat loss. Orchids are an extremely cryptic species and there is still much to be learned regarding the intricate relationships between specific species of orchids and their pollinators (which can include particular insect species as well as the presence of species specific mycorrizal fungi). Coates *et al*. (2003), Vleck (2006) and Mawson (2007) have been consulted as background to the management guidelines given below for the listed species. No orchids were recorded by Venosta *et al*. (2008), however, if any of the orchid species listed are located during targeted searches which are underway at present, mitigation measures will be required.

Due to the paucity of information regarding the micro-habitat requirements of orchid species the preferred option is to retain and protect on site any plants/populations located during targeted searches. It is important to note that there is much work still to be done in the study of native orchids and therefore the following suggested methodologies are to some extent experimental. Where it is not possible to keep plants in-situ the next option is to translocate directly into suitable habitat nearby that can offer ongoing environmental protection. If no suitable habitat is available nearby then plants are to be promptly moved to the Royal Botanic Gardens (RBG) where they can be 'grown-on' until suitable sites for relocation are found. The Royal Botanic Gardens has agreed in principle to take any orchids located during targeted searches providing funding is made available to cover costs incurred (Pers. comm. Robert Cross). These options are further discussed below.

The decision to maintain any plants or populations of orchids in-situ or to consider translocation either directly to a nearby site or to the RBG will be made by LMA in consultation with orchid experts, DEWHA, and DSE.

Timelines have not been written for orchid species as there is a high degree of uncertainty regarding the locations of appropriate recipient sites and the methodologies presented below provide for many possible outcomes. Target outcomes and performance measures for success are based on Vallee *et al* (2004) where a >70% establishment rate and signs of natural recruitment are indicative of the establishment of a sustainable population.

It is important that all targeted searches, along with all future monitoring and maintenance of orchid populations is only undertaken by orchid experts with experience in native orchid management.

Appendix 2B.1 Management requirements for orchids to be managed in-situ

In the event that an individual or population of a listed orchid is located within the construction area but not impacted by physical construction works, a decision will be made as to the feasibility of implementing protection measures in-situ that can assure plant survival and the long term viability of the plant/population. Retention on site is considered the best possible outcome for these individuals or populations of orchid species provided adequate protection and conservation measures can be implemented.

The decision to maintain orchids in-situ will be made by LMA in consultation with DEWHA and DSE. Monitoring will occur over a two year period and in-situ plants will be managed in consultation with orchid experts, DEWHA and DSE. The monitoring and management will include the following:

- Any located plants or populations are to be fenced off and clearly marked on construction site plans;
- All monitoring is to be undertaken by orchid experts;
- Seed will be collected and taken to the RBG for storage and propagation;
- A small piece of leaf tissue will be collected from each plant to be retained for the DNA bank;
- Some material is also to be collected from the collar (at the base of the leaf) for mycorrhizal analysis and cryostorage.
- Further plant material is to be collected in consultation with the RBG orchid ex-situ propagation and research team and DSE as required for individual species.
- Further on-going maintenance and monitoring requirements are outlined in the sections below.

Appendix 2B.2 Construction phase guidelines for orchids to be managed in-situ

If in-situ retention is deemed to be the best possible amelioration for plants or populations of orchids within the construction area, the following management requirements will be implemented during the construction phase:

- Appropriate areas surrounding plants/populations are to be clearly fenced off, gated for maintenance access and protected;
- While construction in the immediate area is underway, plants/populations will be monitored on a weekly basis by the Site Environment Officer (trained by a qualified ecologist) to assess any possible threatening processes that may impact on plant health;
- Records of impacts and threats are to be maintained by the Site Environmental Officer;
- Where threats are observed, appropriate actions to address these are to be implemented immediately.
- Any actions taken to ameliorate threats to translocated plants are to be developed by LMA and the Site Environmental Officer in consultation with the DSE, DEWHA and the Land Manager.

The results of the monitoring programs will be reviewed by the Site Environment Officer, the Land Manager and LMA and reported to DSE (and DEWHA as appropriate). Actions required to improve the translocation and in-situ management programs will then be formulated and incorporated in the CEMP and SEMPs or instigated by the Land Manager.

Appendix 2B.3 Post construction rehabilitation for orchids to be managed in-situ

The following measures will be implemented in order to minimise post-construction threats to orchids, or populations of orchids, that are to be retained in-situ. Potential threats include pedestrian impacts and vandalism, weed invasion, rabbit or herbivore impacts, erosion or other threatening ecological processes. The following management requirements will be implemented:

- Rehabilitation of damaged areas in the vicinity of threatened species are to be implemented – this may include revegetation with suitable companion flora species;
- A GPS location of the plants/population is to be taken and recorded on construction site plans to assist in location identification;
- Permanent protection, such as fencing or caging (as appropriate), must be established to minimise pedestrian damage, to protect the site and plants from construction or maintenance vehicles, and to control rabbits and other herbivours;
- The fencing / caging structures are to be developed and located in consultation with DSE and the Land Manager;
- Sites will be monitored and maintained for 10 years as part of the Roadside Management Plan.

The in-situ orchids are to be managed until the target species or populations are considered well established, i.e. where there is a >70% establishment rate and evidence of recruitment (Vallee *et al* 2004). The need for further management in subsequent years will be reviewed at the end of the 10 year management stage and a plan will be prepared, if required, in consultation with DSE (and DEWHA as appropriate).

Appendix 2B.4 Parent plant translocation of orchids

Flora translocation is considered a measure of last resort, particularly where the conservation of threatened species are involved (Vallee *et al.* 2004). Success rates are low and there is a severe paucity of data both short and long term to give a sound base from which to determine successful procedures. Translocation of plants will be considered only where alternative protective measures have been considered and permission has been sought from DSE and/or DEWHA (see Appendix 4 for details).

Where a decision has been made to undertake translocation (of individual plants or populations of plants) the following measures are to be undertaken. Firstly, the plants to be translocated are to be monitored in-situ for seed production and the seed collected before any translocation process is implemented. It may also be necessary to hand pollinate and then monitor for seed production, and/or collect a sample of plant tissue as outlined in the protocol in Section 2B.1 above. The decision to implement these measures is to be made in conjunction with LMA and in consultation with DEWHA and DSE.

Following in-situ seed collection, the plants, or clumps of plants, should be removed, and placed in a foam box for transport to the RBG herbarium to be grown on for seed and collection of material from the collar (at the base of the leaf) for mycorrizal analysis and cryostorage (Pers. comm. Gidja Walker). The RBG has agreed in principle to take any Maroon Leek Orchids located during targeted searches providing funding is made available to cover costs incurred (Pers comm. Robert Cross).

The seed collected from plants prior to translocation is to be propagated and new plants translocated to an appropriate recipient site. Outlined below are procedures to be followed for any plant/populations of this species, or other orchids, located during the targeted searches.

Appendix 2B.5 Removal and plant storage of orchids

Timing is to be determined on location of any plant/populations of orchids during targeted survey, however, plants can be removed from the in-situ site after seed set during dormancy. This may be in October/November or mid to late autumn before bud development (Sugarloaf Pipeline Alliance 2008).

Prior to plant removal the following measures will be undertaken:

- any located plants/populations will be identified and fenced off, and protected in the field and well marked on construction site plans;
- all tools used are to be cleaned prior to arriving on-site to ensure no pathogens are introduced to orchids;
- all monitoring is to be undertaken by orchid experts;
- seed will be collected and taken to the RBG for storage and propagation;
- a small piece of the leaf will be collected from each plant to be retained for the DNA bank;
- some material is to be collected from the collar (at the base of the leaf) for mycorrhizal analysis and cryostorage;
- additional plant material is to be collected as required for individual species in consultation with the RBG orchid ex-situ propagation and research team and DSE;
- the area around each plant is to be thoroughly watered on the day prior to salvage in order to ensure that the soil is waterlogged and will stick together when removed;
- dig one spade depth with sharp edged square spade and remove as a block containing several orchids or, dig one spade width and 2/3 of spade depth for individuals.

Then follow one or more of the options below:

Option One – Direct Translocation to suitable site nearby

This option will allow the plant/plants to remain in an area likely to have similar soil micro-biota and may allow the continuation of required symbiotic relationships within the soil. The following measures will be undertaken:

- place plants within blocks of soil into foam boxes for transport directly to the recipient site where they will be planted in prepared holes of the same size to the salvaged blocks;
- replant within 3 hours directly into translocation site; and
- water in thoroughly at replanting to ensure there are no air gaps in the soil (Pers. comm. Russ Mawson, Gidja Walker & Robert Cross).

Where a population of orchids is located and translocation option 1 is agreed on, it may be wise to combine it with option 2 as a contingency, taking a number of the plants (if available) to the RBG to be grown-on. This precautionary measure is advised in the event that some major difference in soil micro-biota may be present in the chosen site.

Option Two – Translocation to Royal Botanic Gardens

This option will facilitate the salvage of plant/plants where no suitable habitat is immediately available near-by. The following measures will be undertaken:

- place plants within blocks of soil into foam boxes for transport directly to RBG (Pers. comm. Russ Mawson, Gidja Walker & Robert Cross);

- carefully transfer the plants from the blocks of soil to pots and grown-on in the nursery;
    - store plants in the 'Growth House' which has a solid roof which allows sunlight:
    - but not rain, which allows controlled watering;
    - has shade mesh that can provide shade when desired in order to control the ambient temperature; and
    - is a locked area providing security.

Further information of translocation techniques is available in Appendix 4.

Appendix 2B.6 Recipient site for orchids

If required a suitable recipient site will be located by LMA in consultation with RBG, DSE, DEWHA and the relevant local authority. The recipient sites chosen should take into account vegetation type, topography, soil composition, hydrology and companion species found in the in-situ location.

Appendix 2B.7 Replanting of orchids

Once a suitable recipient site has been identified the final methodology for translocation can be determined. The method chosen will be dependent on the availability of nearby suitable sites, the health and vigour of the transplant material, and allowance for seasonal variance and soil moisture levels. It will also be necessary to maintain on-going consultation with orchid experts, DEWHA and DSE in order to allow any new beneficial information that may have come to light on other projects to be implemented.

The following planting regime taken from Mawson (2007) will be followed:

- all tools used will be cleaned prior to arriving on-site to ensure no pathogens are introduced to orchids;
- plants are to be planted carefully, to their natural tuber depth in the soil;
- there is to be minimal disturbance of the roots during the planting process;
- the soil around the translocated plants is to be transferred with the plants in order to ensure mycorrhizal transfer;
- plants are to be well watered in to ensure that there are no air gaps around the root systems;

The micro-habitat around translocated plants is to be managed to ensure that natural systems, such as rainfall and watering levels, leaf litter cover, soil moisture, and soil mycorrhizal and organic levels are maintained (see below for watering details);plants are to be labelled (see below) for monitoring and evaluation purposes; translocated plants are to maintained and monitored in accordance with the processes outlined below. Any actions taken to ameliorate threats to in-situ and translocated plants are to be developed by LMA and the Site Environmental Officer in consultation with the DSE, DEWHA and the Land Manager.

Translocated plants are to be clearly labelled in the field using fire/rust-resistant tags placed within close proximity of the plants (but far enough away to ensure that the root systems are protected). A consistent system of labelling is to be adopted, for example, labels on spikes to the north of the plants showing species, ecologist responsible (and contact details), GPS coordinates of the plant, and a reference number to the nursery tracking system.

Appendix 2B.8 On-going maintenance of in-situ and translocated orchids

Long term maintenance is imperative to translocation success and in-situ threatened species population survival (Vallee *et al.* 2004). In the case of orchids this will be undertaken only by orchid experts with experience in managing native orchids. The following general guidelines are to be followed:

- Careful hand weeding with NO USE OF HERBICIDES;
- Woody weeds are to be carefully extracted at seedling stage with minimal soil disturbance;
- Grassy weeds are to be cut at the base with a sharp knife, carefully extracted with minimal soil disturbance, or burnt with a flame thrower prior to orchid leaf emergence;
- Hand-pollination of orchids may occur where deemed necessary by the experts.
- Translocated plants are to be maintained for a minimum of 10 years from the time they are translocated into the chosen recipient site. This would involve a minimum of three visits per year for weed control in the first two years which will occur in conjunction with the monitoring program.

Maintenance for weed control is to be done in the times of year when rains and seasonal conditions encourage weed growth. One round will be implemented at the end of the autumn break (June) to address cool season weeds. A second round will be implemented in late winter (August) to address any further weed growth. The last round for each year will occur in late spring (November) to prevent any cool season weeds seeding and/or the establishment of any warm season weeds. Once the summer drought period settles in weed levels will be minimal and little if any maintenance will be required.

Appendix 2B.9 On-going monitoring of in-situ orchids

In-situ and translocated plants are to be tagged for the monitoring program. The tags are to record (but not limited to) species, site of origin, ecologist responsible for the plant's welfare and translocation program (including contact details), GPS coordinates of the plant, and a reference number to the nursery tracking system. Tags are to be of a fire/rust-resistant material and placed within close proximity of the plants (but far enough away to ensure that the root systems are protected). A consistent system of labelling is to be adopted, for example, labels on spikes to the north of the plants.

For in-situ orchids the following information is to be collected:

- Collection of plant survival data for both translocated plants and seedlings once planted;
- Comparison of numbers of germinants between the natural populations and any new populations present;
- Weed cover at each site and the success of the weed control program;
- Identification of threats and actions required / taken to ameliorate these.

Any actions taken to ameliorate threats to translocated plants are to be developed by LMA and the Site Environmental Officer in consultation with the DSE, DEWHA and the Land Manager.

For translocated orchids the following information is to be collected:

- Monitoring of the translocated population of Orchids over a 10 year period;
- Collection of plant survival data for translocated plants;

- Survival rates of translocated plants and any evidence of recruitment;
- Comparison of numbers of germinates between the natural population and any new populations present;
- Weed cover at each site and the success of the weed control program;
- Identification of threats and actions required / taken to ameliorate these.

Any actions taken to ameliorate threats to translocated plants are to be developed by LMA and the Site Environmental Officer in consultation with the DSE, DEWHA and the Land Manager.

The results of the monitoring programs will be reviewed by the Site Environment Officer, the Land Manager and LMA and reported to DSE (and DEWHA as appropriate). Actions required to improve the translocation and in-situ management programs will then be formulated and incorporated in the CEMP and SEMPs or instigated by the Land Manager. The monitoring program is to be implemented for a 10 year period from the date of translocation.

Appendix 2B.10 Evaluation

In order to ensure the > 70% translocation success threshold (Vallee *et al*. 2004) the monitoring regime set out above will inform appropriate response through the delivery of maintenance to ameliorate losses in the translocated plant populations.

It should however be noted that there are many difficulties associated with the translocation of terrestrial orchids (Vlcek 2006). While re-emergence levels in the year following translocation can indicate short-term survival, flowering levels can also be used as an assessment method (Vlcek 2006). Comparisons between known established populations of these species should be made to measure consistency levels between two or more populations as this will provide further evidence of translocation success (Vlcek 2006). Translocation success can be identified if:

- A population is established at the recipient site; and
- There is an increase in the translocated population through recruitment (Vlcek 2006).

While the collection of data noting germinant numbers in the new population may be difficult to collect, it is this information that ultimately governs the success or failure of the translocation as this is the only true indication that the genetics of the translocated plants are not lost to future generations of the species.

The results of the evaluation program are to be reported to DSE, DEWHA and the Land Manager. Improvements to the translocation ad maintenance programs are to be developed in consultation with DSE and implemented though the CEMP and SEMPs. The GPS location of all threatened species are to be referred to DSE for inclusion in the Flora Information System (FIS).

APPENDIX 3. EVC Seed Collection

The difficulties associated with locating appropriate recipient sites for the threatened species to be revegetated or translocated under this plan should not be understated. There is a considerable list of ecological requirements of suitable recipient sites, such as: a similar (or like-for-like) recipient EVC with a diverse range of companion groundstorey flora; a site with similar soils, aspect, slope and soil mycorrizal fungi make-up; and the time required to ensure translocation and revegetation success. It is intended that such requirements will be located locally, or, if necessary, created within the orchard area at the Pines Flora and Fauna Reserve.

The LMA will therefore be undertaking seed collection, within the patches designated by Venosta *et al.* (2008) for targeted searches, in the 2009/2010 flowering season in order to establish a stockpile of local provenance, indigenous seed for revegetation programs (within the orchard area and for revegetation / landscaping programs within the construction area). Where appropriate, vegetative material, such as seedlings, tubers and rhizomal material, may also be collected as part of the seed collection process. These works will be in addition to the individual threatened species translocation programs (if required) set out above.

There are many ecological benefits of this EVC based seed collection, not least of which is the opportunity to establish a diverse seedbank of rare and endangered EVCs; a resource that would otherwise be lost as a result of the Peninsula Link development. The sites chosen for seed collection will include those habitat zones of higher ecological quality (sites with a habitat-hectare score of 0.4 or greater) and will generally match those that have been selected for the threatened species targeted searches (as identified in Venosta *et al* 2008).

The seed collected is to be stored at a qualified location and made available to the Project Company for revegetation within the construction area landscape sites.

The collected seedbank is also to be made available to the contractors appointed by LMA for revegetation works within the orchard area. Pre 1750 EVC mapping suggests that the orchard area once consisted of Heathy Woodland/Hills Herb-rich Woodland Complex (EVC 584). Further survey will be required prior to the revegetation program in order to confirm the pre-1750 EVC makeup of the revegetation site(s), and to define the planting schedules for the establishment of a mosaic of EVC habitat. This work is yet to be completed. Subsequently, the seed collection from within impact sites within the construction area will focus on:

Maximising the efficiency of the seed collection process through the targeting of high quality remnant sites (that are likely to have a high diversity of species with the highest potential for seed production and volume);

- Maximising the range of taxa of parent plant seed sources;
- Targeting threatened species (that are not being translocated) and locally rare taxa for seed sources; and,
- Collecting seed from species that are suited to heathy woodland EVCs.

There is also potential for the collection of vegetative material (such as seedlings, tubers, and cuttings of plants) of locally rare or significant species that can be stored at an appropriate facility for later translocation to appropriate revegetation sites within the orchard area. Similarly, there is potential also to focus on the collection of seed from taxa that would be suited to the establishment of Southern Brown Bandicoot habitat.

The targeted search areas include high quality vegetation of various EVC's and are expected to yield higher quantities of healthy, genetically diverse parent plants across a diverse range of species. The 16 sites for targeted survey of the threatened species listed by Venosta *et al.* (228) include:

- Patches 1a, 1b, 1c, 1d, 1e, 1f, 1j, 3 - Plains Grassy Wetland - and 46a - Grassy Woodland - are listed as *Endangered* EVC's;
- Patches 1a, 1b, 1c, 1f, 1j, 3 - Plains Grassy Wetland remnants;
- Patch 45 & 46a - Grassy Woodland;
- Patches 6 and 6a - Sand Heathland - are listed as Rare EVC's; and
- Patch 32h Heathy Woodland, Patch 43 Damp-sands Herb-rich Woodland and Patch 47b Aquatic Herbland.

These patches provide a diverse range of EVC's with a range of species that would be suitable for the orchard revegetation program. These patches will therefore be the focus of the seed collection program (but not necessarily limited to these sites).

As mentioned in the species-specific management plans above, there is some possibility that threatened species located in the construction area will not flower this season; this is of particular concern with orchid species. Collecting seed from the EVC's that provide habitat for threatened species offers the opportunity to provide a resource for sensitive rehabilitation and/or restoration of other known populations of these species.

Targeted searches are currently underway for the threatened species identified in the plan. These search efforts may also be utilised as a reconnaissance to identify parent plants for seed collection.

Seed collection methods in general will endeavour to achieve the following:

- Permission is to be sought from DSE and DEWHA prior to seed collection taking place;
- Seed will only be collected from healthy parent plants (Florabank 2000);
- The genetic quality of seed collected will be maximised by collecting from as many widely spaced parent plants as possible (Florabank 2000);
- Collection will be from parent plants that are separated from other parent plants by at least two times the plant height (this is in order to avoid collecting from related plants) (Florabank 2000);
- Seed will be retained in paper bags noting species and collection date and placed in a warm location to encourage drying prior to delivery to a suitable storage facility (Pers. comm. Ian Taylor);
- Seed storage will be contracted to the Royal Botanic Gardens or a reputable local indigenous nursery with the appropriate facilities.

Please note that there is no tracking or reporting requirement attached to the seed collection program.

Appendix 3.1 - Summary

In summary, the seed collection program will be coordinated by LMA over the 2009/2010 flowering season in the 16 areas recommended by Venosta *et al.* (2008) for targeted searches. The objective will be to provide:

- a seedbank resource of high quality, quantity and diversity;
- a seedbank for EVC based revegetation of the 16 ha orchard area of The Pines Flora and Fauna Reserve;
- a seedbank for revegetation / landscaping within the construction area;
- a seedbank for Southern Brown Bandicoot habitat rehabilitation;
- to provide opportunity for habitat enhancement for any listed threatened flora species that may require translocation; and
- to maximise the opportunity to recover the genetic resource inherent within rare and endangered EVC habitat zones that are to be lost due to the Peninsula Link development.

APPENDIX 4. Overview of Translocation

Flora translocation is considered a measure of last resort, particularly where the conservation of threatened species are involved (Vallee *et al.* 2004). Success rates are low and there is a severe paucity of data both short and long term to give a sound base from which to determine successful procedures. Translocation of plants will be considered only where alternative protective measures have been considered and permission has been sought from DSE and/or DEWHA.

The three types of translocation for conservation purposes according to Vallee *et al*. 2004 are:

- Enhancement: An attempt to increase population size or genetic diversity by adding further individuals to an existing population, also known as reinforcement.
- Re-introduction: An attempt to establish a population on a site where it formerly occurred, but it is now extinct.
- Conservation introduction: an attempt to establish a species, for the purpose of conservation, on a site where it is not known to occur now or to have occurred in historical times, but which is considered to provide appropriate habitat for the species.

The following methodologies have been devised taking advice from the following taken from Vallee *et al.* 2004:

'Translocation is the deliberate transfer of plants or regenerative plant material from an *ex situ* collection or natural population to a location in the wild, including existing or new sites or those where the species is now locally extinct.' 'Translocation is not an alternative to *in situ* conservation and is not a suitable ameliorative, compensatory, or mitigating measure for development.' 'Attempts to translocate threatened plants have generally been unsuccessful for several reasons, including:

1. failure to adequately control or manage the original threats affecting the species or habitat;
2. lack of adequate consideration of the biological and ecological requirements of the species;
3. use of inappropriate translocation methods, for example the salvage of mature plants when the use of seeds or cutting material may have been more appropriate;
4. failure to use an experimental approach;
5. absence of an ongoing commitment of resources to monitoring, evaluation and follow-up maintenance;
6. failure to consider genetic variability, which may influence chances of translocation success in both the short and long term.'

The end result, and therefore the position of salvaged genetic material, can have varied outcomes, from:

1. well monitored projects that follow a scientific process that are adequately funded and focus on the establishment of self-sustaining populations, to
2. ill considered poorly planned translocations that are unmonitored and unmanaged where resources are lacking and any hope of establishing self-sustaining populations is highly unlikely.

Successful establishment of self-sustaining plant populations in recipient sites cannot be guaranteed anywhere across this spectrum due to the many variables associated with the ecological disturbance created by translocation. Attempts to translocate threatened plant populations in Australia have been generally unsuccessful (Vallee *et al*. 2004, Morgan 1999). Therefore where translocation has been accepted as the only method of retaining the genetics of populations to be the methodology should be scientifically based rather than haphazard plant-outs that are ineffective in the longer term and may interfere with the ecology of the recipient site (Vallee *et al*. 2004). For these reasons translocation should be considered only as a last resort when all other options are deemed inappropriate or have failed. In this instance translocation is seen as a compensatory measure as an attempt to establish a population due to the impact of development (Vallee *et al*. 2004).

As per Vallee *et al*. (2004) assessment of translocation options should include the following:

1. Resource availability and cost

In order to provide the best possible parameters for a successful translocation the process must be adequately funded. The costs associated with adequate ecological surveys, site preparation and actual translocation must also be supported by long-term maintenance and monitoring of the recipient site.

2. Translocation Process

Evaluation of previous attempts of translocation of the particular species to be salvaged for success or failure should be explored to ameliorate past mistakes.

3. Availability of recipient sites

Surrounding vegetation, rainfall, soil and geology give obvious parameters for investigation of recipient site requirements along with micro-habitat specifics. However current maintenance of the recipient site, along with scope for long term maintenance and monitoring, compound the difficulties in locating appropriate recipient sites for successful translocations to occur.

Ecological requirements must be complimented by long-term legal protection if translocated populations are to endure.

4. Ecological integrity

The ecological integrity of the recipient site must be maintained; any plantings must be site indigenous with consideration also given to possible genetic variables that could be damaging to populations hosting translocated plants.

Translocation methodology must ensure that adequate hygiene measures are taken to lesson the threat of weed and pathogen introduction.

APPENDIX 5. Fish Passage and Impact Mitigation Approaches for Dwarf Galaxias

September 2010

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Fish Passage and Impact Mitigation Approaches for Dwarf Galaxias

Peninsula Link Project

Natural & Cultural Heritage Consultants 38 Bertie Street (PO Box 489) Port Melbourne Victoria 3207

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Report to Abigroup Contractors

Fish Passage and Impact Mitigation Approaches for Dwarf Galaxias

16 September 2010

Prepared by

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Project no. 11234

Cover photo: Transient Dwarf Galaxias floodplain habitat between the Balcombe and Watson Creek catchments looking north from W19A, Baxter.

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1.0 BACKGROUND

The Threatened Species Management Plan (TSMP) (Practical Ecology 2009) outlines management requirements for Dwarf Galaxias within the Peninsula Link project area including mitigation measures, habitat enhancement and monitoring requirements.

For the most part, the requirements of the TSMP that relate to Dwarf Galaxias have been or will be adhered to. However, as part of the detailed design process it has been identified that certain elements of the TSMP require refinement. Changes to the TSMP require approval by the relevant regulatory authorities including the Department of Environment, Water, Heritage and the Arts (DEWHA) and the Department of Sustainability and Environment (DSE)..

The objectives of this report are to:

- provide an update on Dwarf Galaxias distribution within and in the vicinity of the Peninsula Link alignment (Section 2);
- discuss and propose new fish passage arrangements for the W12 and W13 crossings of the upper reaches of Watson Creek (Section 3);
- outline the waterway crossing plans for Tuerong Creek (Section 4);
- discuss and provide an overview of channel realignment requirements (Section 5);
- discuss the modification of Dwarf Galaxias habitat in the upper reaches of Watson Creek and outline proposed offset measures (Section 6); and
- provide an overview of fish passage requirements and fish passage design features (Section 7).

