Investigative survey of aquatic fauna
Healesville Koo Wee Rup Road corridor
(Pakenham Bypass to South Gippsland Highway)

The Bunyip River near Healesville Koo Wee Rup Road

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EXECUTIVE SUMMARY

No threatened aquatic fauna was captured in the waterways between the Pakenham Bypass and the South Gippsland Highway. One nationally threatened fish species, the migratory Australian grayling is known to use the Bunyip River and to pass through the study area. Continued fish passage for this species is of a high priority.

As the Bunyip River supports the Australian grayling and a number of other migratory native fish species, it is considered a water of high conservation value. Deep Creek is also important for native migratory fish passage and has moderate conservation value. Other waterways (all of which are drains) are considered of moderate to low conservation value for aquatic fauna.

The key mitigation measures to protect aquatic habitats in the Healesville Koo Wee Rup Road corridor are for bridge crossings over valued waterways and for minimal disturbance of the watercourses during road construction.

CONTENTS

1.0 INTRODUCTION

This study was initiated to evaluate whether aquatic habitat would potentially be affected by the upgrade of the Healesville Koo Wee Rup Road between the Pakenham Bypass and the South Gippsland Highway. This study includes a literature review of known aquatic fauna and a field investigation. Mitigation measures have been suggested to ensure that aquatic fauna is not adversely affected by road widening or realignment.

This investigation will assist VicRoads to ensure that works are undertaken in a manner consistent with the principles of Ecologically Sustainable Development and relevant Federal and State legislation.

2.0 BACKGROUND INFORMATION

2.1 The study area

The study area is between the Pakenham Bypass and the South Gippsland Highway, near the Koo Wee Rup township (Figure 1). Road alignment is to be within a 100 m boundary of the existing road reservation of Healesville Koo Wee Rup Road between the Pakenham Bypass and McDonalds Drain. The connection between this point and the South Gippsland Highway is yet to be decided but is expected to be within the area bounded by the triangle of Rossiter Road, Syabella Avenue and the South Gippsland Highway.

All of the waterways in the study area have been extensively modified in the past, as a result of the draining of the Koo Wee Rup Swamp and associated straightening and realignment of watercourses.

The largest streams in the study area are the Bunyip River and Deep Creek, which have catchments that extend upstream of the Princes Highway. Regional drainage is channelled into McDonalds Drain and Nine Mile Road Drain. Additional localised drainage flows into the Hall Road Drain, Healesville Koo Wee Rup Road Drain, Town Drain and Rossiter Road Drain.

2.2 Existing aquatic data

Table 1 lists the aquatic fauna recorded for the Bunyip River catchment (Victorian Aquatic Fauna Database, DSE, 2005). There is 11 native and 4 exotic fish species recorded in the catchment. Additional aquatic fauna includes platypus (*Ornithorhynchus anatinus*), the long necked tortoise (*Chelodina longicollis*) and the Yarra spiny cray (*Euastacus yarraensis*).

There is 8 migratory native fish species (which have lifestages in both freshwater and saltwater environments) that have been recorded in the Bunyip River. The species include the short finned eel (*Anguilla australis*), the climbing galaxias (*Galaxias brevipinnis*), the common galaxias (*Galaxias maculatus*), the spotted galaxias (*Galaxias truttaceus*), the pouched lamprey (*Geotria australis*), the short head lamprey (*Mordacia mordax*), Australian grayling (*Prototroctes maraena*) and tupong (*Pseudaphritis urvillii*).