2.0 PENINSULA LINK DWARF GALAXIAS DISTRIBUTION

Following completion of the Environmental Effects Statement (EES) investigations, the only location that Dwarf Galaxias were known to occur in the immediate vicinity of the Peninsula Link alignment was at Tuerong Creek. However, Biosis Research (2008) acknowledged the limitations of snap shot surveys and the potential for the species to occur at many locations in the vicinity of Peninsula Link, particularly within the unnamed upper tributaries and drains of the Balcombe Creek Catchment. Subsequently, Biosis Research (2008) recommended follow up targeted survey for this species occur well before commencement of construction (summer 2008/autumn 2009).

These surveys did not occur prior to awarding the construction contract to Southern Way, however during investigations for other projects, Biosis Research recorded Dwarf Galaxias at two other locations of relevance to Peninsula Link; a tributary of Balcombe Creek, and Devilbend Creek (See Figure 2). The Balcombe Creek tributary records were indicative of a large population, that extends within the alignment at W20 during wet conditions (i.e. winter/spring), while the Devilbend Creek record was located approximately 2km downstream of the alignment but increased the likelihood that the species could recolonise the area in the immediate vicinity of the Peninsula Link alignment given suitable conditions.

In the Frankston area, winter 2010 has been the wettest since at least 2004 and possibly since 1996 (Bureau of Meteorology 2010) with local landholders reporting overtopping of dams for the first time in approximately 15 years. For Dwarf Galaxias, an opportunistic short lived species known to disperse readily and spawn under such conditions, these conditions appear likely to be the best they have are experienced over the same time frame. Subsequently the distribution and abundance of this species in the vicinity of Peninsula Link is likely to change markedly.

Recent surveys for the Peninsula Link Project indicate this to be the case, with the species now being recorded at multiple locations in the upper reaches of Watson Creek, Baxter in the vicinity of W18A, W19 and W19A. Records were obtained from permanent and semi-permanent waterbodies and adjacent floodplains. Other records include an upper tributary of Watson Creek approximately 400m downstream of W15, and from upper reaches of Balcombe Creek less than 1km downstream of W22 (See Figure 2).

Recording Dwarf Galaxias from multiple new locations like this demonstrates the ability of the species to recolonise habitat under suitable conditions but it does not necessarily imply that all of these new locations are particularly

important to the species. The habitats from which Dwarf Galaxias were recorded vary considerably. Based largely on anecdotal evidence Dwarf Galaxias habitats could perhaps be categorised as follows:

- transient habitat for movement only – typically ephemeral habitats that flow following inundation and/or do not retain pooled water for sustained periods or habitats dominated by faster flowing hydraulic habitats (e.g. riffle/run) than the no flow/slow flow hydraulic habitats (e.g. backwater/pool/glide) preferred by Dwarf Galaxias.

- spawning habitat only – typically ephemeral habitats with abundant aquatic or fringing terrestrial vegetation (e.g. grasses) that pool for sustained periods (weeks-months) following inundation but ultimately contract back into short or long term refuge habitats.

- short term refuge habitat:

    - habitats that are typically re-colonised following a flooding event, but that only retain water for months or throughout wet years, resulting in loss of that population during a dry year unless a subsequent flow/flooding event allows them to disperse beforehand; or

    - habitats that retain water for longer periods but do not have the required attributes likely to be required to support a self sustaining population of Dwarf Galaxias. Attributes that are likely to be important for Dwarf Galaxias spawning and recruitment are likely to include hydrological regime, connectivity with ephemeral habitat, the degree of cover provided by aquatic and fringing terrestrial vegetation, and the presence/abundance of predatory species (e.g. Redfin and Eastern Gambusia).

- long term refuge habitat – habitats that retain water for years and have a self sustaining population of Dwarf Galaxias. Typically these are perennial waterways, or the deepest pools within an ephemeral waterway, or a dam or wetland on a floodplain. Dwarf Galaxias populations in these habitats are typically referred to as source populations, since it is these populations that persist during dry conditions and from which Dwarf Galaxias will again disperse during suitable conditions (e.g. flood). The size and viability of Dwarf Galaxias populations in these refuge habitats is likely to be heavily influenced by a range of factors including habitat size, hydrological regime (e.g. water level variability and timing), the degree of cover provided by aquatic and fringing terrestrial vegetation (cover/diversity), and the presence

of predatory species (particularly Redfin and Eastern Gambusia).

The likely habitat categories for recent (i.e. Post EES) Dwarf Galaxias records in the vicinity of Peninsula Link are shown in Figure 3. These likelihoods have been assigned on the basis of water permanence, habitat suitability and the presence of predatory species. Of the known Dwarf Galaxias records in the vicinity of Peninsula Link, only a few of these are likely to be long term refuge habitats.

Flood modelling studies undertaken for Peninsula Link revealed that the Balcombe Creek and Watson Creek catchment currently interact during flooding events. This interaction occurs in the flood prone area south west of Baxter (See Figure 3). The average recurrence interval (ARI) for the flooding event that causes this interaction is greater than 10 years (*Andi Boyce pers. comm.*) and it appears that this occurred over the last couple of months. This interaction between the Balcombe and Watson Creek catchments is perhaps the most likely means by which Dwarf Galaxias have colonised the upper reaches of Watson Creek. However, alternative explanations include:

- an upstream migration from the short term refuge habitat (Grant Road) or an unknown long term refuge habitat located within Watson Creek;
- a floodplain migration from a wetland or dam in the vicinity. Dwarf Galaxias were recorded from two such habitats in recent weeks however it is currently unknown whether these offer short or long term refuge habitat or whether they too were colonised in recent months from another source.

Alternatively it is possible that a small population of Dwarf Galaxias may have occurred for a long period of time in the vicinity of W19 but the abundance was low enough that it was not detected during the EES surveys.

The current conditions are likely to have resulted in extensive re-distribution of Dwarf Galaxias in the Balcombe Creek catchment and perhaps even the Devilbend Creek catchment. Anecdotally, Dwarf Galaxias appear to seek upstream movement during flow/flood events. Upstream migration of Dwarf Galaxias in the Balcombe Creek catchment is likely to increase the potential habitat usage in the vicinity of Peninsula Link crossings W21 and W22 (see Figure 3). Although recent survey did not detect the species within the alignment itself, new records were detected nearby and it is presumed that the W21 and W22 crossings currently offer at least transient habitat for the species.

Upstream migration of Dwarf Galaxias in the Devilbend Creek catchment could potentially result in re-colonisation of habitat in the vicinity of Tuerong Rd (W26) and even usage of habitat in the vicinity of Derril Rd (W25) (see Figure 3). Recent surveys did not detect the species in the vicinity of either alignment

but there remains a moderate potential for this to occur in the future and some potential that the species was there in low abundance and was not detected.

3.0 W12 AND W13 FISH PASSAGE

The TSMP (Practical Ecology 2009) outlines specific fish friendly culvert design features for the upper Watson Creek tributary crossings W12 and W13. These crossings together with W10, W15, W18 and W19 are all heavily modified upper tributaries of Watson Creek however the TSMP only specified fish friendly culvert design requirements for W12 and W13 (See Figure 4).

With regard to fish passage, the current habitat and connectivity conditions of these crossings are outlined below. This information is provided on the basis of mapping (e.g. fine scale hydro layers, topography), aerial photography, fish database searches/fish survey results and on the ground assessment/knowledge of these crossings obtained from Frankston Bypass EES investigations (Biosis Research 2008) and during more recent investigations (e.g. Dwarf Galaxias targeted surveys).

- W10 - Approximately 390m of mapped waterway (i.e. on the 1:25,000 VicMap hydro layer) exists upstream (west) of this Peninsula Link crossing. This 390m is highly ill defined, not discernable on aerial photography and may not be discernable on the ground. It terminates at an online dam, beyond which the catchment consists of an underground residential drainage network. We consider fish passage to be warranted at this crossing but have assigned it a low priority. Refer to Section 6 for further details.

- W12 – Approximately 40m of mapped waterway exists upstream (west) of this Peninsula Link crossing. The 40m is channelised, highly ephemeral and since the EES investigations, has been modified to incorporate a retarding basin, beyond which the catchment consists of an underground residential drainage network. We consider fish passage not to be warranted for this crossing given the lack of connected habitat (or opportunities to create connected habitat). Refer to Section 6 for further details.

- W13 – Approximately 150m of mapped waterway exists upstream (west) of this Peninsula Link crossing. The 150m is ill-defined, undiscernible on aerial photography, undiscernible on ground and is connected to habitat of a similar nature downstream which is in turn isolated from the rest of the downstream catchment by a piped network under Baxter (See Figure 3). It is proposed that this crossing be removed and flows redirected to WBT1 (refer to Section 3.1). We consider fish passage to be warranted for WBT1 but have assigned it a low priority. Refer to Section 6 for further details.

- W15 - Approximately 250m of mapped waterway exists upstream (north west) of this Peninsula Link crossing, beyond which the catchment consists of an underground residential drainage network. Approximately 50m

downstream of the crossing, the waterway is again piped underground for approximately 450m. This waterway is ephemeral but does have a well defined channel. We consider fish passage to be warranted for this crossing but have assigned it a low priority given the 450m of piped network immediately downstream is likely to constitute a significant existing barrier to fish passage. Opportunities to remedy this are not feasible given that Melbourne Water are currently undertaking works to upgrade the capacity of this underground system to mitigate flooding to properties within the Baxter region and have expressed no intention of reverting to an above ground system.

- W18 – Approximately 20m of mapped waterway exists upstream (north – west) of this Peninsula Link crossing, beyond which the catchment consists of an underground residential drainage network. This waterway is ephemeral but does have a well defined channel. Despite the lack of connected instream habitat, we consider fish passage to be warranted for this crossing given the habitat connects during flood to adjacent habitats that support Dwarf Galaxias. This crossing has been assigned a medium priority for fish passage.

- W19 – Approximately 50m of mapped waterway exists upstream (north-west) of this Peninsula Link crossing, beyond which the catchment consists of an underground residential drainage network. This waterway is ephemeral but does have a refuge pool and is now confirmed to support a breeding population of Dwarf Galaxias. We consider this crossing to warrant fish passage and have assigned it a high priority.

In summary, despite being identified in the TSMP (Practical Ecology 2009) for special treatment with regard to the provision of fish passage it is evident that W12 and W13 are two of the less important crossings in the upper Watson Creek catchment. This is supported by recent surveys in the area. The highest fish passage priorities in this catchment are the W19 crossing and the associated floodplain (W19A, W18A, W18). W12 does not warrant fish passage at all due to lack of connected upstream habitat and a lack of opportunities to rectify this situation. W13 is a low priority for provision of fish passage under current conditions and this crossing is proposed to be removed and flows redirected to WBT1 (see Section 3.1).

The importance of maintaining fish passage in the upper Watson Creek catchment as outlined within the TSMP is acknowledged and some of the culvert construction specifications will be used for a number of crossings throughout the Peninsula Link alignment (See Figure 3). However, the provision of fish passage needs to consider the current situation together with future constraints and opportunities for enhancement. It is proposed that the fish passage requirements

for crossings W12 and W13 be ascertained in accordance with the same processes being applied to all other waterway crossings throughout the alignment (See Section 7), and that the specific requirements outlined for W12 and W13 in the TSMP be removed.

3.1 W13 Flow Redirection

Due to residential flooding issues in Baxter and the Baxter West Drainage Scheme (2323), Melbourne Water has informed Abigroup that in consideration of the local hydraulics and hydrology, the W13 crossing is no longer required and flows are to be redirected towards W15 (see Figure 4). Initially, the flow path in this area was unclear and based on the VicMap 1:25,000 hydro layer the flow redirection was considered likely to result in a flow increase in one tributary of Watson Creek, and a corresponding decrease the other tributary of Watson Creek (see Figure 4).

Subsequent on ground investigations have revealed that W13 does not occur on a clearly defined waterway and desktop investigations have revealed that the flow path differs considerably from the hydro layer (Andi Boyce. *Pers. comm*. - see Figure 4). Rather than the flow redirection resulting in hydrological changes to two tributaries (i.e. an increase in one and a decrease in another), the flow redirection would actually result in a flow increase to a piped network and no net change to either tributary. The flows would effectively be discharged to the same tributary as is currently the case but the discharge point would be located approximately 450m upstream (See Figure 4).

A population of Dwarf Galaxias was found to occur in the immediate vicinity of the existing discharge point (See Figure 4). As there would be no net increase or decrease in flow volume or rate as a result of this flow redirection (only a change in the direction the flows are coming from within the piped network) then it is considered unlikely that there would be any impact to any aquatic habitat or Dwarf Galaxias population. However, as the flow redirection would result in changes to surface flows and reduced flooding downstream of W13 there may be associated changes/impacts to vegetation and habitat for some fauna (e.g. frogs) in the affected area between Peninsula Link and the residential area (Approximately 500m). The flora and terrestrial fauna values in the affected area are expected to be minimal and any impacts would be offset by the creation of habitat as described below, however further investigations are currently underway to confirm this. The outcome of these investigations will be provided in a letter report and connectivity issues are discussed in the Habitat Connectivity Report (Biosis Research 2010a).

It should be noted that the flow redirection to W15 will result in the creation of a swale drain on the western side of the Peninsula Link (within the land

availability boundary) between W12 and W15. To offset/compensate for the redirection of W13 flows and any potential impacts this may have on flora and fauna the swale drain will connect with the existing open channel system upstream of W15 prior to the point at which W15 will flow into the Melbourne Water piped system (See Figure 4). Wetland habitats and refuge habitats will be created at regular intervals within the grassed swale in a similar manner and design process to that described for Tuerong Creek (see Section 4) and would involve planting with wetland species and creation of refuge pools. This redirection of flows to the channel upstream of W15 may increase the permanence of a small section of ephemeral channel habitat, enhancing the ability of the habitat to support Dwarf Galaxias and to be used as spawning habitat for some frog species, while creation and linking of new habitat in the swale drain may benefit both Dwarf Galaxias and the local frog community. Dwarf Galaxias have some limited potential to colonise these habitats during suitable conditions (i.e. flood) from connected habitat or alternatively these habitats may ultimately offer a suitable translocation site for the species.

4.0 TUERONG CREEK CROSSING

Tuerong Creek is located in the southern section of the alignment. Tuerong Creek is an ephemeral waterway with an ill-defined channel within and in the immediate vicinity of the alignment; however a Dwarf Galaxias refuge habitat exists approximately 100m downstream. As discussed in Section 2, at the time of the EES, the Tuerong Creek Dwarf Galaxias population was the only population located in the vicinity of Peninsula Link and was considered to be the largest and most important known population in the Balcombe Creek catchment. During the EES process the original Peninsula Link alignment was moved approximately 100m north to avoid direct impacts to this habitat. The subsequent TSMP (Practical Ecology 2009) also specified a number of mitigation measures for this crossing including a monitoring program and a number of elements to be incorporated into the design. The monitoring program is the subject of a separate report (Biosis Research 2010b) and is not discussed further

It should be noted that ongoing viability of the Tuerong Creek Dwarf Galaxias population is precariously balanced due to its isolation, small area of habitat and susceptibility to summer desiccation. Subsequently, in recent years, water levels have been monitored by Melbourne Water/volunteers and artificially supplemented when required. The use of Bebo Arches combined with the creation of Dwarf Galaxias refuge habitat (within the alignment) and likely subsequent establishment of a second Tuerong Creek Dwarf Galaxias population was considered a positive outcome for the species in the catchment.

The proposed Tuerong Creek crossing includes four Bebo Arch structures for the split carriageways, onramp and offramp (see Figure 7, 8 and 12). The carriageways will consist of 21m x 7m Bebo Arches, while the ramps will be 15m x 5m Bebo Arches as the vertical clearance of the original ramps could not be accommodated with the required tie-ins to existing roads without compromising compliance with appropriate design safety standards. Additionally Tuerong Creek will require a minor realignment through the structures to achieve an appropriate hydraulic outcome (minimise scour/erosion etc.).

As discussed, the major means by which impacts to Tuerong Creek will be offset is via creation of Dwarf Galaxias refuge habitat upstream of the of Peninsula Link freeway but within the Peninsula Link land availability boundary (See Figure 8 and 9). Offsetting the impacts associated with the proposed structure will be achieved through creating Dwarf Galaxias refuge habitat. The proposed design will essentially replicate natural Dwarf Galaxias refuge habitat and is based on the attributes of the Tuerong Creek refuge habitat, but also draws

broadly on attributes of other refuge locations in the Balcombe Creek catchment and other catchments.

The Tuerong Creek crossing designs including concept drawings for Dwarf Galaxias habitat creation are presented in Figures 7-12. Essentially the Dwarf Galaxias habitat consists of:

- An artificial anabranch (i.e. a parallel second channel) which would be created to convey low flows (the existing channel would become a high flow channel only)(See Figures 8 and 9).
- Within the anabranch there would be three deep pools interspersed by ephemeral habitat (See Figure 9 and 11).
- The pools would be steep sided and deep (See Figure 10 – LD2) to allow for moderate to heavy shading by fringing Swamp Paperbark (to be planted). The shading and depth is intended to ensure permanence and provide relatively cool summer temperatures which should suppress the size of the Eastern Gambusia population (one will inevitably establish).
- The slope between pools would be gentler to allow for establishment of more extensive areas of aquatic vegetation (See Figure 10 -LD3 and Figure 11). An assortment of appropriate submerged and ephemeral aquatic plants with varying hydrological requirements would be planted on pool slopes and interspersing ephemeral zones. The ephemeral zones would typically be inundated over winter/spring and provide an extension of suitable spawning habitat for Dwarf Galaxias.
- A sediment basin and rain garden would be strategically located to convey treated road runoff directly to the middle pool (See Figures 7-9). This would supplement the low summer flows typically experienced by this system and help to increase the permanence of the created habitat in two of the three pools.

In addition to the Dwarf Galaxias habitat creation a number of other measures have been incorporated into the design to minimise/offset impacts:

- The carriageways were split and the distance between them was increased to improve light penetration and promote instream and riparian vegetation growth between the structures.
- The area of Tuerong Creek to be realigned was minimised within the construction zone. Specifically, the design of the arch crossings was aligned by fixing the downstream arch and shifting the upstream arches slightly to minimise the area of the creek to be realigned.

- A No Go Zone will be established both upstream and downstream of the construction zone (See Figure 7). The No Go Zone encompasses the 1 in 100 year flood boundary with and adjacent 20m buffer. Works within 1 in 100 year flood portion of the No Go Zone would be limited to the Dwarf Galaxias habitat creation works, together with revegetation and works required to connect the created habitat with the rain garden. The only works to occur in the adjacent 20m buffer would be associated with the creation of a sediment basin, rain garden and related drainage works.

- The realigned creek within the construction zone will consist of a wide flood channel and small deeper pilot channel to aid fish passage during low flows (See Figure 10 - LD1). In areas with sufficient light penetration, the channels will be vegetated with appropriate aquatic species in accordance with the applicable EVC and hydrological requirements.

- Particular attention will be given to ensure the Tuerong Creek crossing designs, created habitats and WSRD elements (sediment basin and rain garden) maintain the appropriate water balance for the system. This will ensure that there will be no reduction in flows passing downstream to the existing Dwarf Galaxias population. As a result of road runoff being discharged to Tuerong Creek via the sediment basin and rain garden an increase in the volume and frequency of passing flows is anticipated, which should benefit this habitat, however care will be taken to ensure the change is not a marked one.

Most of the road design mitigation measures that were specified in the TSMP for Tuerong Creek, will be or have been adopted with the exception of the following:

- *... majority of work undertaken on one bank of the creek, with tie in works occurring on the other bank.* This is more applicable for a bridge structure than for precast Bebo Arch units. Given the number of crossings and the creek realignments required this requirement is not considered feasible or applicable. It is accepted that significant disturbance will occur within the construction zone but these impacts will be minimised through the implementation of construction environmental management plans and offset by the works previously described.

- *Span the channel to protect against water erosion and debris damage:* There is no clearly defined channel. Under low/moderate flow conditions the channel would be a couple of meters wide and would easily be spanned by the 15m and 21m Bebo Arches, however the width of the 1 in 100 year flood channel is approximately 40-60m and this will not be spanned.

- *Maintain upstream and downstream fish passage under all flow conditions.* The crossing will maintain fish passage under the vast majority of flow

conditions. Some fish friendly design elements (e.g. sidewall roughness – refer to Section 7) will be incorporated to assist fish passage during peak flood flows but it is not considered feasible or necessarily appropriate to ensure fish passage is maintained during the peak of a major flooding event (a very small period of time).

In summary, the Project has incorporated a range of structural and landscape design measures to minimise and offset impact(s) to downstream water quality, aquatic habitat and connectivity for Dwarf Galaxias. The most notable of these is the design of Dwarf Galaxias refuge habitat pools on the Tuerong Creek floodplain, upstream of Peninsula Link but within the Project Right of Way. The creation of this habitat should enable the establishment of a second or expanded Dwarf Galaxias population, thereby enhancing the long-term viability of the species in the Tuerong Creek catchment.

The area of Tuerong Creek that will be re-aligned will be restricted to the area directly beneath and immediately adjacent to the arch structures, with No-Go zones delineated in upstream and downstream areas within the adjacent floodplain to protect existing habitat and prevent construction from impacting on the creek. The re-aligned Tuerong Creek channel will incorporate a pilot channel to cater for Dwarf Galaxias movement under low flow conditions, an enhancement to the current level of connectivity under such conditions.

Proposed landscaping and revegetation of instream and riparian habitats will re-instate and maintain habitat for Dwarf Galaxias and may improve connectivity for this species together with other aquatic and terrestrial species.

5.0 WATERWAY REALIGNMENTS

A number of the Peninsula Link waterway crossings involve realignment (See Section 7, Table 1). These waterway realignments are necessary for a variety of reasons including; to accommodate Melbourne Water minimum distance setback requirements, to reduce the potential for scour/erosion etc. and to minimise the length of waterway under or through a structure. In instances where the angle of skew was minimal efforts have been made to avoid channel realignment.

Alternatives to waterway realignment include skewing bridge piers (e.g. W20) or negotiating smaller minimum setback requirements with Melbourne Water (e.g. W26). In instances where alternatives to realignment are infeasible due to a large angle of skew (e.g. W21) or adjacent terrain incompatibility (e.g. W26), then the realigned waterway will be designed in a manner that offsets the impact of the realignment.

Realigned waterways will be designed to compliment existing bed and bank morphology but will also incorporate habitat features to enhance suitability for Dwarf Galaxias. These features are similar to that proposed for Tuerong Creek in that they consist predominantly of instream and riparian revegetation, together with provision of refuge pools. However, these features would be incorporated into the new waterway only (i.e. there would be no second channel created) and where creation of a refuge pool is applicable, only one pool would be created (usually a short distance upstream). To increase the permanence of these refuge pools, the natural stream flows should (where feasible and appropriate) be supplemented by Peninsula Link runoff, via WSRD elements (i.e. spill containment and rain garden system).

Not all the realigned waterways will be suited to incorporating Dwarf Galaxias habitat features. Generally speaking the waterway realignments that do not warrant Dwarf Galaxias habitat features are the same crossings that do not warrant provision of fish passage (See section 7). The exception to this is the Boggy Creek channel realignment between W1 and W4. The lower reaches of Boggy Creek (i.e. downstream of Lathams Rd) are only marginally suitable for Dwarf Galaxias and are separated from populations in the upper/mid reaches by a couple of kilometres of piped habitat which is likely to pose a barrier to this species. In addition the lower reaches are separated from other freshwater habitats by Eel Race Drain, which is estuarine at their confluence. This estuarine/tidal influence extends into Boggy Creek an unknown distance upstream of the confluence (but not as far upstream as Eastlink), further reducing this isolated area of marginally suitable freshwater habitat (Dwarf Galaxias is an exclusively freshwater species) to somewhere between 900m and 1600m in length. This section of Boggy Creek does however provide suitable habitat for a

range of diadromous species (species that migrate between fresh and salt water), so the design of the realigned waterway will incorporate habitat features that are broadly suitable for these species.

It should be noted that all of the waterways that are proposed for realignment (See section 7) are currently highly modified/disturbed (e.g. little riparian vegetation, low diversity of aquatic vegetation, high cover of weeds, existing erosion issues etc.). Once established the proposed waterway realignments will not only offer suitable habitat to Dwarf Galaxias and other native aquatic fauna species, but will also represent a localised improvement to the condition of these waterways.

6.0 WATSONS CREEK DWARF GALAXIAS HABITAT

As outlined in Section 2, recent investigations have revealed Dwarf Galaxias to occur within the Project land availability boundary in the upper reaches of Watson Creek in the vicinity of W18A, W19 and W19A. The Dwarf Galaxias habitats at this location are considered to consist of small areas of:

- isolated short term refuge habitat (i.e. a semi-permanent pool in a channel immediately downstream of a residential piped drainage network)
- connected spawning habitat (i.e. the highly ephemeral habitat not shown on the VicMap 1:25,000 Hydro layer); and
- associated transient habitat (i.e. the floodplain).

Most of the known refuge habitat in the channel and most of the connected spawning habitat exists too centrally within the land availability boundary to be avoided by the construction footprint itself and thus requires removal (see Figure 5).

To offset the removal of this Dwarf Galaxias habitat, these spawning and refuge habitats will be recreated within the existing channel, proposed swale drainage systems and the floodplain within the land availability boundary, predominantly on the northern side and if feasible, also on the southern side of Peninsula Link (See Figure 5).

The created habitat would consist of a combination of small, purpose built Dwarf Galaxias wetlands on the floodplain, purpose built habitats within the swale drain system and a second refuge or northern expansion of the existing refuge pool within the existing channel. The small wetlands and the swale system would be designed to incorporate long term refuge habitat (i.e. deep pools), with fringing spawning habitat and more extensive areas of connected spawning habitats (i.e. ephemeral habitat). The created habitats would mimic existing habitat conditions (e.g. hydrological regime, depth, vegetation, shading, connectivity) as closely as possible, including enhancement (e.g. greater permanence) where appropriate.

The design of these created habitats would be similar and of comparable importance to that described for Tuerong Creek (Section 4) and the design process would require collaboration between an aquatic ecologist, drainage engineer and landscape architect. The approximate areas within the land availability boundary that could potentially be utilised for creation of Dwarf Galaxias habitat are shown on Figure 5.

7.0 FISH PASSAGE REQUIREMENTS

The Peninsula Link Project will cross a number of waterways including Tamarisk Creek, Devilbend Creek, Tuerong Creek and a number of tributaries of Balcombe Creek and Watson Creek (See Figure 6).

As per the EES, TSMP and PSR requirements the project design team and Biosis Research have been working together in developing detailed designs for waterway crossings in consultation with DSE and Melbourne Water. Waterway and floodplain crossings are being designed to facilitate fish passage under low flow and most flood conditions where appropriate. The designs would be based on the relevant fish passage guidelines (Fairfull and Witheridge 2003, Witheridge 2002).

Where fish passage is warranted, designs will ensure Dwarf Galaxias dispersal under the vast majority of flow conditions, although it should be noted that at some locations it will not be feasible nor necessarily appropriate to ensure fish passage is maintained during the peak of a major flooding event (e.g. 1 in 100 year ARI). As Dwarf Galaxias dispersal is known to occur during flooding events, features will be incorporated to assist passage throughout smaller flooding events and up to a point pre the peak period and after a point post the peak period of larger flooding events.

The TSMP specified that two crossings (W26 and W22) should be bridge crossings. In accordance with Melbourne Water requirements a further six waterway crossings will be bridge crossings and three will be arch crossings (see Table 1). The fish passage guidelines (Witheridge 2002) specify that bridges are preferred to arch structures, arch structures are preferred to culverts, culverts are preferred to fords, and fords are preferred to causeways. The guidelines offer a fish habitat classification system as an example means of selecting the appropriate crossing type. In all cases the proposed Peninsula Link waterway crossings meet or exceed the minimum crossing requirements specified in the guidelines.

While bridges or arch structures are recognised as generally have the least impact on fish passage, problems can occur as a result of:

- large scale turbulence generated by instream bridge piers;
- increased flood flow velocities resulting from a loss of floodplain and channel flow area;
- heavy shading of the waterway creating a visual or physiological barrier to

some fish species;

- loss of, or changes to, bank vegetation that may affect flow velocities, water shading and essential habitat cover immediately adjacent to the channel banks; and

- blockage of fish passage along floodplains caused by elevated approach roads.

Section 2.1 of the guidelines (Witheridge 2002) specifies a number of design principles for arches and bridges including pier placement, scour protection, retention of bed and bank vegetation/features, location of bridge abutments, incorporation of floodplain culverts, review of structure and floodplain flow velocity, and light penetration between and through structures (i.e. skylights). These principles will be followed wherever applicable/feasible to ensure the risks of the fish passage problems listed above are minimised.

For all crossings other than the lower reaches of Boggy Creek, fish passage designs will cater primarily for the known or potential occurrence of Dwarf Galaxias. Providing fish passage for Dwarf Galaxias will in most instances provide fish passage for other native aquatic species, although there would potentially be reduced passage for these species during flood conditions at some crossings. In the lower reaches of Boggy Creek the potential for Dwarf Galaxias to occur is limited but the creek does support a range of native fish species (e.g. Common Galaxias, Southern Shortfin Eel, Climbing Galaxias, Flathead Gudgeon, Bluespot Goby, etc.) and fish passage designs will therefore primarily cater for these species.

The requirement for the provision of fish passage at each crossing was determined by Biosis Research using relevant guidelines (Fairfull and Witheridge 2003, Witheridge 2002), together with mapping (e.g. fine scale hydro layers, topography, flood layers), aerial photography, fish database searches/fish survey results and on the ground assessment/knowledge of these crossings obtained from Frankston Bypass EES investigations (Biosis Research 2008) and during more recent investigations/survey.

Dwarf Galaxias is a species that can persist in small and degraded habitats and is known to use flooding events for dispersal through highly ephemeral habitat, for spawning within such habitat and ultimately for re-colonisation of instream and floodplain habitats (e.g. wetlands). The determination of the need for ensuring fish passage and the prioritisation of that fish passage was therefore only loosely based on the habitat class example guidelines (Fairfull and Witheridge 2003, Witheridge 2002) since these guidelines place a large emphasis on the size and permanence of the waterway and to some extent discount the importance of ephemeral habitats to threatened species. The determination took into account a

range of factors including the proximity of known and potential habitat, but was heavily influenced by the existing degree of connectivity and the extent of habitat that would be connected (fish passage provided) or isolated (no fish passage) under current conditions. Also taken into consideration were the opportunities or lack thereof for future enhancements. Waterway crossings that were determined to warrant fish passage are presented in Table 1 and Figure 6.

Table 1: Fish passage requirements and fish passage priority/importance for Peninsula Link waterway crossings.

Crossing #	Crossing type	Catchment	Waterway name	Fish Passage Required?	Priority	Realignment required?	Habitat creation required?	Comments
W1	Culvert	Boggy	Boggy Creek	YES	M	NO	-	Maintain existing connectivity for amphibians
W2	Culvert	Boggy	Unnamed	NO	-	NO	-	Maintain existing connectivity for amphibians
W2A	Culvert	Boggy	Unnamed	NO	-	NO	-	Maintain existing connectivity for amphibians
W2B	Culvert	Boggy	Unnamed	NO	-	NO	NO	Maintain existing connectivity for amphibians
W3	Bridge	Boggy	Boggy Creek	YES	M	YES	YES*	*For native fish other than Dwarf Galaxia. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians
W4	Culvert	Boggy	Boggy Creek	YES	M	YES	YES*	*For native fish other than Dwarf Galaxias. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians

Crossing #	Crossing type	Catchment	Waterway name	Fish Passage Required?	Priority	Realignment required?	Habitat creation required?	Comments
W5	Culvert	Boggy	Unnamed	NO	-	YES	NO	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians
W6	Culvert	Boggy	Boggy Creek	YES	L	YES	NO	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians
WFD1	Culvert	Boggy	Boggy Creek	YES	L	NO	NO	Existing culvert extension Maintain existing connectivity for amphibians
W7	Culvert	Tamarisk	Unnamed	YES*	L	NO	NO	*Appropriateness of this crossing will be further investigated in consultation with DSE, MW and PV
W8A	Culvert	Tamarisk	Tamarisk Creek	NO	-	NO	NO	Maintain existing connectivity for amphibians
W8	Bridge	Tamarisk	Tamarisk Creek	YES	M	NO	YES	Maintain existing connectivity for amphibians and reptiles. Fauna furniture to provide ground cover

Crossing #	Crossing type	Catchment	Waterway name	Fish Passage Required?	Priority	Realignment required?	Habitat creation required?	Comments
W8B	Arch	Tamarisk	Tamarisk Creek	YES	M	NO	YES	Maintain existing connectivity for amphibians and reptiles Fauna furniture to provide ground cover
W9	Bridge	Tamarisk	Tamarisk Creek	YES	M	YES	YES	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians and reptiles
W-SK-1	Culvert	Skye Road	Unnamed	NO	-	YES	NO	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.
W-SK-2	Culvert	Skye Road	Unnamed	NO	-	YES	NO	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.
U-KH-1	Culvert	Karingal Hub	Unnamed	NO	-	NO	NO	
U-WR-1	Culvert	Willow Road WL	Unnamed	NO	-	NO	NO	

Crossing #	Crossing type	Catchment	Waterway name	Fish Passage Required?	Priority	Realignment required?	Habitat creation required?	Comments
W10	Culvert	Watson	Unnamed	YES	L	YES	NO	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians
W11A	Culvert	Watson	Unnamed	YES	L	NO	NO	
W12	Culvert	Watson	Unnamed	NO	-	NO	NO	
W13	Culvert	Watson	Unnamed	NO*	-	NO	No	*Crossing proposed to be removed
WBT1	Culvert	Watson	Unnamed	YES	L	YES	YES	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE.

Crossing #	Crossing type	Catchment	Waterway name	Fish Passage Required?	Priority	Realignment required?	Habitat creation required?	Comments
W15	Culvert	Watson	Unnamed	YES	L	YES	YES	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE.
W18	Culvert	Watson	Unnamed	YES	M	NO	NO	Connected to W18A/W19 during flood. Maintain existing connectivity for amphibians
W18A	Culvert	Watson	Floodplain	YES	H	NO	NO	Maintain existing connectivity for amphibians
W18B – Access rd	Culvert	Watson		YES	H	NO	-	
W19	Culvert	Watson	Unnamed	YES	H	NO	NO	Maintain existing connectivity for amphibians
W19A	Culvert	Watson	Floodplain	YES	H	NO	NO	Proposed to be split into two crossings:W19A and W19C Maintain existing connectivity for amphibians
W19B – Access Rd	Culvert	Watson		YES	H	NO	-	
W19C	Culvert	Watson	Floodplain	YES	H	-	-	
W20	Bridge	Balcombe	Unnamed	YES	H	NO	NO	Maintain existing connectivity for amphibians

Crossing #	Crossing type	Catchment	Waterway name	Fish Passage Required?	Priority	Realignment required?	Habitat creation required?	Comments
W21	Arch	Balcombe	Unnamed	YES	H	YES	YES	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE
W22	Bridge	Balcombe	Balcombe Creek	YES	H	YES	YES	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE
W23	Culvert	Balcombe	Unnamed	NO	-	YES	NO	Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.

Crossing #	Crossing type	Catchment	Waterway name	Fish Passage Required?	Priority	Realignment required?	Habitat creation required?	Comments
WER1	Culvert	Balcombe	Unnamed	YES*	H*	NO	NO	*Extension of an existing culvert which may already pose a barrier to fish. Maintain existing connectivity for amphibians
W24	Culvert	Devilbend	Unnamed	NO	-	NO	NO	Maintain existing connectivity for amphibians
W25	Bridge	Devilbend	Devilbend Creek	YES	M	YES	YES	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians/ and other terrestrial species Will be designed in consultation with Melbourne Water and DSE
W25A	Culvert	Devilbend	Unnamed	NO	-	NO	NO	

Crossing #	Crossing type	Catchment	Waterway name	Fish Passage Required?	Priority	Realignment required?	Habitat creation required?	Comments
W26	Bridge	Devilbend	Devilbend Creek	YES	M	YES	YES	Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians/ and other terrestrial species Will be designed in consultation with Melbourne Water and DSE
W27	Arch	Tuerong	Tuerong Creek	YES	H	YES	YES	Habitat creation will include an artificial anabranch to convey low flows, and incorporate three deep pools interspersed by ephemeral habitat Maintain existing connectivity for amphibians/ and other terrestrial species Will be designed in consultation with Melbourne Water and DSE

For waterway crossings that were determined to warrant fish passage, a relative importance/priority of high, medium or low has been assigned to ensure an concordant amount of effort is applied in incorporating design features required to ensure fish passage. For the lowest priority crossings, it is proposed that these crossings be designed with some regard for fish passage, but the focus will be on ensuring the crossings do no pose an obvious physical barrier (e.g. a drop structure) that would preclude fish passage, rather than actually ensuring that fish passage will be achieved. For medium and high priority crossings, fish passage will be ensured however differing design approaches (e.g. hydraulic or stream simulation method) would be used in accordance with the Guidelines

(Witheridge 2002). The relative importance/priority of the crossings with regard to provision of fish passage is outlined in Table 1.

The fish passage needs of Peninsula Link crossings will take into account the importance/priority that has been assigned but will be determined on a crossing by crossing basis. The guidelines for bridges and arches as previously discussed are generally consistent with Melbourne Water requirements, and the structures will therefore pose the smallest risk to fish passage. For arch or bridge crossings assigned a high importance/priority, particular care will be taken to ensuring that the structures do not pose a velocity barrier to fish passage during flood conditions. Culverts represent the highest risk to fish passage and they are the focus of the fish passage guidelines (Witheridge 2002). The guidelines outline a range of culvert design approaches and fish friendly design features, some of which will and some of which may not be appropriate/feasible for Peninsula Link. The design team will continue to work together with Biosis Research and other experts as appropriate in developing fish friendly crossing designs for waterway crossings in accordance with Witheridge (2002) and in consultation with DSE and Melbourne Water.

8.0 CONCLUSION

The Project has and will continue to include a variety of design measures to protect and maintain habitat connectivity for Dwarf Galaxias and to create aquatic habitat that favours the species during construction and operation of the road. These measures have been developed in consultation with a Biosis Research aquatic ecologist, together with DSE and Melbourne Water and should if implemented appropriately, ensure that the viability of the Dwarf Galaxias populations in the Balcombe and Watson Creek catchments is maintained or enhanced.

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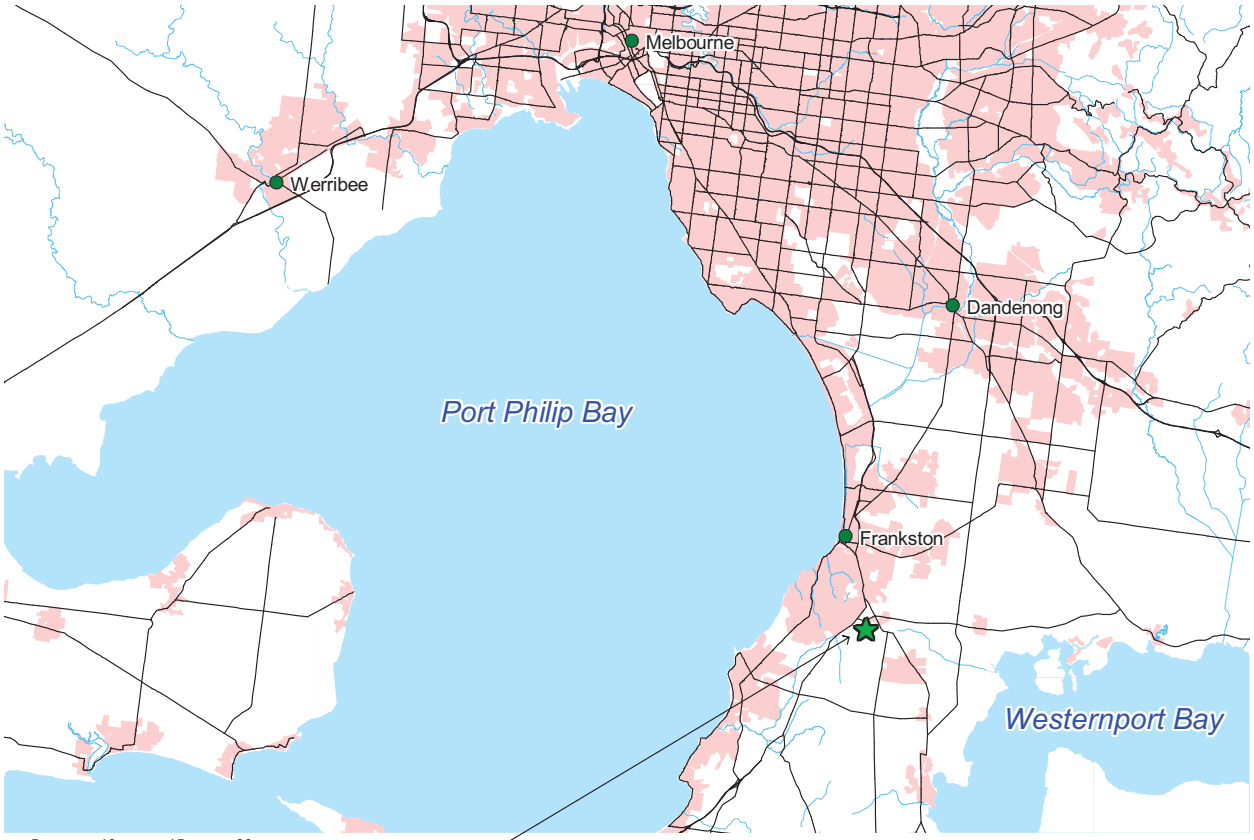
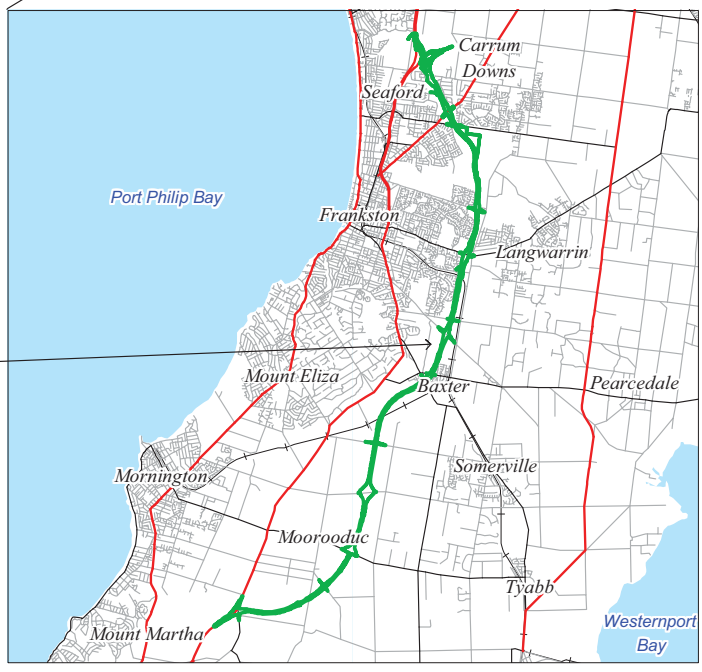
FIGURES





Acknowledgement: VicRoads

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Figure 1: Location of the study area

DATE: 7 September 2010
Checked by: CJB | Drawn by: PJY | File number: 11234
Location: P:\11200s\11234\Mapping\11234 Figure 1.wor

Scale: 0 2.5 5.0 7.5 10.0 kilometres

MGA94 Zone 55

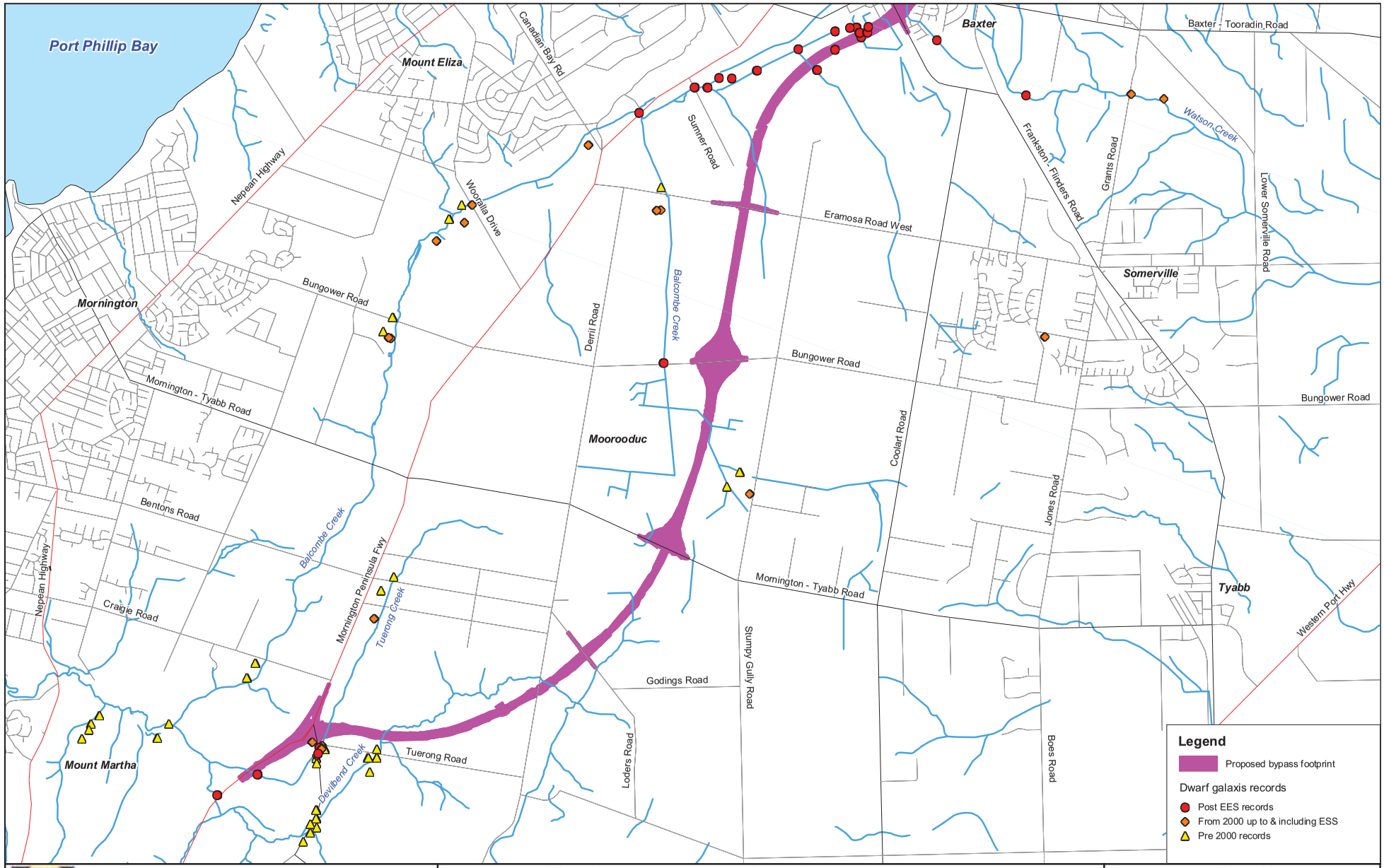

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Figure 2: Pre and post EES Dwarf Galaxias records in the Balcombe & Watsons Creek catchments

DATE: 7 September 2010

Checked by: CJB | Drawn by: PMA / SKM / PJY | File number: 11234

Location: P:\11200s\11234\Mapping\Aquatic data\11234 Figure 2.wor

Scale: 0 400 800 1200 1600 2000 metres

MGA94 Zone 55

Figure 2: Pre and post EES Dwarf Galaxias records in the Balcombe & Watsons Creek catchments

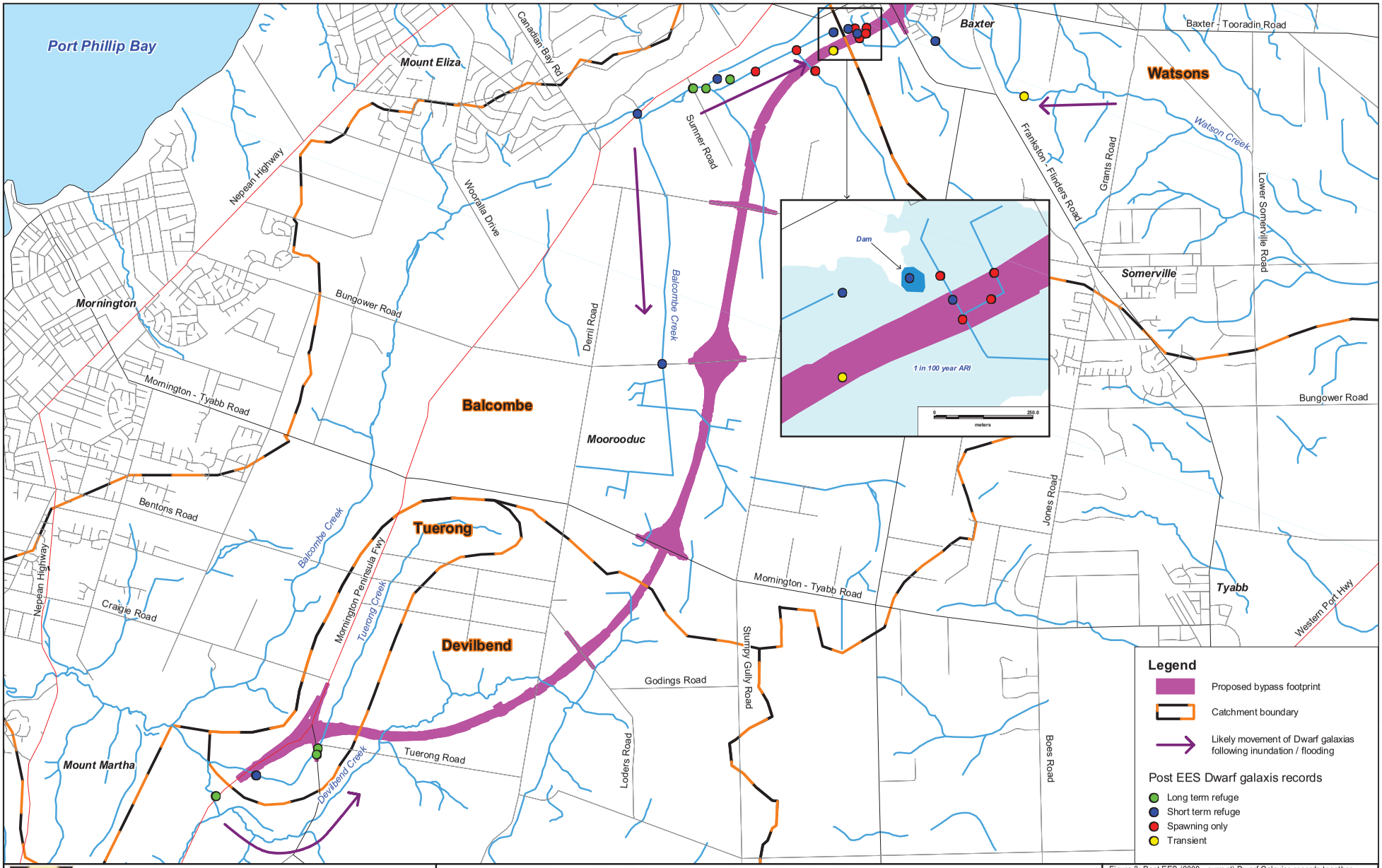

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Figure 3: Post EES (2008 - current) Dwarf Galaxias records together with an indication of the likely habitat category and expected movement direction during inundation / flood

Figure 3: Post EES (2008 - current) Dwarf Galaxias records together with an indication of the likely habitat category and expected movement direction during inundation / flood

DATE: 7 September 2010

Checked by: CJB | Drawn by: PMA / SKM / PJY | File number: 11234

Location: ...\11234\Mapping\Aquatic data\11234 Fig 3.wor

Scale: 0 400 800 1200 1600 2000 metres

MGA94 Zone 55

N W E S

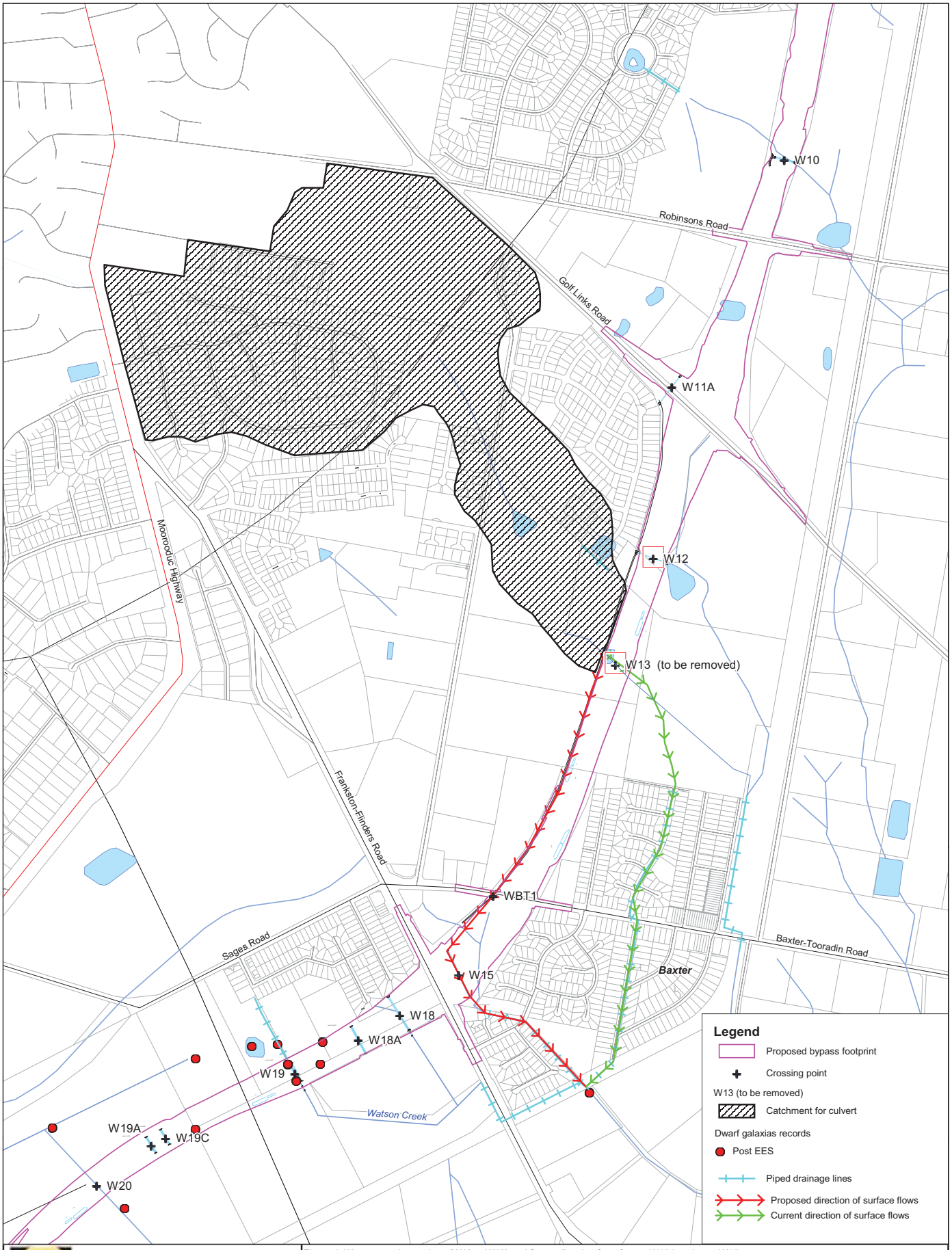

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Figure 4: Watson creek crossings (W10 to W19) and flow redirection from former W13 location to W15

DATE: 8 September 2010
Checked by: CJB | Drawn by: SKM | File number: 11234
Location: ...\11234\Mapping\Aquatic data\11234 Fig 4.wor

Scale: 0 100 200 300 400 500 metres

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Figure 5: Dwarf galaxias records and propsed channel realignment in upper Watson Creek

DATE: 8 September 2010

Checked by: CJB | Drawn by: PJY | File number: 11234

Location: P:\11200s\11234\Mapping\Aquatic data\11234 Figure 5.wor

Scale: 0 20 40 60 80 100 metres

MGA94 Zone 55

Figure 5: Dwarf galaxias records and propsed channel realignment in upper Watson Creek

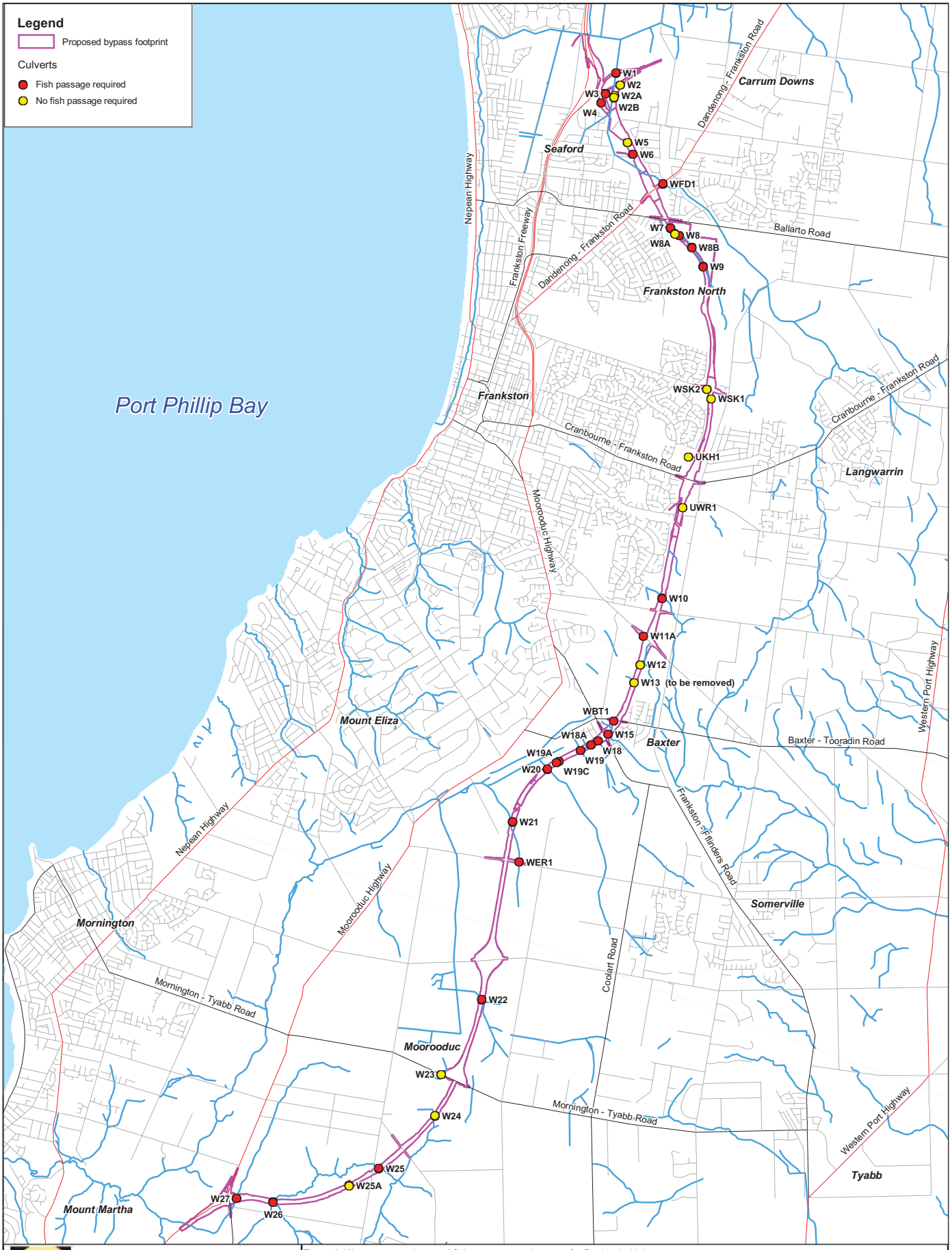

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Figure 6: Waterway crossings and fish passage requirements for Peninsula Link

DATE: 15 September 2010
Checked by: CJB | Drawn by: PJY | File number: 11234
Location: P:\11200s\11234\Mapping\Aquatic data\11234 Figure 6.wor

Scale: 0 600 1200 1800 2400 3000 metres

MGA94 Zone 55

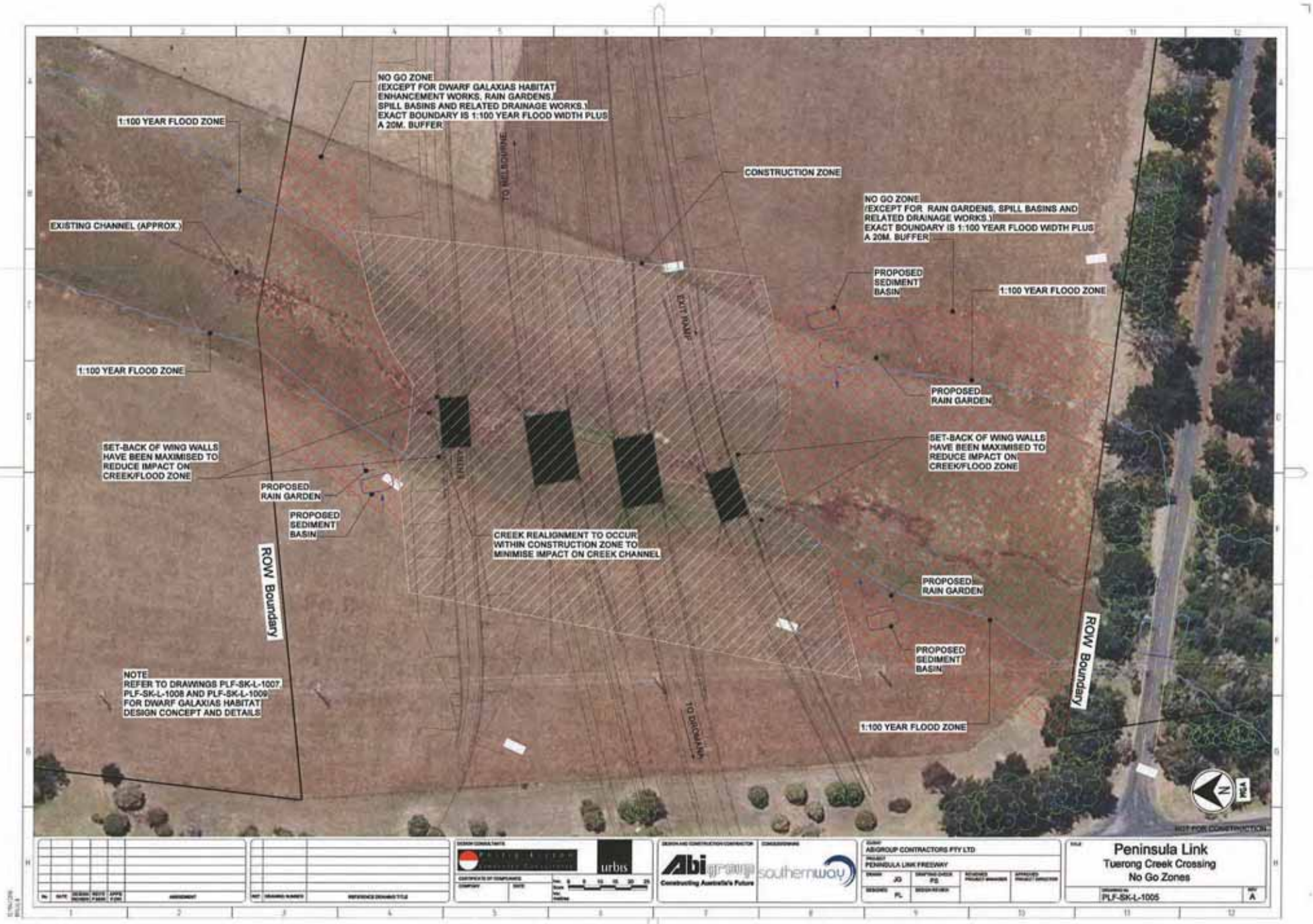


Figure 7: Tuerong Creek crossing - Construction and No Go Zones.

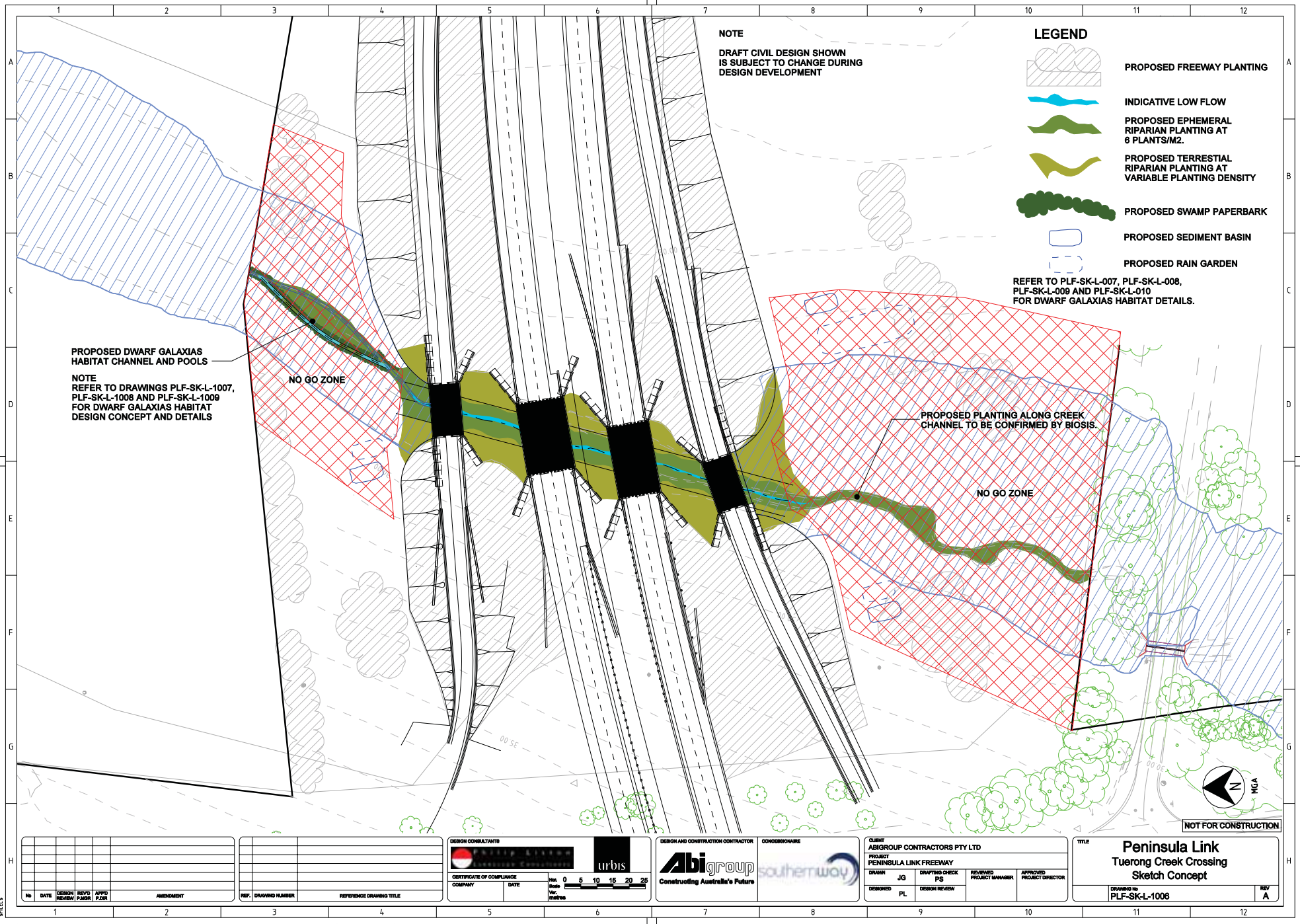


Figure 8: Concept sketch for Dwarf Galaxias habitat creation and revegetation of Tuerong Creek.

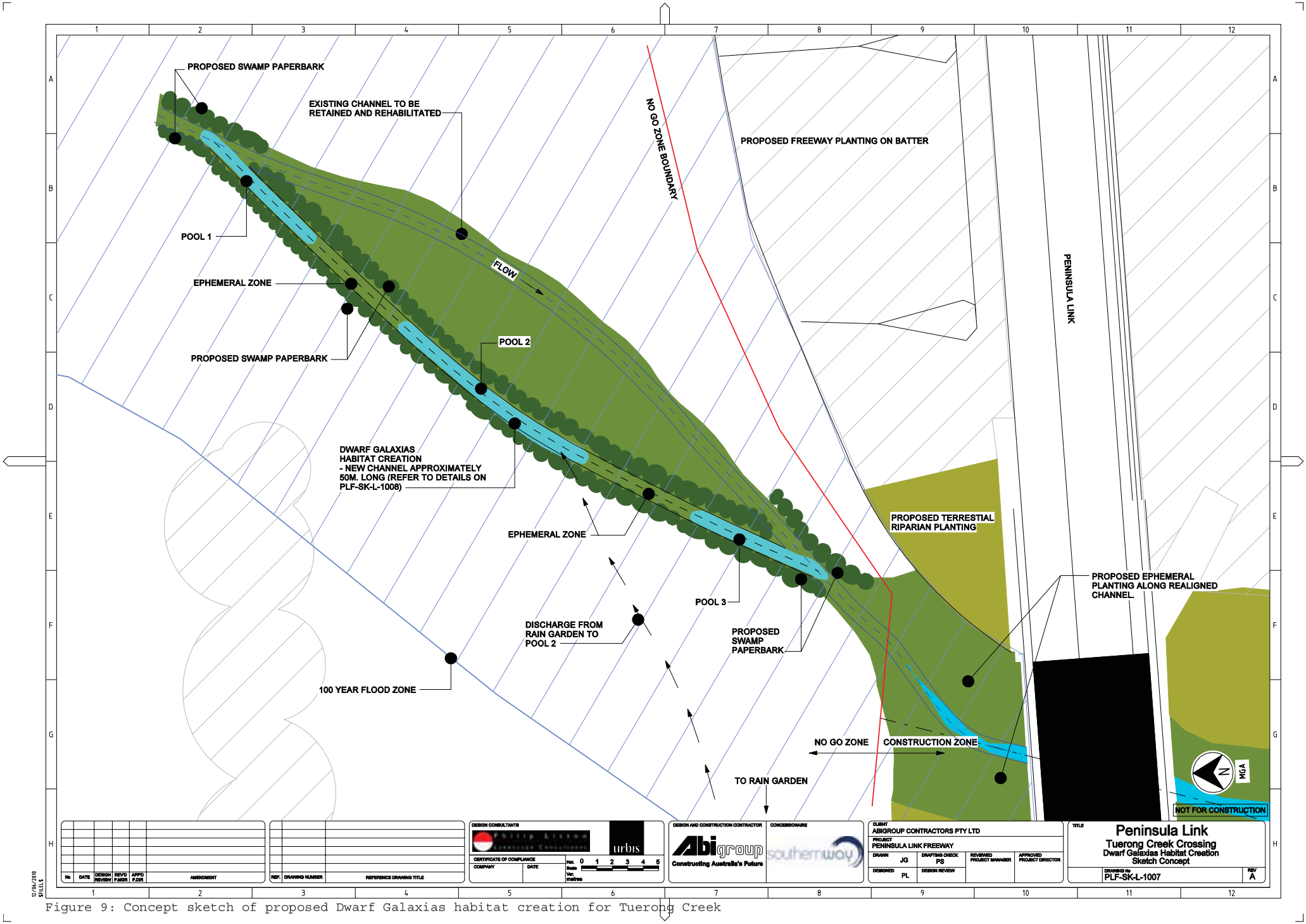
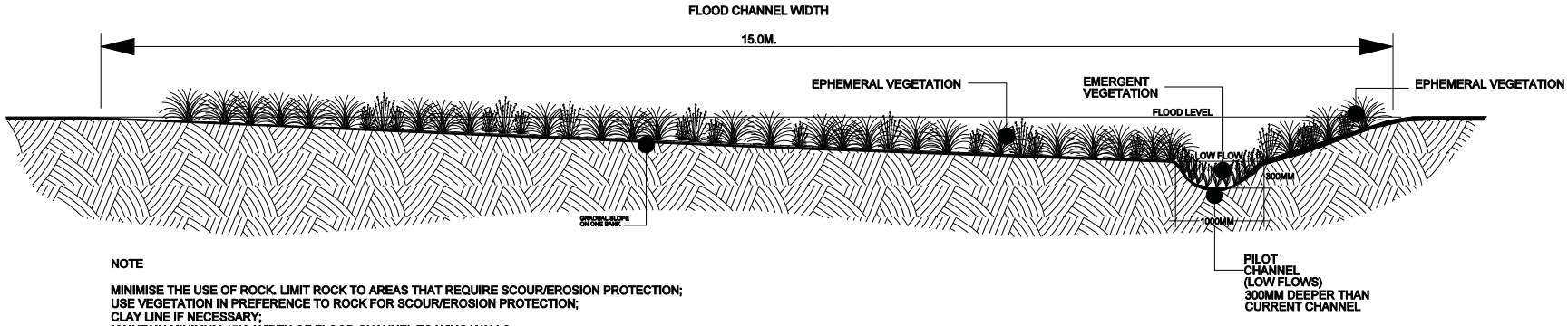


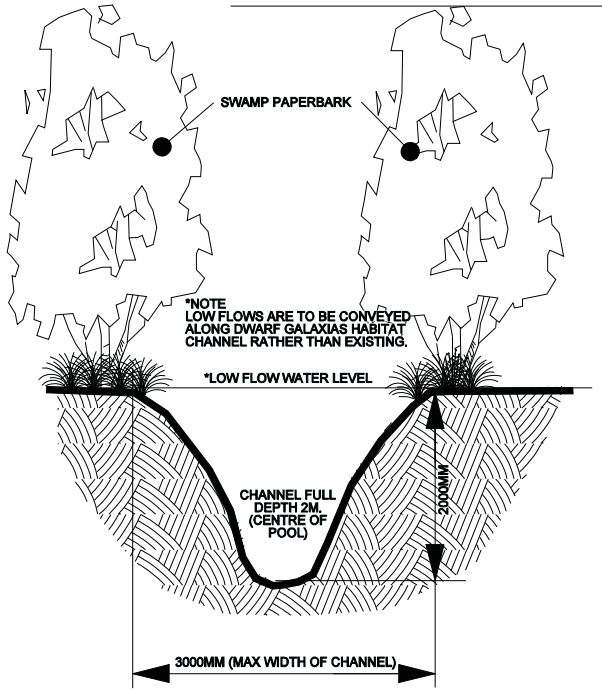
Figure 9: Concept sketch of proposed Dwarf Galaxias habitat creation for Tuerong Creek



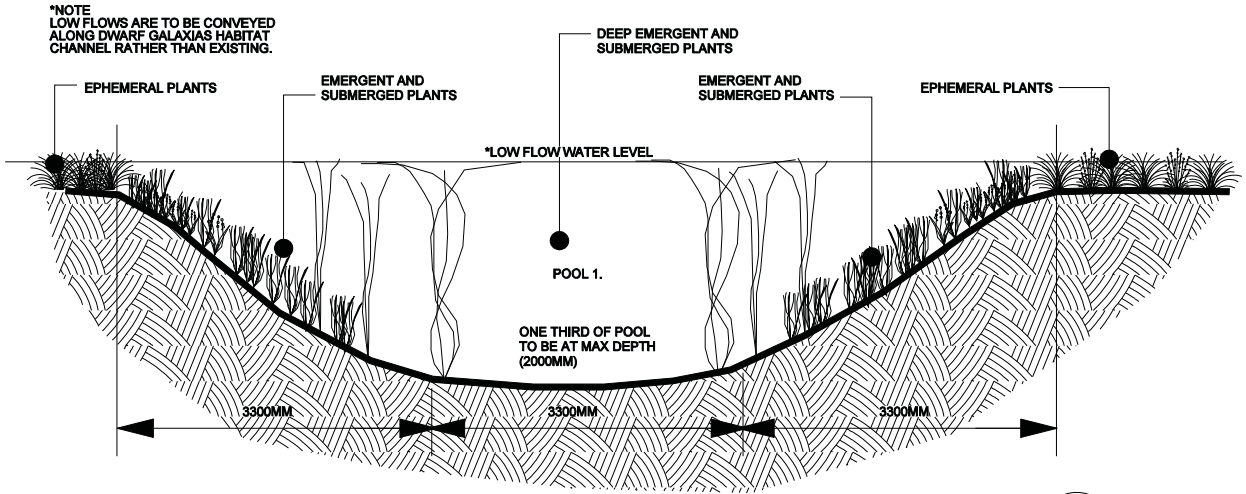
NOTE

MINIMISE THE USE OF ROCK. LIMIT ROCK TO AREAS THAT REQUIRE SCOUR/EROSION PROTECTION;
USE VEGETATION IN PREFERENCE TO ROCK FOR SCOUR/EROSION PROTECTION;
CLAY LINE IF NECESSARY;
MAINTAIN MINIMUM 15M. WIDTH OF FLOOD CHANNEL TO WING WALLS.

CONSTRUCTION ZONE - REALIGNED/MODIFIED CHANNEL
TYPICAL SECTION NTS — LD 1



DWARF GALAXIAS CHANNEL
TYPICAL SECTION NTS — LD 2



DWARF GALAXIAS POOL DIMENSIONS
TYPICAL LONGITUDINAL SECTION NTS — LD 3

NOT FOR CONSTRUCTION

No	DATE	DESIGN REVIEW	REVD P.MGR	APPD P.DIR	AMENDMENT

REF.	DRAWING NUMBER	REFERENCE DRAWING TITLE

DESIGN CONSULTANTS: Phillip Elliston Landscape Consultants; urbis
CERTIFICATE OF COMPLIANCE — COMPANY | DATE
Hor. Scale
Ver. metres

DESIGN AND CONSTRUCTION CONTRACTOR: Abigroup — Constructing Australia's Future
CONCESSIONAIRE: southernway

CLIENT: ABIGROUP CONTRACTORS PTY LTD
PROJECT: PENINSULA LINK FREEWAY

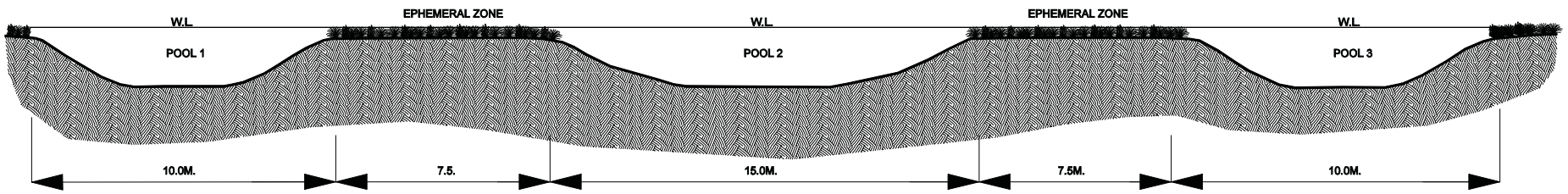
DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
JG	PS		
DESIGNED	DESIGN REVIEW		
PL			

TITLE: Peninsula Link
Tuerong Creek Crossing
Dwarf Galaxias Habitat Creation Details

DRAWING No: PLF-SK-L-1008
REV: A

12/06/200
$file$

Figure 10: Cross section designs for Dwarf Galaxias habitat pools (LD 2, LD3) and the realigned section of Tuerong Creek (LD1)



DWARF GALAXIAS CHANNEL LD 4

TYPICAL LONGITUDINAL SECTION NTS

NOT FOR CONSTRUCTION

No	DATE	DESIGN REVIEW	REVD P.MGR	APPD P.DIR	AMENDMENT

REF.	DRAWING NUMBER	REFERENCE DRAWING TITLE

DESIGN CONSULTANTS: Philip Lighton Environmental Consultants; urbis

CERTIFICATE OF COMPLIANCE — COMPANY | DATE

Hor. Scale
Ver. mult'ns

DESIGN AND CONSTRUCTION CONTRACTOR: Abigroup Constructing Australia's Future

CONCESSIONAIRE: southernway

CLIENT: ABIGROUP CONTRACTORS PTY LTD

PROJECT: PENINSULA LINK FREEWAY

DRAWN	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
JG	PS		
DESIGNED	DESIGN REVIEW		
PL			

TITLE: Peninsula Link
Tuerong Creek Crossing
Dwarf Galaxias Habitat Creation
Details

DRAWING No: PLF-SK-L-1009 REV: A

12/06/200
1318

Figure 11: Cross section designs of proposed Dwarf Galaxias habitat channel

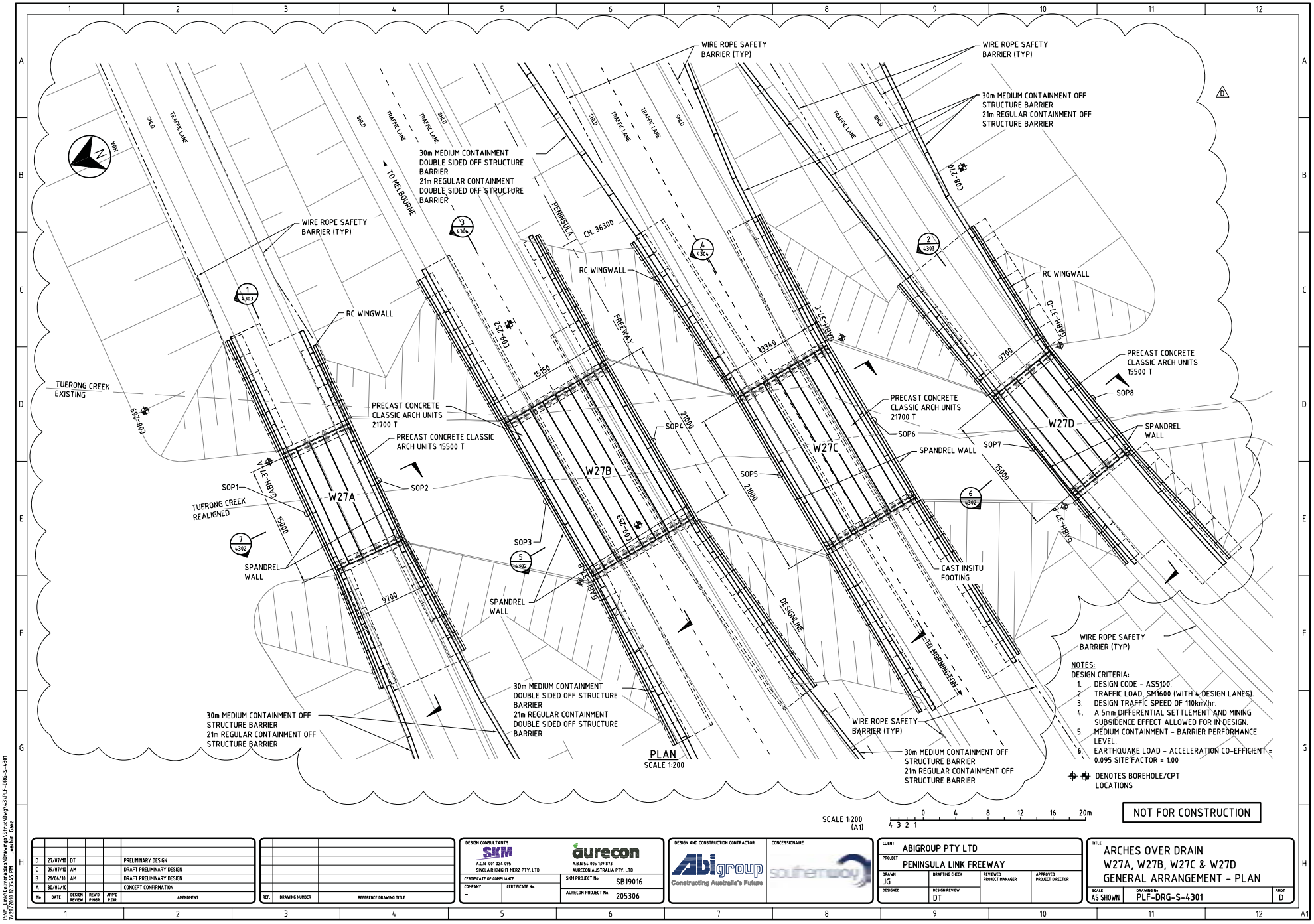


Figure 12: Preliminary Designs for Tuerong Creek crossing structures (Bebo Arches)

APPENDIX 1

Crossing No.	Fish Passage Priority	Realignment Required	Habitat Offset Required	*Performance Criteria (From updated TSMP)*	Fauna Furniture	Treatments	Witheridge Guideline Options Considered				
							1	2	3	4	5
W1	Medium Priority	N	N	*Maintain existing connectivity for amphibians*	N	W1 has been designed with the Stream Simulation Method, the culvert area is equal to the channel cross section under high flow conditions and the culvert will typically be permanently wet.	Y	N	H	NA	Y
W2	Not Required	N	N	*Maintain existing connectivity for amphibians*	N	Not Required	NA				
W2A	Not Required	N	N	*Maintain existing connectivity for amphibians*	N	Not Required	NA				
W2B	Not Required	N	N	*Maintain existing connectivity for amphibians*	N	Not Required	NA				
W3	Medium Priority	Y	Y*	**For native fish other than Dwarf Galaxias. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians*	N	W3 in an open channel beneath the Peninsula Link over Eastlink Bridge. The channel incorporates a low flow channel to aid with Fish Passage.	Y	NA	H	NA	Y
W4	Medium Priority	Y	Y*	**For native fish other than Dwarf Galaxias. Will be designed in consultation with Melbourne Water and DSE.Maintain existing connectivity for amphibians*	N	W4 has been designed with the Stream Simulation Method, the culvert area is equal to the channel cross section under high flow conditions and the culvert will have an incoming low flow channel which will be seasonally wet.	N	NA	H	NA	Y
W5	Not Required	Y	N	*Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians*	N	Not Required	NA				
W6	Low Priority	Y	N	*Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians*	N	Culvert designed to not provide a barrier to fish passage.	N	N	N	NA	Y
WFD1	Low Priority	N	NA	*Existing culvert extension. Maintain existing connectivity for amphibians*	N	Culvert designed to not provide a barrier to fish passage.	N	N	N	NA	Y
W7	Low Priority	N	N	*Appropriateness of this crossing will be further investigated in consultation with DSE, MW and PV*							
W8A	Not Required	NA	NA	*Maintain existing connectivity for amphibians*	Y	Not Required	NA				
W8	Medium Priority	N	N	*Maintain existing connectivity for amphibians. Fauna furniture to provide ground cover.*	Y	Low Bridge Structure, with no piers allows for minimal turbulence/barriers within the waterway crossing and with a centre median break allowing for light penetration.	Y	N	H	Y	Y
W8B	Medium Priority	N	Y	*Maintain existing connectivity for amphibians. Fauna furniture to provide ground cover.*	Y	Drainage Arch, with no piers allows for minimal turbulence/barriers within the waterway crossing and with a centre median break allowing for light penetration.	NA	NA	NA	NA	NA
W9	Medium Priority	Y	Y	*Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians and reptiles. Will be designed in consultation with Melbourne Water and DSE.*	Y	Large Span Bridge, 2x30m spans, with a centre median break allowing for light penetration.	Y	NA	H	NA	Y
BC01	Not Required	NA	NA		Y	Not Required	NA				
BC02	Not Required	NA	NA		Y	Not Required	NA				
BC03	Not Required	NA	NA		Y	Not Required	NA				
BC04	Not Required	NA	NA		Y	Not Required	NA				
WSK1	Not Required	Y	N	*Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.*	N	Not Required	NA				
WSK2	Not Required	Y	N	*Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.*	N	Not Required	NA				
UKH1	Not Required	NA	N		N	Not Required	NA				
UWR1	Not Required	NA	N		N	Not Required	NA				

Crossing No.	Fish Passage Priority	Realignment Required	Habitat Offset Required	*Performance Criteria (From updated TSMP)*	Fauna Furniture	Treatments	Witheridge Guideline Options Considered				
							1	2	3	4	5
W10	Low Priority	Y	N	*Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE. Maintain existing connectivity for amphibians*	N	Culvert designed to not provide a barrier to fish passage.	N	N	N	NA	Y
W11A	Low Priority	N	N		N	Culvert designed to not provide a barrier to fish passage.	N	N	N	NA	Y
W12	Not Required	NA	NA		N	Not Required	NA				
W13		N	N	*Crossing to be removed*							
WBT1	Low Priority	Y	Y	*Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians Will be designed in consultation with Melbourne Water and DSE.*	N	Culvert designed to not provide a barrier to fish passage.	N	N	N	NA	Y
W15	Low Priority	Y	Y	*Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians. Will be designed in consultation with Melbourne Water and DSE.*	N	Underground pipe network, inlet will not have a barrier to fish passage.	N	N	N	NA	Y
						Fish Habitat Offset to be constructed within the swales					
W18	Medium Priority	N	N	*Connected to W18A/W19 during flood. Maintain existing connectivity for amphibians*	N	Culvert will have a shaped base for a low flow channel.	Y	Y	H	Y	Y
W18A	High Priority	N	N	*Maintain existing connectivity for amphibians*	N	Flood Plain Culverts, these activate when the area is flooded and allow for water balance to both sides of the freeway. Crossing inlet will be designed to ensure that it does not create a barrier to fish passage.	NA	NA	NA	NA	Y
W18B - Access Road	High Priority	N	N		N	Culvert will be embedded at 300mm lower than the creek invert to create permanent water within the culvert to allow for fish passage after flood events. Culvert area is equal to channel cross section for medium flow.	Y	Y	H	Y	Y
W19	High Priority	N	N	*Maintain existing connectivity for amphibians*	N	Culvert will be embedded at 300mm lower than the creek invert to create permanent water within the culvert to allow for fish passage after flood events. Culvert area is equal to channel cross section for high flow.	Y	Y	H	Y	Y
W19A	High Priority	N	N	*Proposed to be split into two crossings:W19A and W19C. Maintain existing connectivity for amphibians*	N	Flood Plain Culverts, these activate when the area is flooded and allow for water balance to both sides of the freeway. Crossing inlet will be designed to ensure that it does not create a barrier to fish passage.	NA	NA	NA	NA	Y
W19B - Access Road	High Priority	N	N		N	Culvert will be embedded at 300mm lower than the creek invert to create permanent water within the culvert to allow for fish passage after flood events. Culvert area is equal to channel cross section for medium flow.	Y	Y	H	Y	Y
W19C	High Priority	NA	NA		N	Flood Plain Culverts, these activate when the area is flooded and allow for water balance to both sides of the freeway. Crossing inlet will be designed to ensure that it does not create a barrier to fish passage.	NA	NA	NA	NA	Y
W20	High Priority	N	N	*Maintain existing connectivity for amphibians*	N	Large Span Bridge, 15m span over waterway (63m full length), with a centre median break allowing for light penetration, noting that this waterway was retained on its existing alignment.	Y	NA	H	Y	Y

Crossing No.	Fish Passage Priority	Realignment Required	Habitat Offset Required	*Performance Criteria (From updated TSMP)*	Fauna Furniture	Treatments	Witheridge Guideline Options Considered				
							1	2	3	4	5
W21	High Priority	Y	Y	*Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians. Will be designed in consultation with Melbourne Water and DSE.*	N	Drainage Arch, with no piers allows for minimal turbulence/barriers within the waterway crossing and with a centre median break allowing for light penetration.	Y	Y	H	N	Y
					N	Fish Habitat Offset to be constructed within the realigned Creek.					
WER1	High Priority	N	N	**Extension of an existing culvert which may already pose a barrier to fish. Maintain existing connectivity for amphibians*	N	Larger central pipe culvert, to have 300mm depth of permanent water.	Y	NA	M	N	Y
W22	High Priority	Y	Y	*Combination of small, purpose-built Dwarf Galaxia wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians. Will be designed in consultation with Melbourne Water and DSE.*	N	Large Span Bridge, 2x20m/1x22m spans, with a centre median break allowing for light penetration.	Y	NA	H	NA	Y
						Fish Habitat Offset to be constructed within the realigned Creek.					
W23	Not Required	Y	N	*Realignment to improve current bed and bank morphology. Will be designed in consultation with Melbourne Water and DSE.*	N	Not Required	NA				
W23A	Not Required	NA	NA		N	Not Required	NA				
W24	Not Required	N	N	*Maintain existing connectivity for amphibians*	N	Not Required	NA				
W25	Medium Priority	Y	Y	*wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians/and other terrestrial species. Will be designed in consultation with Melbourne Water and DSE.*	N	Large Span Bridge, 15m span over waterway (60m full length), with a centre median break allowing for light penetration, noting that this waterway was retained on its existing alignment.	Y	NA	H	NA	Y
						Fish Habitat Offset to be constructed within the realigned Creek.					
W25A	Not Required	NA	NA		N	Not Required	NA				
W26	Medium Priority	Y	Y	*wetlands on floodplains, purpose-built habitats within swale drain systems, refuge pools and additional spawning habitat, where appropriate. Maintain existing connectivity for amphibians/and other terrestrial species. Will be designed in consultation with Melbourne Water and DSE.*	N	Large Span Bridge, 15m span over waterway (59m full length), with a centre median break allowing for light penetration, noting that this waterway was retained on its existing alignment.	Y	NA	H	NA	Y
						Fish Habitat Offset to be constructed within the realigned Creek.					

Crossing No.	Fish Passage Priority	Realignment Required	Habitat Offset Required	*Performance Criteria (From updated TSMP)*	Fauna Furniture	Treatments	Witheridge Guideline Options Considered				
							1	2	3	4	5
W27ABCD	High Priority	Y	Y	*Habitat creation will include an artificial anabranch to convey low flows, and incorporate three deep pools interspersed by ephemeral habitat (see Appendix 5 for further details including additional habitat creation measures and design measures to minimise/offset impacts). Maintain existing connectivity for amphibians/and other terrestrial species.* *Will be designed in consultation with Melbourne Water and DSE*	N	Large Drainage Arches, with no piers allows for minimal turbulence/barriers within the waterway crossing and with a centre median break allowing for light penetration.	Y	Y	H	NA	Y
						Channel alignment through arches to be constructed specifically to promote fish passage along the channel edges.					
						Fish Habitat Offset to be constructed within the realigned Creek.					

Whitheridge Guideline - Considerations to enable fish passage.

1 - Low Flow

2 - Sidewall Roughness

3 - Cross Sectional Area, L - Low Flow, M - Medium Flow, H - High Flow

4 - Floodplain Culvert

5 - No fish passage barriers

Definitions

1. Low Flow - Appropriate Culvert Elevation - Following this guideline entails installing the nominated "wet" cell of the culvert slightly below the downstream bed level. A low flow channel or a permanent water channel can promote fish passage. Water depths considered for the crossings allowed for 300mm typcial depths to account for 100mm of sediment deposition.

2. Side Wall Roughness - Side wall roughness 5-6mm to be achieved on appropriate culverts and arches and achieved through either modifications to the pre-cast methods or alternatively by in-situ application of suitable products or exposure of the aggregate.

3. Cross Sectional Area - The crossings can be designed to be of a similar cross sectional area to the incoming channel.

4. Flood Plain Culverts - These crossings where proposed aid in the passage across the freeway embankment providing the hydraulic design is not compromised.

5. No fish passage barriers - There will be no obvious barriers to fish passage (e.g sudden drops in water levels etc.) that will preclude fish passage. Fish passage is expected to be feasible during some conditions but the proposed crossing will not include any specific fish friendly design measures.

Additional Considerations from the Guidelines

During the consultation process additional considerations for fish passage were assessed for the crossings, these included:

Light Penetration - These were allowed for by breaks in the arches and bridge crossings between the carriageways.

Bed Roughness - This was considered and where low flow passage has been allowed for, there will be a level of sediment deposition over time which will create the bed roughness.

Resting Areas - These were considered, however it was determined that for the Dwarf Galaxias species the typical resting area treatments may actually pose a barrier.

AQUATIC BIOLOGIST - CONSULTANT - BIOSIS RESEARCH

APPENDIX 6. Follow up targeted survey of Dwarf Galaxias *Galaxiella pusilla* in the Boggy, Watsons Balcombe Creek catchments, Victoria.

June 2010

Biosis Research

BIOSIS
RESEARCH

PENINSULA LINK

Follow up targeted survey of Dwarf Galaxias *Galaxiella pusilla* in the Boggy, Watsons and Balcombe Creek catchments, Victoria.

Natural & Cultural Heritage Consultants 38 Bertie Street (PO Box 489) Port Melbourne Victoria 3207

BIOSIS
RESEARCH

Report to Abigroup Contractors Pty Ltd.

PENINSULA LINK

Follow up targeted surveys of Dwarf Galaxias *Galaxiella pusilla* in the Boggy, Watsons and Balcombe Creek catchments, Victoria

24 June 2010

prepared by

Chris Bloink

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Dwarf Galaxias habitat in an unnamed tributary of Balcombe Creek, Baxter.

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- for access to ecological databases (Victorian Aquatic Fauna)

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- for access to Tuerong and Devilbend Creeks

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- Sally Mitchell, Robert Fitzgerald, Paul Young, mapping

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- Duncan Buchanan from Dromana Estate
- David Phillips and family

ABBREVIATIONS

DSE	Department of Sustainability & Environment
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
FFG	*Flora and Fauna Guarantee Act 1988* (Vic.)
MWF	Melbourne Water Fish Database
spp.	Species (more than one species)
VAF	Victorian Aquatic Fauna (DSE 2005)

CONTENTS

EXECUTIVE SUMMARY

In late 2007 and early 2008, Biosis Research Pty. Ltd. undertook targeted fish surveys for the nationally significant Dwarf Galaxias in the vicinity of the proposed Frankston Bypass (now known as Peninsula Link). The surveys were a component of the flora and fauna assessments which were undertaken for the Environmental Effects Statement (Biosis Research 2008).

Biosis Research was engaged by Abigroup Contractors Pty Ltd to undertake further survey and monitoring of Dwarf Galaxias required by state (DSE) and federal (DEWHA) regulatory authorities as outlined within the Peninsula Link Threatened Species Management Plan (Practical Ecology 2009).

The objectives of this investigation were to:

- Undertake targeted searches for Dwarf Galaxias in critical areas in consultation with DSE (as outlined within the TSMP); and
- Undertake a pre-construction survey of the known populations of Dwarf Galaxias at Tuerong Creek and upper Balcombe Creek tributary.

The results of this investigation will assist in the development of a site or activity specific environmental management plan for the Dwarf Galaxias population at Tuerong Creek, upper Balcombe Creek tributary and any additional populations found as a result of the targeted searches.

Targeted pre-construction Dwarf Galaxias survey were undertaken at one site on Boggy Creek, one site on an upper Watsons Creek drainage line, and ten sites in the Balcombe Creek catchment. In total, eight indigenous aquatic fauna species (five fish and three decapod crustacea) and two introduced fish species were recorded from the sites surveyed in the Boggy, Watsons and Balcombe Creek catchments. The survey recorded Dwarf Galaxias at three new sites and confirmed the persistence of the known populations in Tuerong Creek and the upper Balcombe Creek catchment.

The new locations that were found to support Dwarf Galaxias, essentially confirm movement and connectivity of those known populations to surrounding waterbodies, but are largely inconsequential with regard to Peninsula Link in terms of requiring additional site specific EMP monitoring requirements.

Two critical areas' in the upper reaches of the Balcombe Creek catchment were dry or too shallow to be surveyed during the current assessment. These areas may provide habitat for Dwarf Galaxias movement and/or spawning during wetter periods within the alignment and warrant investigation (i.e. survey) at an appropriate time of the year (i.e. following inundation).

It is recommended that at least one Dwarf Galaxias survey occur prior to

commencement of clearing/construction works in the vicinity of the known upper Balcombe Creek tributary and Tuerong Creek Dwarf Galaxias populations. The survey should utilise the same methodology, survey effort and standardised equipment to be used for during and post construction monitoring. If additional time is available before commencement of clearing/construction works, it is recommended that pre-construction monitoring also occur at a comparable frequency to during and post construction monitoring (i.e. monthly).

1.0 INTRODUCTION

1.1 Project Background

In late 2007 and early 2008, Biosis Research Pty. Ltd. undertook targeted fish surveys for the nationally significant Dwarf Galaxias in the vicinity of the proposed Frankston Bypass (now known as Peninsula Link). The surveys were a component of the flora and fauna assessments which were undertaken for the Environmental Effects Statement (Biosis Research 2008).

Abigroup Contractors Pty Ltd (herein referred to as Abigroup), as part of the Southern Way consortium was appointed by the Victorian Government to design and construct the Peninsula Link freeway.

Abigroup engaged Biosis Research to undertake further survey and monitoring of Dwarf Galaxias, to fulfil and meet the performance criteria and objectives stipulated by the Project Scope and Requirements (PSR). These include:

- Protect habitat of vulnerable aquatic fauna and minimise impact on State and nationally significant fauna species including Dwarf Galaxias and the Growling Grass Frog.
- Undertake targeted searches in critical areas, in consultation with DSE.
- Include procedures in the Flora and Fauna Management Plan for monitoring the Dwarf Galaxias population at Tuerong Creek during and post construction. Details must include frequency and methodology of monitoring and the credentials of the monitoring organisation

The Threatened Species Management Plan (TSMP) requires Abigroup to undertake:

- targeted searches for Dwarf Galaxias to be undertaken in critical areas, in consultation with DSE
- development of a site or activity specific environmental management plan for the Dwarf Galaxias population at Tuerong Creek (and any additional populations found as a result of the targeted searches);
- monitoring of Dwarf Galaxias population at Tuerong Creek during and post construction; and
- further monitoring for other potential habitat sites as determined with DSE in conjunction with Melbourne Water, Linking Melbourne Authority (LMA) and an aquatic ecologist.

Abigroup have prepared an Environmental Management System and series of ten Environmental Management Plans (EMPs), to meet the requirements of the PSR. The Flora and Fauna Management Plan (FFMP) will include procedures for monitoring the Dwarf Galaxias population at Tuerong Creek during and post construction.

In August 2009 Biosis Research undertook additional targeted survey in the upper reaches of Balcombe Creek for another project (Biosis Research 2009). The area surveyed included areas within and downstream of the Peninsula Link alignment, areas that were predominantly dry/un-surveyable during the EES surveys in 2007/2008. Biosis Research (2009a) recorded Dwarf Galaxias adults and newly hatched juveniles in this area in very high abundance. Tuerong Creek was recognised in the EES and the TSMP as being the most important waterway being crossed by Peninsula Link with regard to Dwarf Galaxias. The upper Balcombe Creek tributary population is considered to be of comparable importance, given the high abundance recorded and the confirmation of the species occurrence and breeding within the alignment. The Tuerong Creek population may also breed within the alignment but to date has only been recorded from the refuge habitat outside (downstream) of the alignment.

The objectives of this investigation were to:

- Undertake targeted searches for Dwarf Galaxias in critical areas in consultation with DSE (as outlined within the TSMP and PSR); and
- Undertake a pre-construction survey of the known populations of Dwarf Galaxias at Tuerong Creek and upper Balcombe Creek tributary.

The results of this investigation will assist in the development of a site or activity specific environmental management plan for the Dwarf Galaxias population at Tuerong Creek, upper Balcombe Creek tributary and any additional populations found as a result of the targeted searches.

1.2 Dwarf Galaxias *Galaxiella pusilla*

Dwarf Galaxias is a tiny, threatened fish species that is listed as Vulnerable in Victoria (DSE 2007) and is listed under the FFG Act 1988. Dwarf Galaxias is endemic to south eastern Australia (including Tasmania and Flinders Island) and the distribution of populations is generally disjunct and patchy, due to the nature of its lowland, shallow, swampy habitat. The species appears to have become extinct in many localities in and around the south eastern fringes of urban Melbourne and the ongoing survival of the species in many catchments is far from secure.

Dwarf Galaxias occurs in still or slow flowing, usually ephemeral waterbodies

(streams, wetlands, drains) that in many instances partially dry up over summer. Dwarf Galaxias usually occurs in relatively shallow waterbodies and typically requires abundant marginal and aquatic vegetation. In waterways where the introduced Eastern Gambusia *Gambusia holbrooki* is present, anecdotal evidence suggests that Dwarf Galaxias require deep, heavily shaded refuge areas and/or connected extensive ephemeral areas with an appropriate hydrological regime to ameliorate the predation/competition threats posed by this noxious species and enhance their prospects of long term survival. Otherwise, this species appears to have fairly broad habitat requirements.

Dwarf Galaxias is short lived (1-2 years) and opportunistic, appearing to have physiological and behavioural adaptations that allow it to survive in very small bodies of permanent water with low dissolved oxygen content. The species appears capable of rapid re-colonisation of large low lying ephemeral areas under suitable conditions. Spawning appears to be tied to such events and has been observed to occur from April through to December (C. Bloink *pers. obs*.), rather than being restricted to the July-September period indicated in the literature. Following successful spawning events, Dwarf Galaxias populations appear to contract from these ephemeral areas with receding water levels and become concentrated in small permanent/semi-permanent refuge pools. Short term (days or weeks) desiccation of these pools is considered likely to at least result in large degree of mortality of Dwarf Galaxias, whereas long term desiccation (months or years) is considered likely to result in temporary or permanent loss of the species from such habitats.

During the EES, Dwarf Galaxias was only recorded from two sites of relevance to Peninsula Link:

- a vagrant individual in Boggy Creek within the Pines Flora and Fauna Reserve. This record is only of relevance to Peninsula Link because Boggy Creek and Tamarisk Creek are potentially connected during flooding events by the Tamarisk Creek diversion channel. Tamarisk Creek will be realigned and redirected as part of the Peninsula Link design and construction works. The Boggy Creek record in the vicinity of the diversion channel supported the notion that the species had some potential (albeit slight) to access and colonise Tamarisk Creek during and following flood conditions.

- a large known population in Tuerong Creek located within a very small section of the creek that offers refuge habitat for the species. This population is located approximately 120 m distance downstream of the Peninsula Link construction footprint. Potential impacts to this population have been significantly reduced by altering the location of the proposed alignment and construction footprint from the original easement.

The EES noted that potential exists for this species to occur at many sites or locations in the vicinity of Peninsula Link, particularly within the unnamed upper tributaries and drains of the Balcombe Creek catchment.

Since the EES, whilst working on other projects in the area, Biosis Research has recorded Dwarf Galaxias at two new sites of relevance to the Peninsula Link Project.

- a large population in the upper reaches of Balcombe Creek (Biosis Research 2009a). During wetter times of the year this population was confirmed to occur and breed within the Peninsula Link alignment.
- a population in Devilbend Creek immediately downstream of the Mornington Peninsula Freeway (Biosis Research 2009b). This is the first record of the species from Devilbend Creek downstream of the Devilbend Reservoir since 1992. The site is located just over 300 m from the Peninsula Link construction footprint (for works on the existing freeway) but is located approximately 3 km downstream of the Devilbend Creek crossing point for Peninsula Link (upstream of Tuerong Rd).

1.3 Study Area

With the inclusion of the known populations in Tuerong Creek and upper Balcombe Creek tributaries, the study area thus predominantly included areas of the Balcombe Creek catchment (including Devilbend and Tuerong Creek sub-catchments), together with small areas of the Watsons Creek and Boggy Creek catchments (Figure 1).

2.0 METHODS

2.1 Classification

Common and scientific names for flora and fauna follow the Flora Information System (FIS 2007 version) and the Atlas of Victorian Wildlife (AVW 2007 version) of the Department of Sustainability and Environment (DSE). Fish names follow the Codes for Australian Aquatic Biota (CAAB)(Rees, Yearsley & Gowlett-Holmes).

2.2 Background Review and Critical Area Selection

In recognition of snap shot survey limitations, Biosis Research (2008) recommended that further targeted survey for Dwarf Galaxias occur in 2008 and 2009, particularly in the Balcombe Creek catchment. These areas were surveyed as part of pre-construction targeted surveys and undertaken as part of this report.

There were relevant areas that were not surveyed for Dwarf Galaxias during the EES and an outline of these is provided below:

- Surveys were conducted in summer when the only water present within most of the relevant waterways was in online dams and the deepest pools (i.e. drought refuge habitats). The advantage of conducting survey during such times is that Dwarf Galaxias populations are concentrated in smaller areas and are therefore more detectable, providing refuge habitats can be located. However, such surveys provide little information on habitats used (including within the alignment) for movement and spawning during wetter periods.

- Tuerong Creek in the vicinity of the existing Mornington Peninsula Freeway. This existing crossing was not originally affected by the Peninsula Link proposed construction footprint. The proposed Peninsula Link alignment was altered in this area after the Dwarf Galaxias surveys were undertaken and surveys in this area were not undertaken due to time constraints.

- The Watsons Creek catchment. Survey in this catchment was less intensive than other catchments because the proposed bypass footprint only affected the very upper highly ephemeral drainage lines, almost all of which were separated from middle reaches of the catchment by large dams. Many of the online dams that were not directly affected by the proposed alignment were inspected and determined not to warrant survey on the basis of poor or marginal habitat for Dwarf Galaxias and reduced suitability due to Eastern Gambusia infestation. The mid reaches of the Watsons Creek catchment were inspected but found to be highly ephemeral and un-surveyable at the time. In addition, these reaches were highly modified, located a significant distance downstream of the proposed footprint, and were protected to some extent by the presence of online dams upstream. Online dams upstream act as a pollutant trap/sediment sink etc. should offsite pollution/sedimentation occur.

- Boggy Creek downstream of Lathams Road. This length of Boggy Creek is highly modified, isolated from upstream areas where Dwarf Galaxias populations are known to occur and located only 1.6 km upstream from the confluence with Eel Race Drain. In the vicinity of the confluence, Eel Race Drain is known to be estuarine and this influence may extend into the lower reaches of Boggy Creek, further reducing the area of suitable habitat for Dwarf

Galaxias, an exclusively freshwater species.

The selection of critical areas for targeted Dwarf Galaxias survey as required under the PSR and TSMP was undertaken taking into consideration:

- the EES knowledge gaps
- the location of previous Dwarf Galaxias records as sourced from relevant databases (Victorian Aquatic Fauna database and Melbourne Water Fish database) and reports (Streamline Research 2007, Biosis Research 2008, 2009a, 2009b);
- the location of the area relative to the proposed Peninsula Link construction footprint
- mapping (VicMap Hydro 1:25,000, 1 in 100 year flood and floodway layers)
- aerial photography (i.e. Google Maps) and
- existing knowledge on habitat suitability and waterway connectivity.

For the targeted searches of Dwarf Galaxias in critical areas it was considered more pertinent to undertake a survey of the knowledge gaps areas, with particular focus on the Balcombe Creek catchment, rather than undertake repeat survey at refuge sites where Dwarf Galaxias were previously not recorded. Biosis Research proposed a number of 'critical areas' for targeted Dwarf Galaxias survey which were subsequently endorsed by DSE. Boggy Creek downstream of Lathams Rd was added at the request of DSE. The areas proposed and requested are outlined below:

- Devilbend Creek between the Mornington Peninsula Freeway and Old Moorooduc Rd;
- Tuerong Creek from immediately upstream of the Mornington Peninsula Freeway to the confluence with Devilbend Creek;
- Devilbend Creek from the confluence with Tuerong Creek to the confluence with Balcombe Creek;
- Devilbend Creek and tributaries between Derril Rd and Loders Rd;
- Upper tributary of Watsons Creek, south of Baxter Road (adjacent to Hawkins Rd);
- Upper Balcombe Creek upstream of Bungower Rd;
- Upper tributary of Balcombe Creek between Peninsula Link alignment and

newly discovered population; and

- Boggy Creek downstream of Rutherford Rd (DSE request).

2.3 Survey

The survey methodology used was broadly consistent with the 'Dwarf Galaxias Monitoring Methodology' developed by Biosis Research, endorsed by DSE and included as an attachment to the FFMP. Targeted Dwarf Galaxias survey was undertaken at one site on Boggy Creek, one site on an upper Watsons Creek drainage line, and ten sites in the Balcombe Creek catchment (See Figure 2). Surveys were undertaken between 30 March and 9 April 2010. Final site selection was based on the critical areas that had been defined, accessibility, water depth and habitat. The details of survey site locations and the methods utilised are outlined and provided in Table 1. The location of the sites surveyed during the current study and those surveyed for the EES (Biosis Research 2008) are presented in Figure 2.

Fyke nets (4 mm stretch mesh), bait traps, dip nets and a Smith Root LR 24 backpack electrofisher were utilised to undertake the survey. The sampling techniques employed in this study were selected in order to maximise sampling efficacy in accordance with site characteristics such as water electrical conductivity (EC), turbidity, depth, width, vegetation and other forms of instream cover (e.g. cobbles, boulders, logs, branches).

For known Dwarf Galaxias populations at Tuerong Creek and the upper Balcombe Creek tributary, the techniques employed were limited to passive techniques (i.e. fyke netting and bait trapping) rather than active techniques (electrofishing and dip netting) to reduce the potential sampling impacts on Dwarf Galaxias spawning habitat (i.e. aquatic vegetation) eggs, larvae and juveniles that may have been present. Additionally, the fyke nets were fitted with exclusion grills (20 mm square plastic mesh) to minimise capture of large fish (e.g. Southern Shortfin Eels and Redfin) and subsequently minimise the potential for predation of Dwarf Galaxias and other small fish to occur within the fyke net.

A visual scan for Dwarf Galaxias larvae and early juveniles on the water surface was made while setting eight bait traps overnight at each site. Bait traps were set amongst aquatic vegetation and to a lesser extent, other forms of cover (e.g. branches, rubbish) with a cylume light stick placed inside each as an attractant. This is a particularly effective, low impact and quantitative method of capturing Dwarf Galaxias.

Table 1 Targeted Dwarf Galaxias survey locations and sampling methods (Map datum: GDA 94)

Site number	Site location description	Zone	Easting	Northing	Sampling Method: FN – Fyke net EF – Electrofishing BT – Bait trap DN – Dip net OB – Observation
1	Boggy Creek downstream of Rutherford Rd, Seaford	55H	338053	5781597	EF (792s) 8×BT
2	Watsons Creek downstream of Baxter Tooradin Rd, Baxter	55H	338882	5770848	8×BT DN (5 min)
3	Online dam on unnamed tributary of Devilbend Creek, 150m downstream of Lodes Rd, Moorooduc	55H	334435	5763015	2×FN 8×BT
4	Tuerong Creek online dam upstream of Mornington peninsula Freeway, Tuerong	55H	330583	5761906	4×FN 8×BT
5	Tuerong Creek online dam 50m downstream of Mornington Peninsula Freeway, Mount Martha	55H	330343	5762005	2×FN 8×BT
6	Devilbend Creek 50m downstream of Old Moorooduc Rd, Tuerong	55H	331071	5761172	4×FN 8×BT
7	Devilbend Creek 600m downstream of Old Moorooduc Rd, Tuerong	55H	330704	5761128	1×FN 8×BT
8	Devilbend Creek immediately upstream of Balcombe Creek confluence, Mount Martha	55H	329552	5762483	EF (398s) 8×BT
9	Backwater of unnamed tributary of Balcombe Creek, Baxter	55H	335922	5769972	8xBT
10*	Unnamed tributary of Balcombe Creek approximately 150m upstream of Sumner Rd, at confluence with drainage line, Baxter	55H	335789	5769861	12xBT
11*	Tuerong Creek between Tuerong Rd and Old Moorooduc Road, Tuerong.	55H	331296	5762219	12xBT
12	Offline wetland/dam approximately 50 m north-west of unnamed tributary of Balcombe Creek and associated	55H	336070	5769966	DN (1 dip). No habitat assessment
13	Unnamed tributary of Balcombe Creek at rail reserve, approximately 850 m downstream of Eramosa Rd West, Baxter	55H	336289	5769348	DRY
14	Balcombe Creek, downstream of Bungower Rd, Moorooduc	55H	335284	5766729	DRY

* Sites with known Dwarf Galaxias populations.

Aquatic habitat assessment including physical attributes (e.g. depth, substrate, flow, cover, aquatic vegetation, riparian vegetation etc.), existing sources of disturbance and *in situ* water quality (e.g. dissolved oxygen, electrical conductivity, pH, turbidity and temperature) was conducted at sites surveyed.

In situ measurements of Dissolved Oxygen (DO), pH, Electrical Conductivity, temperature and turbidity were made using a calibrated Horiba U52 water quality meter. All water quality measurements were taken in accordance with EPA publication 441 (EPA 2000).

Fauna records will be submitted to the Victorian Aquatic Fauna (VAF) database.

2.4 Qualifications

The following qualifications apply to this survey:

- The surveys conducted provide a snap shot of the aquatic fauna communities at the time of assessment. Other aquatic fauna species may have occurred at the site in the past and may again occur in the future. Failure to detect a species does not necessarily imply that the species is not present, but may imply low abundance of that species (provided appropriate survey techniques and survey effort was applied for detection of that species).
- The Victorian Aquatic Fauna database (VAF) currently provides data recorded up to December 2003. Data submitted since that time is not currently available.
- Mapping is conducted using hand-held (uncorrected) GPS units and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration. As such, these points should not be relied on for design purposes.
- Access to the known Dwarf Galaxias population in the upper Balcombe Creek tributary was not granted by the landholder and the sites surveyed were subsequently limited to areas downstream.

3.0 RESULTS

3.1 Aquatic Fauna Species

Records during present assessment

In total, eight indigenous aquatic fauna species (five fish and three decapod crustacea) and two introduced fish species were recorded from the sites surveyed in the Boggy, Watsons and Balcombe Creek catchments (Table 2 and Table 3).

Table 2 Dwarf Galaxias survey results for Sites 1-5 (30 March – 9 April, 2010)

		Notes	Boggy Creek	Watsons Creek	Devilbend Creek trib.	Tuerong Creek	
	Site Number:		**1**	**2**	**3**	**4**	**5**
Native fish species							
Dwarf Galaxias	*Galaxiella pusilla*	O,1				1	
Southern Shortfin Eel	*Anguilla australis*	D	15			149	3
Common Galaxias	*Galaxias maculatus*	D	22	7			12
Southern Pygmy Perch	*Nannoperca australis*	O		1		7	13
Spotted Galaxias (Trout Galaxias)	*Galaxias truttaceus*	D					
Introduced fish species							
Goldfish	*Carassius auratus*	O	7				
Eastern Gambusia	*Gambusia holbrooki*	O,N	28			900	8
Native Decapod Crustacean species							
Freshwater Shrimp	*Paratya australiensis*	O			100	22	
Yabby	*Cherax* sp.	O		1			
Burrowing Crayfish	*Engaeus* sp.	O		1			

Table notes:
* Sites with known Dwarf Galaxias populations.
E - Euryhaline species – species which are capable of occurring in marine and freshwater environments (typically estuarine species and marine vagrants).
D - Diadromous species – species which migrate between fresh and salt water at specific parts of their lifecycle (includes anadromous, catadromous and amphidromous species).
O -Obligate freshwater species – species incapable of survival in estuarine (not just brackish) or saltwater habitats.
N - Declared noxious species under the Fisheries Act, 1995.
T - Non-indigenous (translocated) native species.

Table 3 Dwarf Galaxias survey results for Sites 1-5 (30 March – 9 April, 2010)

		Notes	Devilbend Creek			Balcombe Creek trib.		Tuerong Creek	Offline dam
	Site Number:		**6**	**7**	**8**	**9**	**10***	**11***	**12**
Native fish species									
Dwarf Galaxias	*Galaxiella pusilla*	O,1				156	28	99	10
Southern Shortfin Eel	*Anguilla australis*	D	36	1					
Common Galaxias	*Galaxias maculatus*	D	103	44	20	1			
Southern Pygmy Perch	*Nannoperca australis*	O	113	107	56	206	127	5	
Spotted Galaxias (Trout Galaxias)	*Galaxias truttaceus*	D	1						
Introduced fish species									
Goldfish	*Carassius auratus*	O							
Eastern Gambusia	*Gambusia holbrooki*	O,N	78	68	2	32	15	6	
Native Decapod Crustacean species									
Freshwater Shrimp	*Paratya australiensis*	O	64	9		14	36	8	
Yabby	*Cherax* sp.	O							
Burrowing Crayfish	*Engaeus* sp.	O		1		1			

Table notes:
* Sites with known Dwarf Galaxias populations.
E - Euryhaline species – species which are capable of occurring in marine and freshwater environments (typically estuarine species and marine vagrants).
D - Diadromous species – species which migrate between fresh and salt water at specific parts of their lifecycle (includes anadromous, catadromous and amphidromous species).
O -Obligate freshwater species – species incapable of survival in estuarine (not just brackish) or saltwater habitats.
N - Declared noxious species under the Fisheries Act, 1995.
T - Non-indigenous (translocated) native species.

The survey recorded Dwarf Galaxias (See Plate 1 below) at three new sites and confirmed the persistence of the known populations in Tuerong Creek and the upper Balcombe Creek catchment. The new sites (Sites 4, 9 and 12) were located either on or connected to the same waterway (Site 4 and 9) as known populations of Dwarf Galaxias, or were located in an area expected to connect to the waterways with known populations during flood conditions (Site 12). The Dwarf Galaxias record from one site (Site 4) consisted of a single individual. Given the poor habitat at this site and very large numbers of Eastern Gambusia, this record is considered to represent a vagrant individual from the known population upstream, rather than another population. No Dwarf Galaxias larvae or early juveniles were observed or captured, although adult Dwarf Galaxias were observed to be close to breeding colouration.

Plate 1: Vagrant Dwarf Galaxias (juvenile) captured at Tuerong Creek online dam (Site 4).

3.2 Habitat

Habitat assessment results are presented in Appendix 1. Photos of sites at which Dwarf Galaxias were recorded in the current study (other than Site 12) are shown in Plates 2 to 5. With the exception of Boggy Creek, all survey sites consisted either entirely or predominantly of pools. Boggy Creek was flowing moderately at the time of assessment and consisted of pools interspersed with run and glide. For stream sites, the average wetted width ranged from 0.5 m (Watsons Creek) to 6 m (Boggy Creek). Site 4 was the largest dam surveyed, with a maximum width of 35 m. For stream sites, average depth ranged from to 0.2 m (Watsons Creek) to 1.2m (Devilbend Creek) but was generally less than 0.6 m. Turbidity was high (> 50 NTU) at most sites and lowest at Devilbend Creek between the Mornington Peninsula Freeway and Old Moorooduc Rd. Water temperature ranged from 14 (Site 5) to 18.9 ºC (Site 7) but this generally reflected the time of day the measurement was taken (most waterbodies were shallow). Dissolved oxygen varied from 9.6 % (Site 5) to 130 % (Site 2), but again to some extent this was a reflection of the time of day the measurement was taken and the degree of shading. Electrical conductivity varied from 144 µS/cm (Site 2) to 6430 µS/cm (Site 7) and was generally highest in Devilbend Creek and lowest in Watsons Creek and upper Balcombe Creek tributaries. pH varied from 6.4 (Site 5) to 7.8 (Site 3).

Plate 2: Site 4 – Tuerong Creek online dam upstream of Mornington peninsula Freeway, Tuerong. One vagrant Dwarf Galaxias was recorded from this site.

Plate 3: Site 9 – Backwater of unnamed tributary of Balcombe Creek, Baxter. 156 Dwarf Galaxias were recorded from this site.

At all sites the substrate was comprised primarily of silt/clay. Aquatic vegetation provided the predominant form of cover to aquatic fauna at all sites. Other significant forms of cover included woody debris (e.g. logs/branches)(Site 8 and 10), coarse particulate organic matter (e.g. leaves)(Site 8, 10 and 11) and overhanging terrestrial vegetation (Site 10). The degree of instream cover available to aquatic fauna ranged from approximately 35% (Site 5) to 100% (Site 10). Aquatic vegetation at all sites except Site 3 consisted mainly of emergent macrophytes (e.g. Bulrush *Typha* sp., Slender Knotweed *Persicaria decipiens* sp. and *Paspalum* sp.). Significant stands of submergent macrophytes (e.g. Pondweed *Potamogeton* sp., *Callitriche* sp.) were present at Site 3, 6 7 and 8.

Plate 4: Site 10 - Unnamed tributary of Balcombe Creek approximately 150m upstream of Sumner Rd, at confluence with drainage line, Baxter. A known Dwarf Galaxias population occurs in this site. 28 were recorded here during the current study.

Plate 5: Tuerong Creek between Tuerong Rd and Old Moorooduc Road, Tuerong. A known Dwarf Galaxias population occurs at this site. 99 were recorded here during this study.

The riparian vegetation at most sites was limited to relatively thin strips consisting of the occasional tree or shrub (usually native) over a predominantly introduced ground cover. Extensive revegetation works were evident along some areas of Devilbend Creek and this is likely to have assisted in bank

stabilisation. More extensive riparian vegetation consisting primarily of Swamp Scrub (*Melaleuca ericifolia*) was evident Site 8 (Devilbend Creek), Site 9-10 (Balcombe Creek tributary) and Site 11 (Tuerong Creek), however the width of the riparian zone was still limited and again the ground cover consisted predominantly of introduced vegetation. Riparian vegetation provided a moderate (26-50%) amount of instream shading at Sites 2, 4, 5, 6 and 10 and a high (>51%) amount of instream shading at Site 8 and 9. Disturbance to aquatic habitat appeared highest at Boggy Creek and Watsons Creek and lowest Site 8 (Devilbend Creek). Major forms of disturbance include bank erosion, the clearing of riparian vegetation, the presence of barriers, sedimentation, rubbish, invasive aquatic vegetation (e.g. *Paspalum* sp.), altered hydrological regime and channelisation.

4.0 DISCUSSION

Only 99 Dwarf Galaxias were captured from the known population at Tuerong Creek (Site 11). A quick comparison with data obtained during EES surveys reveals that the capture rate per unit of survey effort (i.e. Dwarf Galaxias per bait trap/hour) at this site appears to have declined dramatically, from 3.0 Dwarf Galaxias per bait trap/hour in December 2007 to 0.5 Dwarf Galaxias per bait trap/hour in April 2010. There are many variables (e.g. pool size, timing, breeding, trap standardisation etc.) that are likely to influence capture rates. Hence comparison between two snap shot survey results should be treated with caution. It should be noted that the April 2010 capture rates are still indicative of a large Dwarf Galaxias population, however given the magnitude of the apparent decline (~85%), it appears likely that the population has declined significantly.

The sand bag wall that has been constructed within Tuerong Creek between the December 2007 survey and April 2010, is acknowledged to be a very valuable short term tool for ensuring the site does not dry out and the Dwarf Galaxias population is not lost. However it should also be acknowledged that the wall is a barrier to fish passage and an alteration to the hydrological regime and is probably the most likely reason for the apparent decline in the population size at the site. At the time of assessment, the wall was inundated and Dwarf Galaxias were found to occur on both sides. As the water recedes and the wall again presents a barrier to fish passage, it is likely that large numbers of Dwarf Galaxias would become stranded. Furthermore, alterations to the hydrological regime (i.e. wetting and drying cycles) typically leads to changes in aquatic vegetation cover and diversity, habitat that is of critical importance to Dwarf Galaxias for spawning and cover.

In the short term it is recommended that Melbourne Water create (i.e. excavate) an additional refuge pool on the downstream side of the wall, so that Dwarf Galaxias stranded on this side of the wall may follow receding water into this refuge pool and survive until the wall is again drowned out. In the longer term it is recommended that Melbourne Water investigate alternative methods for maintaining this site as a drought refuge habitat for Dwarf Galaxias. The site consists of three refuge pools that were isolated during this assessment and appear likely to be isolated in all but the wettest periods of the year. All of these pools, particularly the one that extends either side of Old Moorooduc Rd and includes the culvert, to some extent act as sediment traps, gradually becoming shallower and hence more ephemeral and less capable of acting as refuge habitats over time. The depth of the water column of these pools should be monitored and the centre of the pools should be periodically excavated as required. Excavation should not damage the banks or increase the area of the pools and should only occur following translocation of the bulk of the Dwarf Galaxias from

the pool to be deepened into the other pools.

The apparent decline in the population size at the known Tuerong Creek population between the EES survey and this survey is not related to Peninsula Link, as construction and works in this area are yet to commence. However, the apparent decline demonstrates the need for further pre construction (i.e. baseline survey) monitoring to occur. Without adequate baseline data, future declines in the size of the Dwarf Galaxias population detected during or post construction could erroneously be considered attributable to Peninsula Link construction or post construction impacts, when in fact these temporal changes in abundance may have occurred irrespective of Peninsula Link.

5.0 CONCLUSION

This study confirmed the continued presence of Dwarf Galaxias populations at Tuerong Creek and upper Balcombe Creek tributaries in the vicinity of the Peninsula Link alignment. The new locations that were found to support Dwarf Galaxias, essentially confirm movement and connectivity of those known populations to surrounding waterbodies, but are largely inconsequential with regard to Peninsula Link in terms of requiring additional site specific EMP monitoring requirements.

Two critical areas' in the upper reaches of the Balcombe Creek catchment (Sites 13 and 14) were dry or too shallow to be surveyed during the current assessment. These areas may provide habitat for Dwarf Galaxias movement and/or spawning during wetter periods within the alignment and warrant investigation (i.e. survey) at an appropriate time of the year (i.e. following inundation).

The sand bag wall that has been constructed within Tuerong Creek is acknowledged to be a very valuable short term tool for ensuring the site does not dry out and the Dwarf Galaxias population is not lost. However, it is also the most likely explanation for an apparent decline in the population size at the site. In the short term it is recommended that Melbourne Water create (i.e. excavate) an additional refuge pool on the downstream side of the wall, so that Dwarf Galaxias stranded on this side of the wall may follow receding water into this refuge pool and survive until the wall is again drowned out. In the longer term it is recommended that Melbourne Water investigate alternative methods (i.e. deepening of existing pools) for maintaining this site as a drought refuge habitat for Dwarf Galaxias.

It is recommended that Dwarf Galaxias survey occur prior to commencement of clearing/construction works in the vicinity of the known upper Balcombe Creek tributary and Tuerong Creek Dwarf Galaxias populations in June 2010 and at a comparable frequency to during and post construction monitoring (i.e. monthly). The survey should utilise the same methodology, survey effort and standardised equipment to be used for during and post construction monitoring.

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APPENDICES

APPENDIX 1

Aquatic habitat assessment

Table A1. Aquatic habitat assessment of sites surveyed.

HABITAT CHARACTERISTICS	*SITE CODE* 1	2	3	4	5	6
Water body type	Stream	Stream	Online dam	Online dam	Online dam	Stream
Mean waterbody width (m)	6	0.25	N/A	25	N/A	3.5
Max. waterbody depth (m)	>1.0	2	>1.5	>1.25	>1.75	>1.5
Land type/use	Industrial	Agriculture, recreational reserve/park, residential	Pasture	Pasture, Agriculture	Other	Agriculture
Water Quality						
pH (units)	7.16	7.25	7.81	7.34	6.42	6.88
Turbidity (NTU)	132	71.3	81	87	63	16.3
Temperature (˚C)	18.2	18.54	17.6	18.5	14	17.3
Electrical Conductivity (µS/cm)	798	144	4870	4610	922	3790
Dissolved Oxygen (mg/L)	6.1	11.82	6.85	10.38	0.96	1.05
Substrate (% composition)						
Bedrock						
Boulder		5				
Cobble						
Pebble						
Gravel						10
Sand	70					10
Silt/Clay	30	95	100	100	100	80
Flow type (%)						
Rapid/cascade						
Run	20					
Riffle						
Glide	20					
Pool	50	100	100	100	100	100
Backwater	10					
Dam/Wetland/Lake						
Tidal						
Other						
Instream cover (% wetted area)						
Substrate (Rock, etc)		2.5				
Logs				1	1	1
Log jams						
Branches	5			1	1	2
Branch piles						
Leaves, organic debris	5	5				5
Overhanging bank						1
Overhanging vegetation	5					2
Urban rubbish	5	2.5	5			1
Aquatic vegetation	65	70	30	80	70	60
Willow roots						
Other				1		
Width of Riparian Zone	5	3	0	1	1.5	4

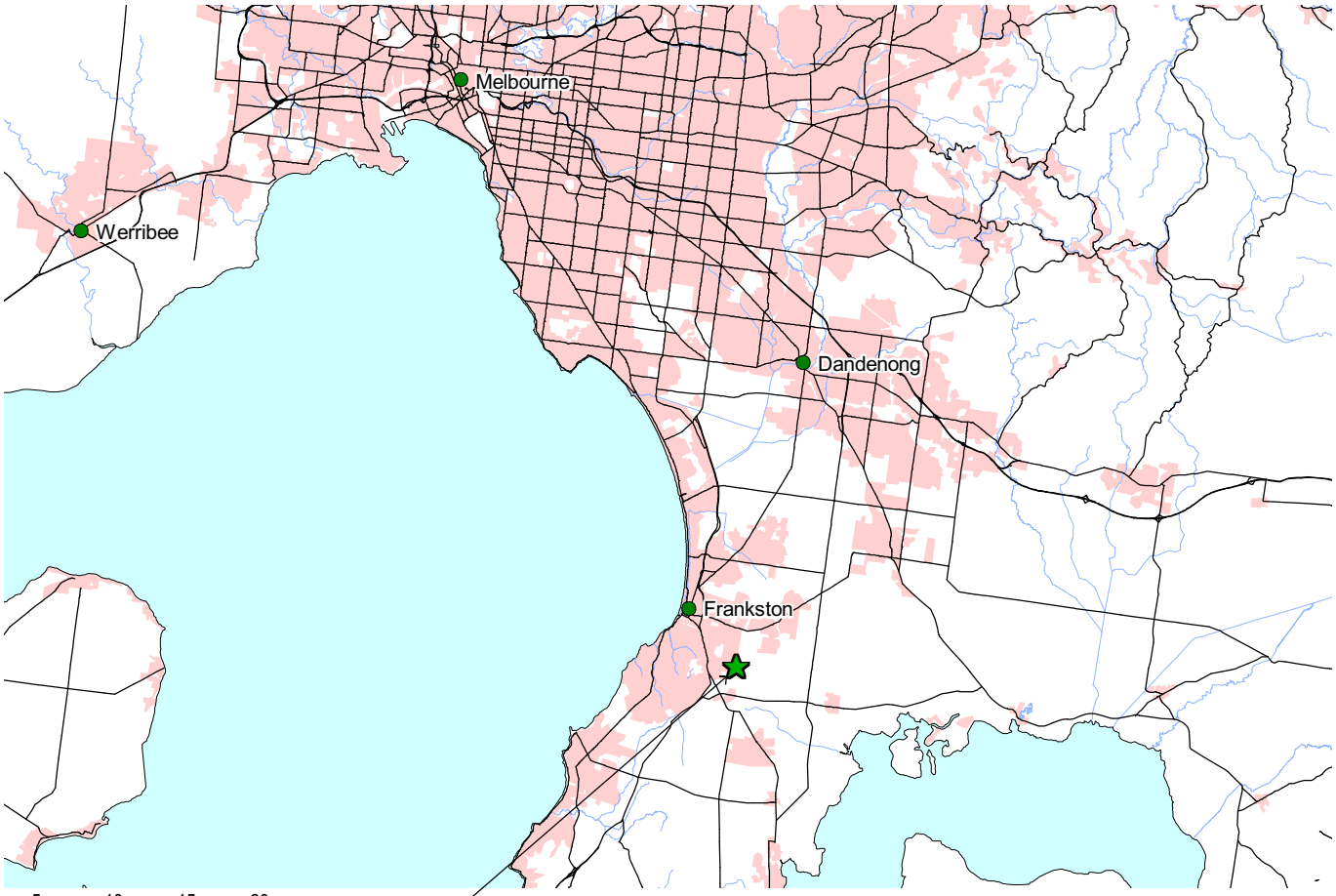
HABITAT CHARACTERISTICS	*SITE CODE* 1	2	3	4	5	6
Structural composition (% cover)						
Trees	50-80	20-50	N/A	<20	20-50	20-50
Shrubs	50-80	20-50	N/A	20-50	<20	20-50
Ground Cover	50-80	>80	N/A	50-80	>80	50-80
Exotic vegetation (%)						
Trees	41-60	0	N/A	0	0	0
Shrubs	>60	11-40	N/A	>60	1-10	41-60
Ground Cover	>60	>60	N/A	>60	>60	>60
Shading of waterbody (%)	6-25	26-50	<5	6-25	26-50	26-50
Aquatic Vegetation (%)						
Submerged			95	5		35
Floating				5	10	5
Emergent	100	100	5	90	90	60
Filamentous algae						
Chara						
Flow Status	Optimal	Marginal	Poor	Poor	Poor	Optimal
Disturbance						
Disturbance Rating	Very high	Very high	Very high	High	Moderate	Moderate
Major forms of disturbance	Bank erosion, riparian veg clearance, culvert, rubbish, sedimentation, barrier, altered hydrological regime	Riparian veg clearance, parallel or adjacent road, culvert, rubbish, drain, sedimentation, invasice exotic veg, barrier, altered hydrological regime	Bank erosion, riparian veg clearance, rubbish, stock access, sedimentation	Riparian veg clearance, culvert, sedimentation, invasive exotic veg, barrier, altered hydrological regime	Riparian veg clearance, parallel or adjacent road, culvert, sedimentation, barriers, altered hydrological regime	Bank erosion, riparian veg clearance, sedimentation, invasive exotic veg, altered hydrological regime

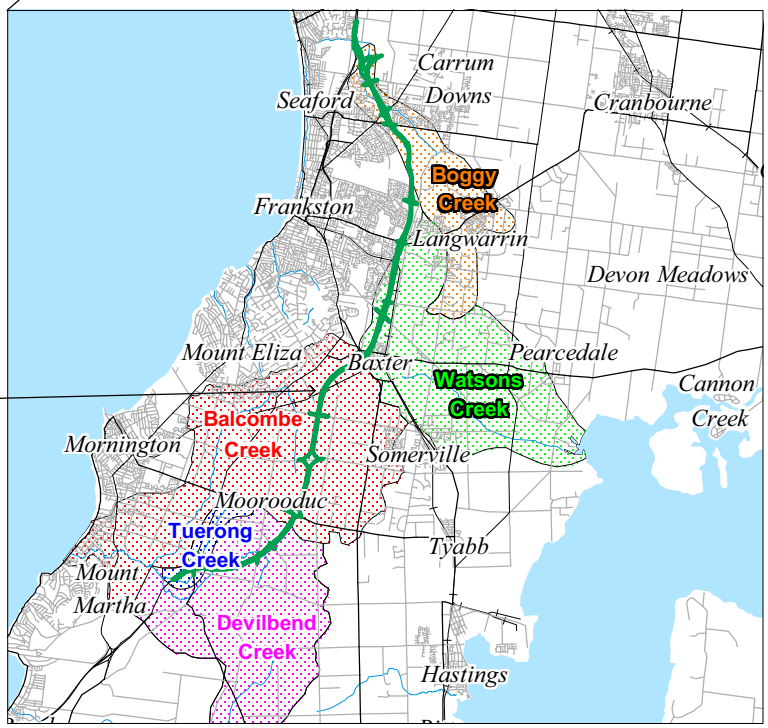
Table A2. Aquatic habitat assessment of sites surveyed.

HABITAT CHARACTERISTICS	*SITE CODE* 7	8	9	10	11
Water body type	Stream	Stream	Stream	Stream	Stream
Mean waterbody width (m)	1.5	1.75	4	2.5	1.5
Max. waterbody depth (m)	1.3	0.5	1.25	1.25	1.1
Land type/use	Agriculture	Conservation reserve	Heath/Scrub/Woodland	Pasture, Scrub	Pasture, scrub
Water Quality					
pH (units)	6.82	N/A	6.5	6.52	6.04
Turbidity (NTU)	18.5	N/A	64.8	137	44.8
Temperature (˚C)	18.9	N/A	17.68	17.03	17.32
Electrical Conductivity (µS/cm)	6430	N/A	800	158	920
Dissolved Oxygen (mg/L)	10.35	N/A	5.11	2.57	1.17
Substrate (% composition)					
Bedrock					
Boulder	1				
Cobble	1				
Pebble					10
Gravel					
Sand					5
Silt/Clay	98	100	100	100	85
Flow type (%)					
Rapid/cascade					
Run					
Riffle	1				
Glide	1				
Pool	98	100	100	100	100
Backwater					
Dam/Wetland/Lake					
Tidal					
Other					
Instream cover (% wetted area)					
Substrate (Rock, etc)	1				
Logs		5	2	10	5
Log jams					
Branches	1	15	2	10	5
Branch piles		5			
Leaves, organic debris	2	35		25	10
Overhanging bank				5	2
Overhanging vegetation	2	5		10	5
Urban rubbish	1				2
Aquatic vegetation	75	15	70	50	35
Willow roots					
Other					
Width of Riparian Zone	1.5	22.5	30	16.5	11
Structural composition (% cover)					
Trees	<20	0	0	<20	20-50
Shrubs	<20	>80	50-80	>80	20-50
Ground Cover	>80	20-50	<20	>80	>80
Exotic vegetation (%)					
Trees	0	0	0	0	41-60
Shrubs	1-10	1-10	41-60	11-40	41-60

HABITAT CHARACTERISTICS	*SITE CODE*				
	7	**8**	**9**	**10**	**11**
Ground Cover	>60	41-60	>60	>60	>60
Shading of waterbody (%)	6-25	>76	51-75	26-50	6-25
Aquatic Vegetation (%)					
Submerged	30	20			5
Floating			25	55	5
Emergent	65	80	75	40	85
Filamentous algae	5			5	5
Chara					
Flow Status	Optimal	Suboptimal	Suboptimal	Suboptimal	Marginal
Disturbance					
Disturbance Rating	High	Low	Moderate	Moderate	Moderate
Major forms of disturbance	Bank erosion, riparian veg clearance, culvert, sedimentation, invasive exotic veg, barriers, altered hydrological regime	Altered hydrological regime	Invasive exotic veg, channelisation, altered hydrological regime	Bank erosion, riparian veg clearance, invasive exotic veg, channelisation	Parallel or adjacent to road, culvert, sedimentation, barrier

FIGURES





Study area

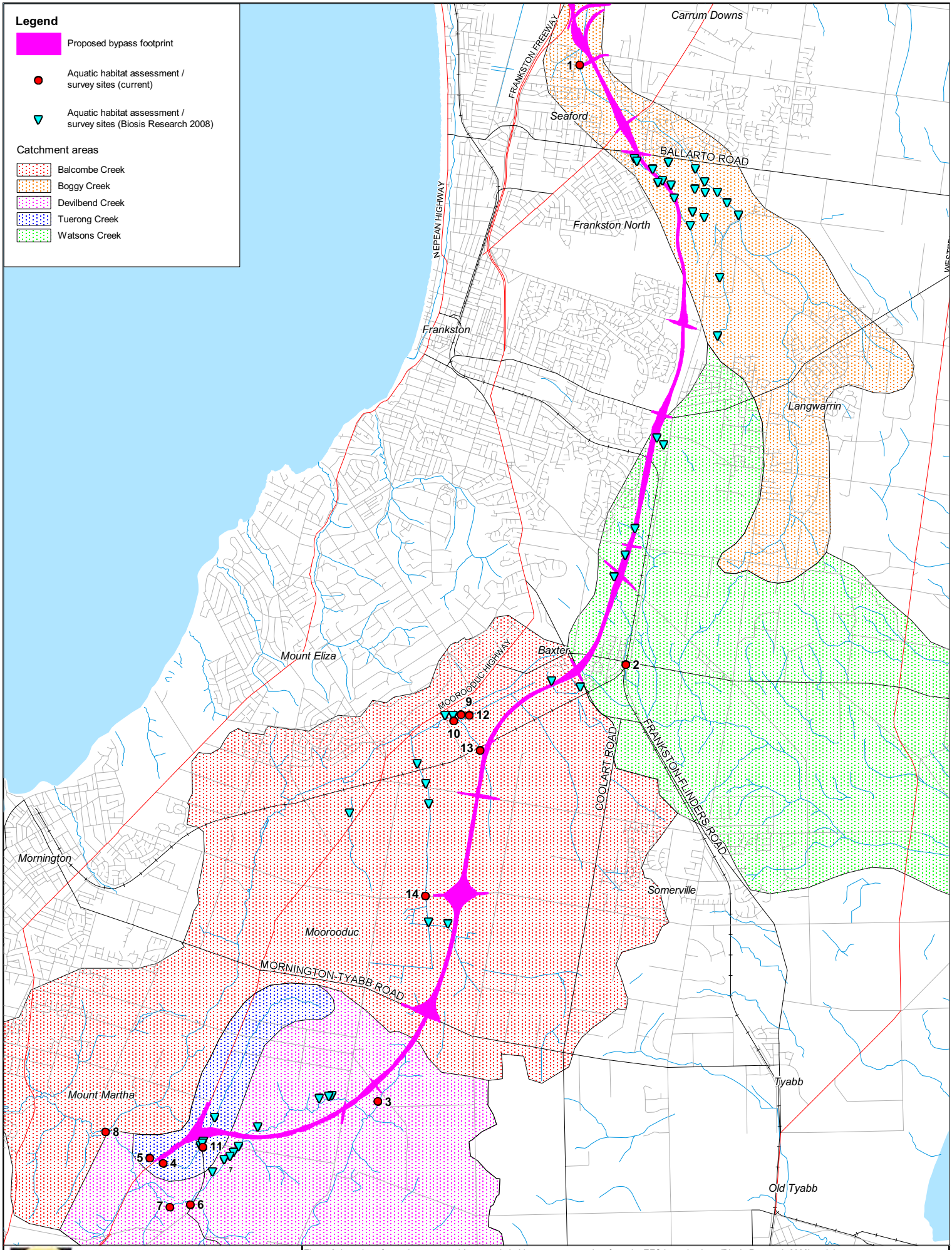
Biosis Research Pty. Ltd.
38 Bertie Street
(PO Box 489)
Port Melbourne
VICTORIA 3207

Figure 1: Location of the Peninsula Link and and the catchments traversed

DATE: 14 May 2010
Checked by: CJB | Drawn by: PJY | File number: 11518
Location: P:\11500s\11518\Mapping\11518 Figure 1.wor

Scale: 0 3 6 9 12 kilometres

MGA Zone 55



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VICTORIA 3207

Figure 2: Location of aquatic survey and / or aquatic habitat assessment sites from the EES investigations (Biosis Research 2008) and the current study

DATE: 24 June 2010
Checked by: CJB | Drawn by: PJY | File number: 11518
Location: P:\11500s\11518\Mapping\11518 Figure 2.wor

Scale: 0 0.6 1.2 1.8 2.4 3.0 kilometres

N W E S

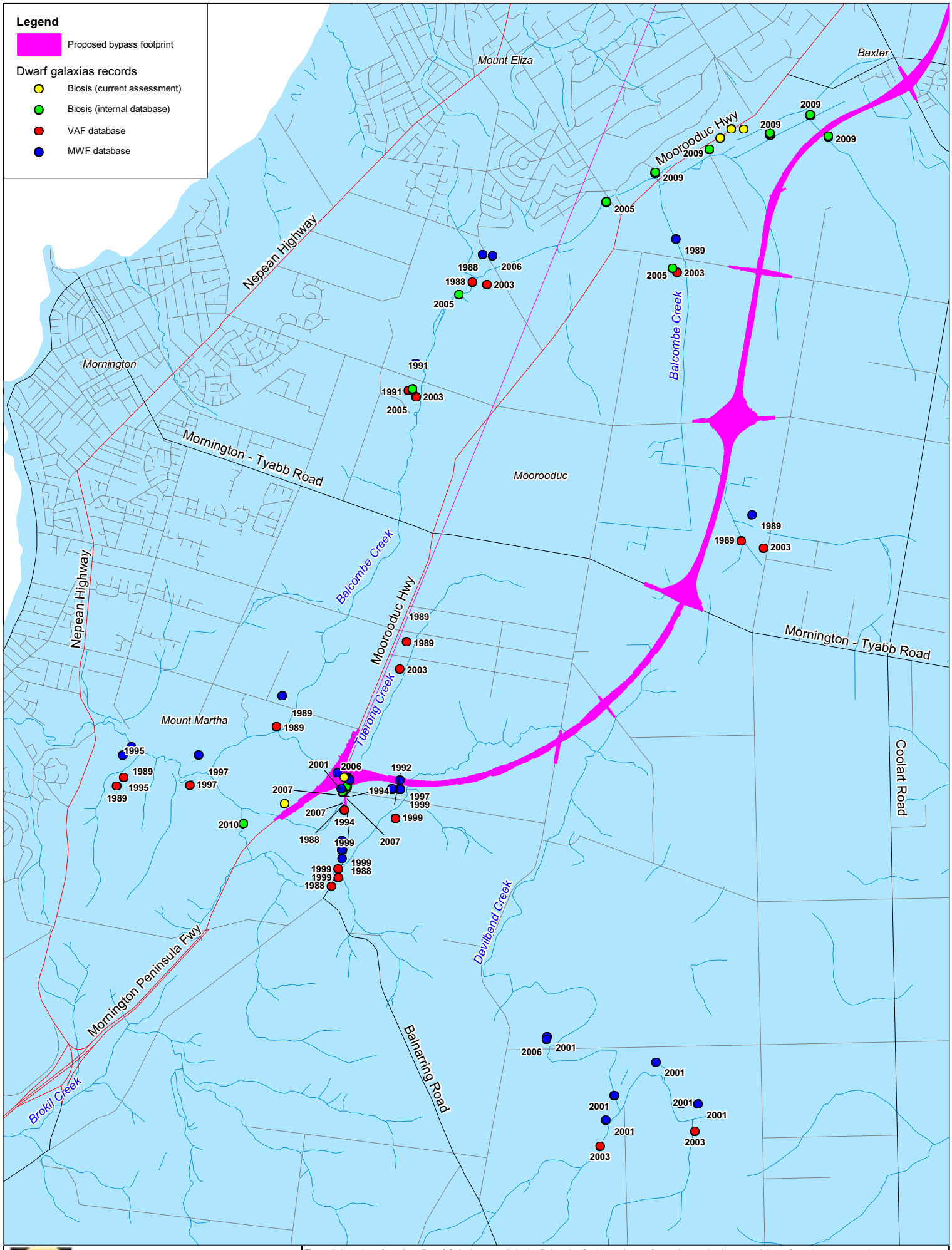

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Figure 3: Location of previous Dwarf Galaxias records in the Balcombe Creek catchment from relevant databases and those from the current study

DATE: 13 May 2010
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Location: P:\11500s\11518\Mapping\11518 Figure 3.wor

Scale: 0 0.4 0.8 1.2 1.6 2.0 kilometres

N W E S

APPENDIX 7. Waterway Crossings and associated mitigation measures for Dwarf Galaxias

Sheet 1
Flora and Fauna proposed works at drainage crossings
Peninsula Link Project

Drainage Crossing Point
Dwarf Galaxis found
PenLink Design data

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Scale 1:6,000
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Map Created October 2010
Projection: MGA Zone 55

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Sheet 2
Flora and Fauna proposed works at drainage crossings
Peninsula Link Project

Drainage Crossing Point
Dwarf Galaxis found
PenLink Design data

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Map Created October 2010
Projection: MGA Zone 55

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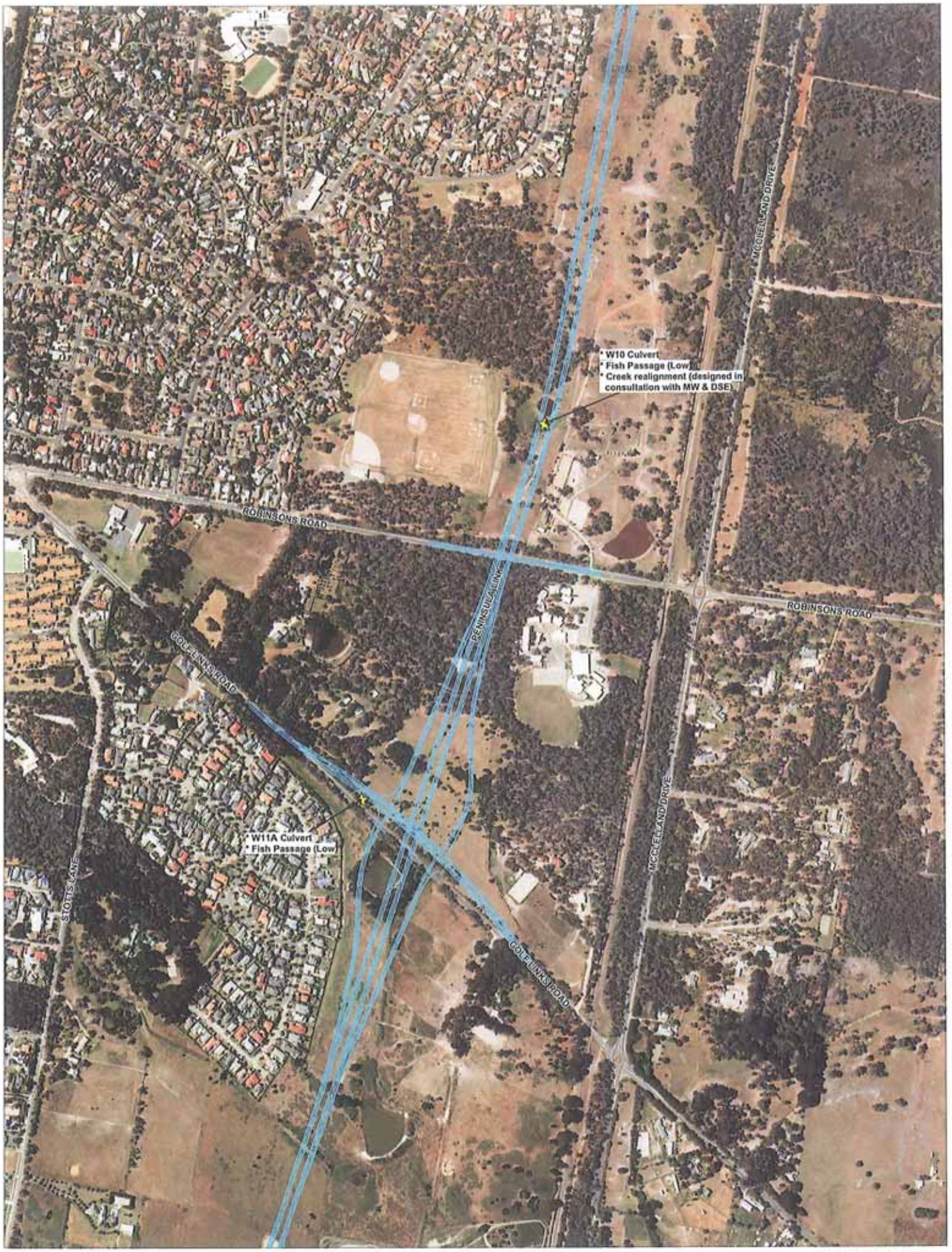

Sheet 3
Flora and Fauna proposed works at drainage crossings
Peninsula Link Project

Drainage Crossing Point
Dwarf Galaxis found
PenLink Design data

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Map Created October 2010
Projection: MGA Zone 55

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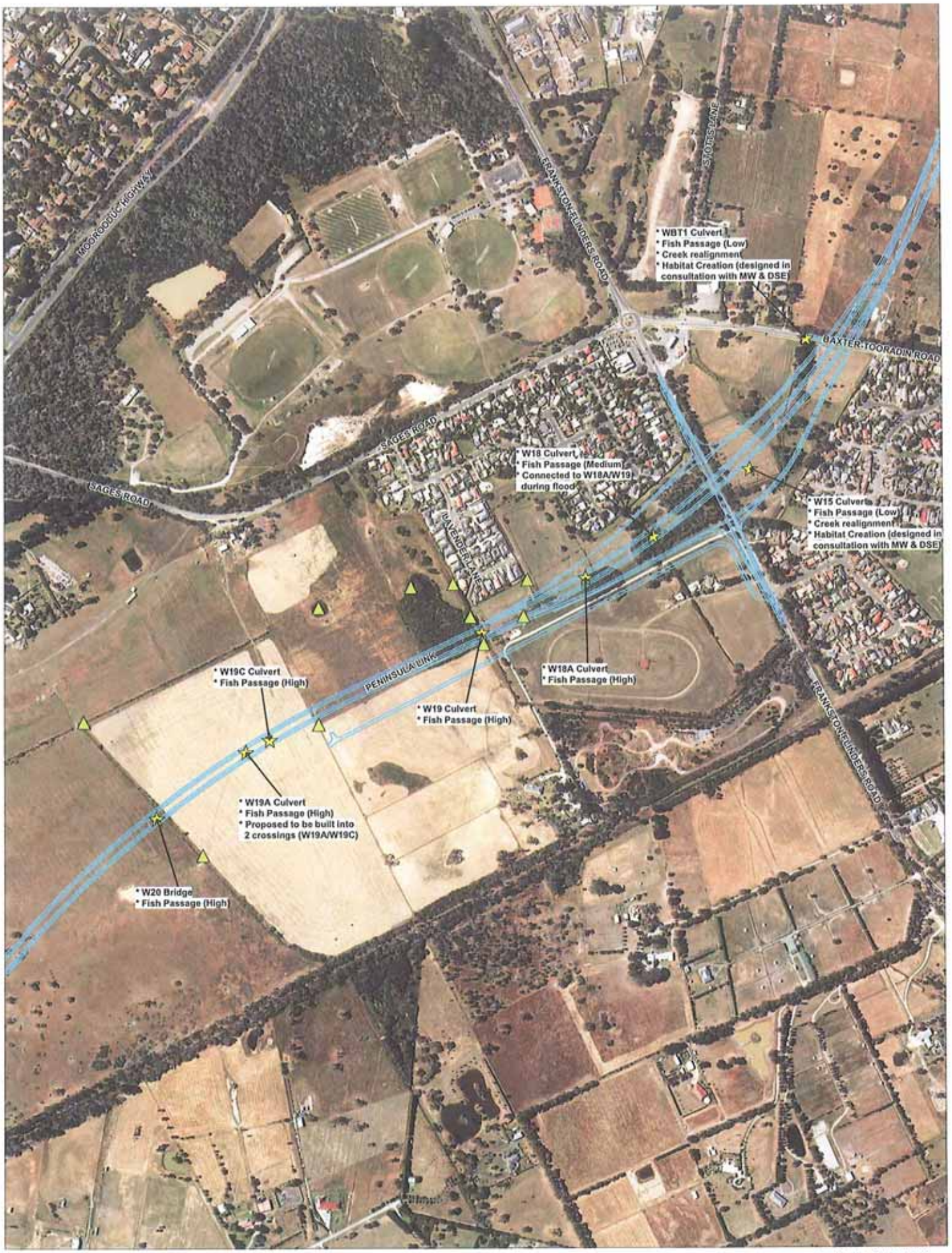

Sheet 4
Flora and Fauna proposed works at drainage crossings
Peninsula Link Project

Drainage Crossing Point
Dwarf Galaxis found
PenLink Design data

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Map Created October 2010
Projection: MGA Zone 55

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Sheet 5
Flora and Fauna proposed works at drainage crossings
Peninsula Link Project

Drainage Crossing Point
Dwarf Galaxis found
PenLink Design data

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Projection: MGA Zone 55

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Sheet 6
Flora and Fauna proposed works at drainage crossings
Peninsula Link Project

Drainage Crossing Point
Dwarf Galaxis found
PenLink Design data

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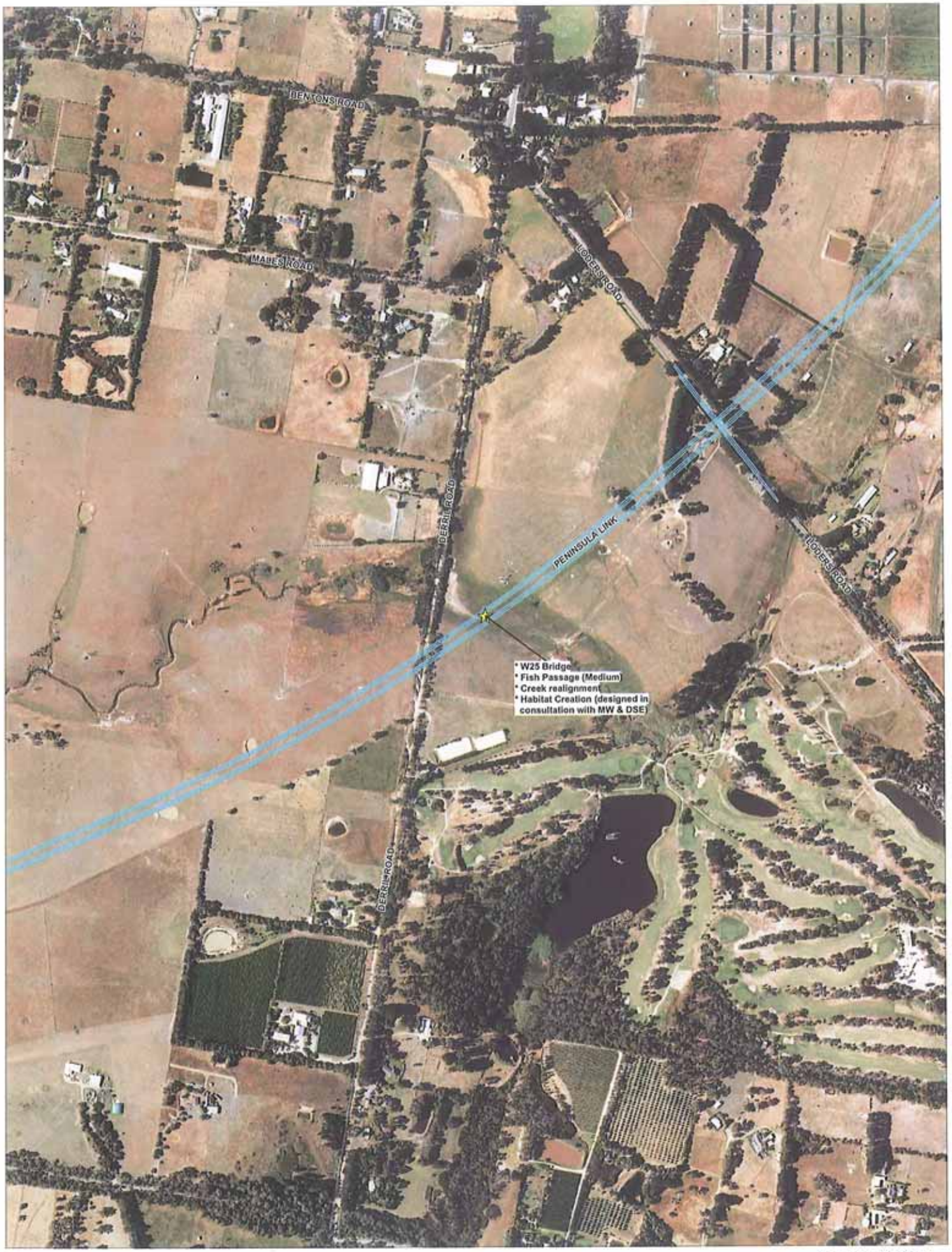

Sheet 7
Flora and Fauna proposed works at drainage crossings
Peninsula Link Project

Drainage Crossing Point
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PenLink Design data

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Sheet 8
Flora and Fauna proposed works at drainage crossings
Peninsula Link Project

Drainage Crossing Point
Dwarf Galaxis found
PenLink Design data

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Map Created October 2010
Projection: MGA Zone 55

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APPENDIX 8. Threatened Species Targeted Searches

January 2010

Practical Ecology Pty Ltd

Contracting and Consulting in Ecological
Restoration and Environmental Planning
ABN 88 082 911 377

Appendix to:

Threatened Species Management Plan:

Peninsula Link - Carrum Downs to Mount Martha, Victoria.

Threatened Species Targeted Searches

Purple Blown-grass *Lachnagrostis Punicea* subsp. *filiformis*
Photo by Damien Cook

22 January 2010

Prepared for the Linking Melbourne Authority

By Joy MacDonald

Phone: 9484 1555 Fax: 9484 9133
Email: enquiries@practicalecology.com.au
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Appendix to: Threatened Species Management Plan: Peninsula Link – Carrum Downs to Mount Martha, Victoria. November 2009

22 January 2010

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Report by Joy MacDonald
Report prepared by Practical Ecology Pty Ltd on behalf of the Linking Melbourne Authority.

Practical Ecology project number: SEI 1090

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Jenny Carbery – Linking Melbourne Authority	Linking Melbourne Authority
John McGuckin – Streamline Research	Dwarf Galaxias Mitigation Plan
Gidja Walker – Practical Ecology	Expert opinion/Targeted Searches
Damian Cook – Australian Ecosystems	Expert opinion/Targeted Searches
Russell Mawson ANOS	Expert opinion
Karen Lester DSE	Background research
Peter Gannon	Expert opinion and review
Biosis Research	Base Report
Michelle Savona	Peer Review

Version control:

Version	Date sent to client	Reviewed by
1	22/1/2010	Michelle Savona

Contents

Tables

1. INTRODUCTION

In 2008 an Environmental Effects Statement (EES) was developed for the construction of the Peninsula Link freeway (formerly known as the Frankston Bypass) from Carrum Downs to Mount Martha, Victoria (SEITA 2008). Several technical reports were prepared for the EES, including the *Flora and fauna assessment of the proposed Frankston Bypass, Carrum to Mount Martha, Victoria*, conducted by Biosis Research (Venosta *et al* 2008).

Subsequent to the EES a conditional approval was granted, under the *Environment Protection and Biodiversity Conservation (Cwth) Act 1999* (EPBC Act), for the construction of the freeway (EPBC Act Approval 2007/3480). The approval was granted subject to several conditions, including the development of a Threatened Species Management Plan (TSMP) aimed at the protection and recovery of selected threatened flora and fauna taxa which was ratified by DEWHA on 20 January 2010.

This report forms an addendum to the TSMP to report the findings of targeted searches which have been undertaken from September 2009 to January 2010 as per the requirements of the TSMP.

1.1 Objectives

This addendum reports the findings of targeted searches for threatened species as listed in Table 1 below as per section 1.4 of the TSMP (See Table 2 section 1.5 of the TSMP for Species Background and search requirements). Searches were undertaken from September 2009 to January 2010. Seasonal variance has been influential in search effort due to unseasonably warm weather in Victoria over spring 2009 and early summer 2010. As a consequence greater search effort has taken place early to accommodate early flowering; although it should be noted that overall search times have covered the full scope of time allotted in order to provide robust results.

Table 1. Target Species

Conservation Status			Common Name	Scientific Name	Habitat	Ideal Survey Period (flowering time)
FFG	EPBC	State				
FLORA						
	VU		River Swamp Wallaby-grass	*Amphibromus fluitans*	Swampy areas in grassy open forest and riparian scrub.	Nov-Mar
L	VU	VU	Clover Glycine	*Glycine latrobeana*	Grasslands and Grassy Woodlands.	Sep-Dec
L	EN	EN	Maroon (Slaty) Leek-orchid	*Prasophyllum frenchii*	Grassland, heathland and grassy woodland.	Oct-Dec
	VU	VU	Swamp Fireweed	*Senecio psilocarpus*	High quality herb-rich wetlands and swamps prone to inundation on volcanic clays or peaty soils.	Nov-Mar
L		R	Purple Blown Grass	*Lachnagrostis punicea* subsp. *filifolia*	Lowland grassy wetlands and damp plains grasslands.	Sep-Dec
L		VU	Purple Diuris	*Diuris punctata* var. *punctata*	Grassland, grassy woodland, and less commonly in open forest.	Oct-Nov
L	EN	EN	Frankston Spider Orchid	*Caladenia robinsonii*	Heathy Woodland, damp Sands Herb-rich Woodland and possibly Grassy Woodland remnants (see species management plan).	Sep-Oct

Conservation Status Codes (EPBC and FFG Acts):	Victorian Conservation Status Codes (DSE):
EN – Endangered under the National EPBC Act *(very high risk of extinction in the wild)*	EN – Endangered *(at risk of becoming extinct)*;
VU – Vulnerable under the National EPBC Act *(high risk of extinction in the wild)*	VU – Vulnerable *(at risk of becoming endangered)*;
L – Listed as threatened under the Flora and Fauna Guarantee Act	R –Rare *(rare but not considered otherwise threatened)*;
	K –poorly known *(accurate distribution information is inadequate to allocate to one of the conservation status categories)*;

Source: FIS – Flora Information System; PMST – EPBC Act Protected Matters Search Tool

2. RESULTS

2.1 Targeted Search Areas

As per the TSMP targeted searches have been undertaken over September, October, November and December 2009 and January 2010 totalling 148 search hours. Areas covered include the 16 sites listed by Venosta *et al.* (228) as potential habitat for threatened species which are:

- Patches 1a, 1b, 1c, 1d, 1e, 1f, 1j, 2 & 3 – Plains Grassy Wetland;
- Patches 6 and 6a – Sand Heathland;
- Patch 45 and 46a – Grassy Woodland;
- Patch 32h Heathy Woodland, Patch 43 Damp-sands Herb-rich Woodland and Patch 47b Aquatic Herbland.

In addition further survey was undertaken to groundtruth results of Venosta *et al.* (2008) for River Swamp Wallaby-grass located in The Pines Flora and Fauna Reserve and to assess the condition of plants targeted for translocation from this area.

2.2 Targeted Search Results – EPBC listed Species

No EPBC listed species were located during targeted searches. The additional survey of the population of River Swamp Wallaby-grass located in The Pines Flora and Fauna Reserve found that seed levels were low probably due to macropod herbivory.

2.3 Targeted Search Results – FFG listed Species

One FFG listed species, Purple Blown-grass, was located during the targeted searches in patches 1b – 1e, 1d, 1e, 1g and 3 as per Venosta *et al.* (2008) figure 2a; this includes the area surrounding the Eastlink interchange area of the proposed alignment for Peninsula Link where this species is frequent and well represented with numbers of plants in the 100's.

2.4 Targeted Search Results – Other Species of Interest

Three species of interest not specified in the TSMP were located during targeted searches, these included:

- Dandenong Scent-bark *Eucalyptus fulgens* which is listed as rare in Victoria,
- Yarra Gum *Eucalyptus yarraensis* also listed as rare in Victoria, and

- Grey Spike-sedge *Eleocharis macborronii* which is listed as poorly known in victoria.

These were located in Patches 1c, 32c and 70.

Other species identified for seed collection or possible translocation include Pale Swamp Everlasting *Helichrysum aff. rutidolepis,* Prickfoot *Eringium vesiculosum*, Running Marsh-flower *Villarsia reniformis*, Slender Speedwell *Veronica gracilis*, Poong-ort *Carex tereticaulis* and *Chiloglottis* X *pescottiana.* It should be noted that the areas assessed have also been targeted for EVC seed collection as part of the Threatened Species Management Plan (TSMP) developed for this project.

3. LOCATED THREATENED SPECIES MANAGEMENT REQUIRED

As per the TSMP, the following measures have been or will be implemented for flora species found during the targeted surveys threatened

- The location of the species has been recorded (See attached Maps).
- The general site environmental management requirements detailed in Section 4 will be implemented.
- The species specific management plan will be implemented (refer to Appendix 2 of the TSMP for details).
- Mitigation measures include seed collection from known populations including translocation of parent plants in some circumstances (refer to Appendix 2 of the TSMP for details).

3.1 EPBC listed Species

The Management Plan for the population of River Swamp Wallaby-grass located in the Pines Flora and Fauna Reserve is set out in Section 2 of the TSMP.

An assessment of the extent of the population of the River Swamp Wallaby –grass located in the Pines Flora and Fauna Reserve was undertaken in January 2010. The extent of the population is shown in the figure below.


BALLARTO ROAD
FORMER KTRI SITE
THE PINES
FLORA & FAUNA RESERVE
FREEWAY DESIGN
SEP
EXCAVATION
THE PINES
FLORA & FAUNA RESERVE
LINKING MELBOURNE AUTHORITY
River Swamp Wallaby-grass Location Plan
LEGEND
Extent of River Swamp Wallaby Grass
Noise wall
Shared Use Path
Construction Licence Boundary
0 50 100 200
SCALE 1:5,000
meters
N

3.2 FFG listed Species

The Management Plan for the populations of Purple Blown-grass located in Patches 1b – 1e, 1d, 1e, 1g and 3 as per Venosta *et al.* (2008) Figure 2a is set out in Appendix 2 Section 9 of the TSMP.

See section 9.1 to 9.3, Management requirements for species to be managed in-situ, of the TSMP for plants located outside the construction footprint and section 9.4 to 9.6 of the TSMP for plants located inside the construction footprint.

3.3 Other Species of Interest

As per Appendix 2 Section 11 of the TSMP the LMA are undertaking seed collection, within the patches designated by Venosta *et al.* (2008) for targeted searches, in the 2009/2010 flowering season. This is in order to establish a stockpile of local provenance, indigenous seed for revegetation programs (within the orchard area and for revegetation / landscaping programs within the construction area). Where appropriate, vegetative material, such as seedlings, tubers and rhizomal material, may also be collected as part of the seed collection process. These works will be in addition to the individual threatened species translocation programs as required set out above.

The mapping highlights points where species of interest for seed collection are located. These include two species listed as rare in Victoria which will be specifically targeted for seed collection.

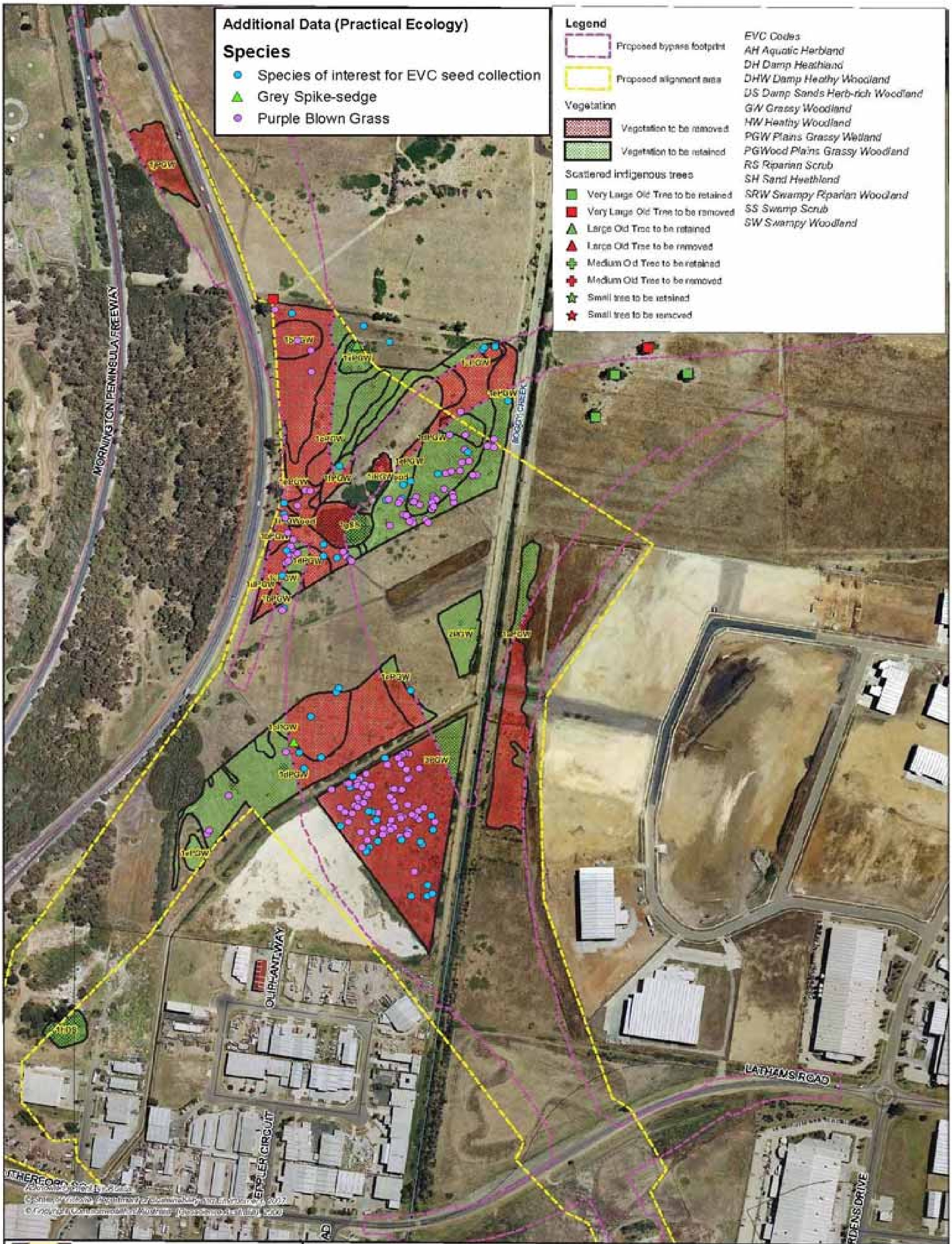

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Figure 2a: Proposed loss/retention of EVCs and scattered indigenous trees for the Frankston Bypass.

DATE: 25 June 2008		
Checked by: NHS	Drawn by: RMF	File number: 6813
Location: MRG-6800s\6813\Mapping\6813 Figure 4a-4b.wor		

Scale: 0 40 80 120 160 200 metres

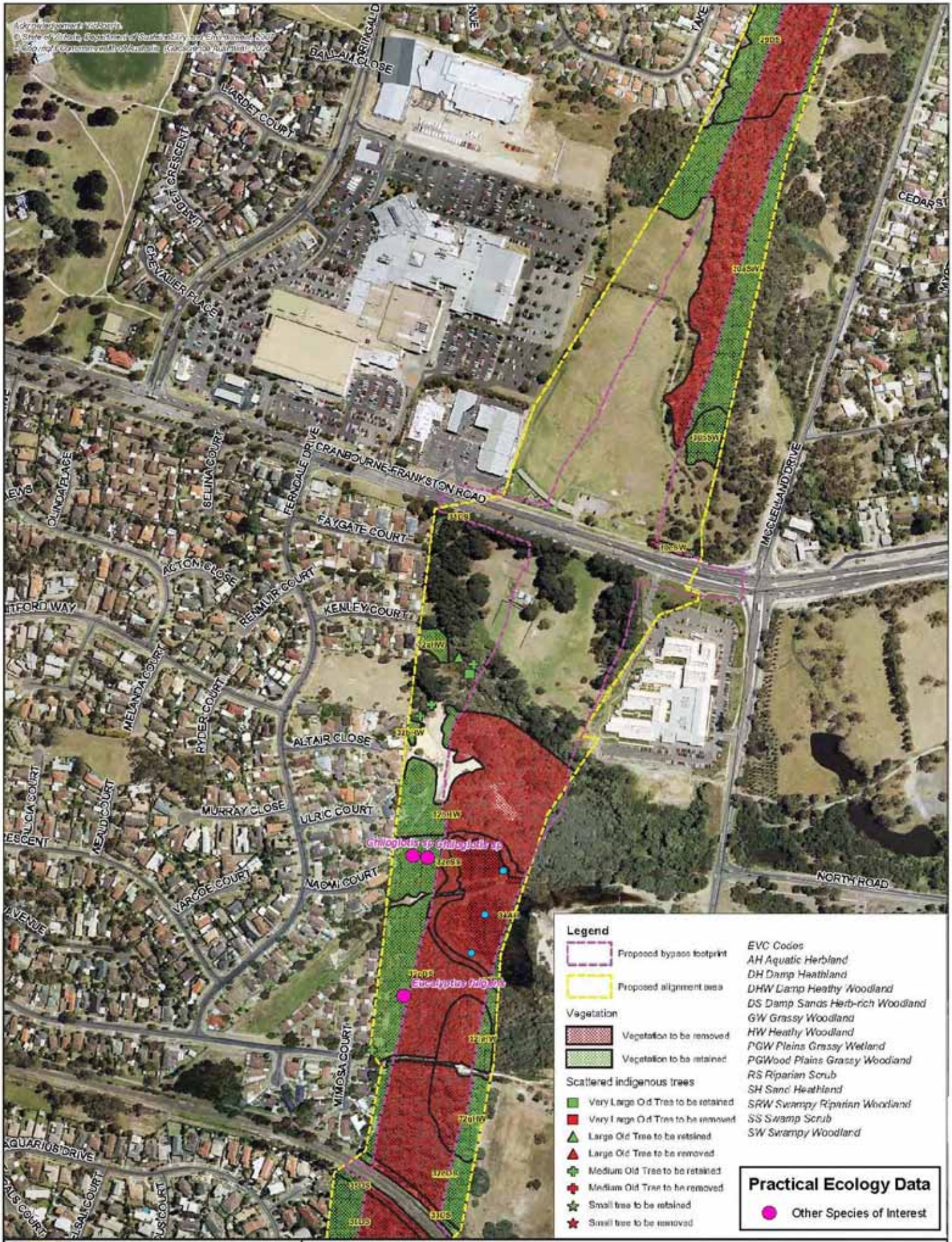

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Figure 2: Proposed loss/retention of EVCs and scattered indigenous trees for the Frankston Bypass.

DATE: 26 June 2006
Checked by: NHS | Drawn by: RMF | File number: 6613
Location: MRG 6608\6613\Mapping\6613 Figure 4a-4b.wor

Scale: 0 40 80 120 160 200 metres

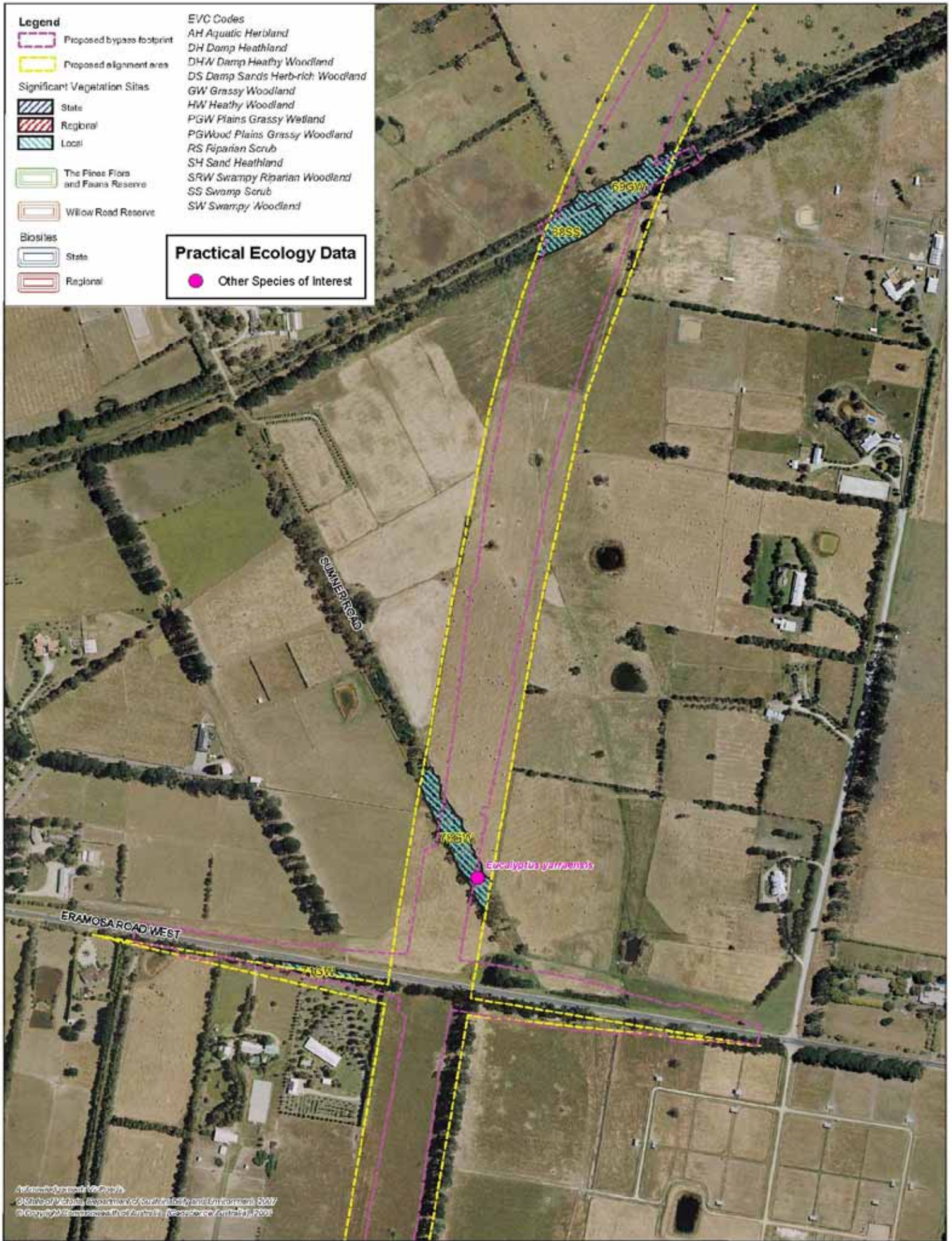

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Figure 7j: State and regionally significant patches within the proposed bypass alignment

DATE: 22 September 2008
Checked by: NHS | Drawn by: PJV | File number: 6813
Location: M:\Projects\6600s6613\Mapping\6613 Figure 7.wor

Scale: 0 40 80 120 160 200 metres

APPENDIX 9. Creek Crossing Photographs

Plate 1: Boggy Creek (W1)

Plate 2: Boggy Creek (W4)

Plate 3: Boggy Creek (W5)

Plate 4: Boggy Creek (W6)

Plate 7: Tamarisk Creek (W8) upstream

Plate 8: Tamarisk Creek (W8A)

Plate 9: Tamarisk Creek (W8B)

Plate 10: Tamarisk Creek (W9)

Plate 11: Watsons Creek (W10)

Plate 12: Watsons Creek (W12)

Plate 13: Watsons Creek (W13)

Plate 14: Watsons Creek (W18)

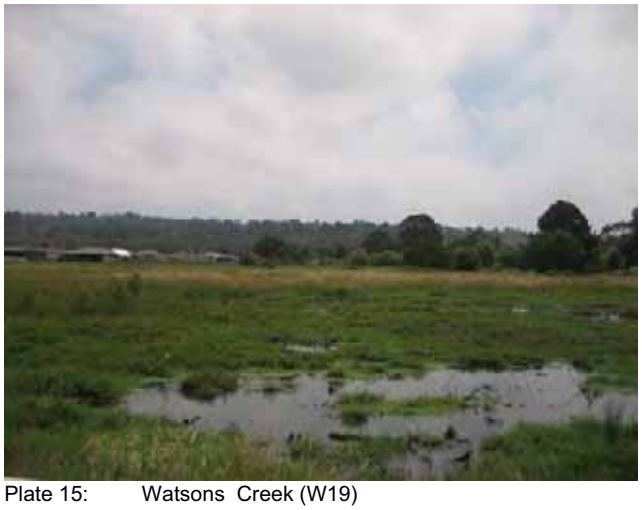

Plate 15: Watsons Creek (W19)

Plate 16: Watsons Creek (W19A)

Plate 17: Watsons Creek (W19C)

Plate 18: Balcombe Creek (W20)

Plate 19: Balcombe Creek (W21) upstream

Plate 20: Balcombe Creek (W22)

Plate 23: Devilbend Creek (W25) downstream

Plate 24: Devilbend Creek (W26)

Plate 25: Tuerong Creek (W27) upstream

Plate 26: Tuerong Creek (W27) downstream