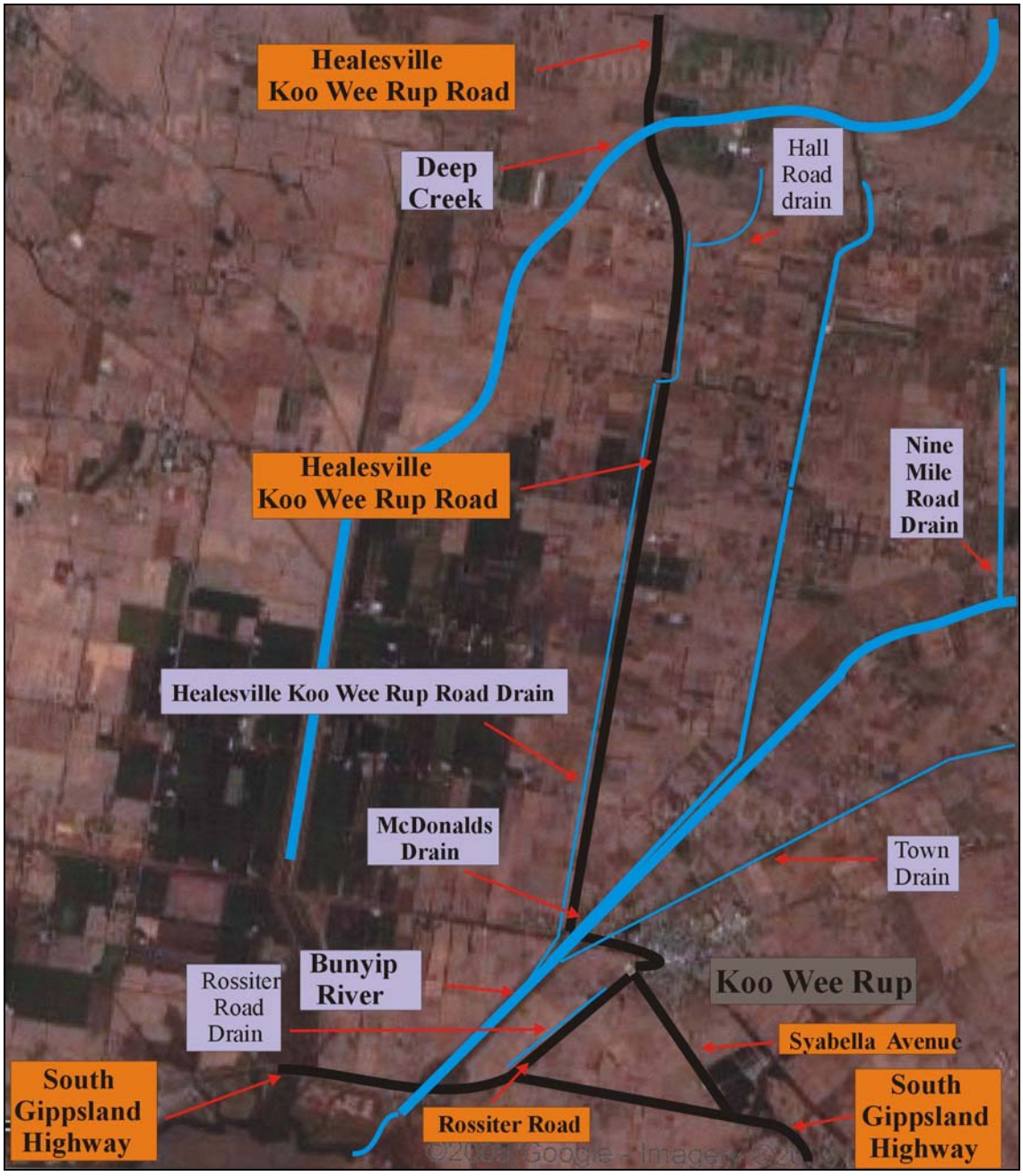

Figure 1. The study area

There is 3 exclusively native freshwater species recorded in the Bunyip River catchment, the river blackfish (*Gadopsis marmoratus*), the dwarf galaxias (*Galaxiella pusilla*) and the southern pygmy perch (*Nannoperca australis*).

All of the recorded exotic fish species live exclusively in freshwater environments. Exotic fish species include goldfish (*Carassius auratus*), eastern gambusia (*Gambusia holbrooki*), rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). Rainbow trout and brown trout were stocked in the Bunyip River up until 1972 (Barnham, 2000).

Table 1. Aquatic fauna recorded in Bunyip River catchment (Victorian Aquatic Database, DSE, 2005).

Aquatic fauna	Scientific name	Common name
Native fish	*Anguilla australis*	short-finned eel **m**
	Gadopsis marmaratus	river blackfish
	Galaxias brevipinnis	climbing galaxias **m**
	Galaxias maculatus	common galaxias **m**
	Galaxias truttaceus	spotted galaxias **m**
	Galaxiella pusilla **1 2 3**	dwarf galaxias
	Geotria australis	pouched lamprey **m**
	Mordacia mordax	short-headed lamprey **m**
	Nannoperca australis	southern pygmy perch
	Prototroctes maraena **1 2 3**	Australian grayling **m**
	Pseudaphritis urvillii	tupong **m**
Exotic fish	*Carassius auratus*	goldfish
	Gambusia holbrooki	eastern gambusia
	Oncorhynchus mykiss	rainbow trout
	Salmo trutta	brown trout
Aquatic mammal	*Ornithorhynchus anatinus*	platypus
Tortoises	*Chelodina longicollis*	long necked tortoise
Crayfish	*Euastacus yarriensis*	Yarra spiny cray

m migratory species

1 listed as vulnerable threatened species in Australia (EPBC Act, 1999)

2 listed as threatened fauna in Victoria (DSE, 2003)

3 listed under FFG Act, 1988

Two native fish species, the dwarf galaxias and the Australian grayling are considered threatened in Victoria and Australia. These fish species are listed as vulnerable in Victoria (Department of Sustainability of Environment (DSE), 2003) and in Australia (Environment Protection and Biodiversity Conservation (EPBC) Act, 1999). Both are listed for protection under the Victorian Flora and Fauna Guarantee (FFG) Act, 1988.

Figure 2 shows localities within close proximity to the Healesville Koo Wee Rup Road where the dwarf galaxias and the Australian grayling have been recorded in the past few years.

The dwarf galaxias has been found in Cannibal Creek, a headwater tributary of the Bunyip River (McGuckin, 2004). There are also records for dwarf galaxias in Yallock Creek, at the South Gippsland Highway (McGuckin, 2002) and at Bayles (McGuckin, 2004). The species has also been captured within Cardinia Creek at Thompsons Road and near Beaconsfield (McGuckin, 2005).

Australian grayling have been recorded in the Bunyip River, at the water tower in Koo Wee Rup and at the Vervale fishway (Raadik, 1999). The Australian grayling has also been recorded at Thompsons Road in Cardinia Creek in recent years (Boubee *et al.*, 2003).

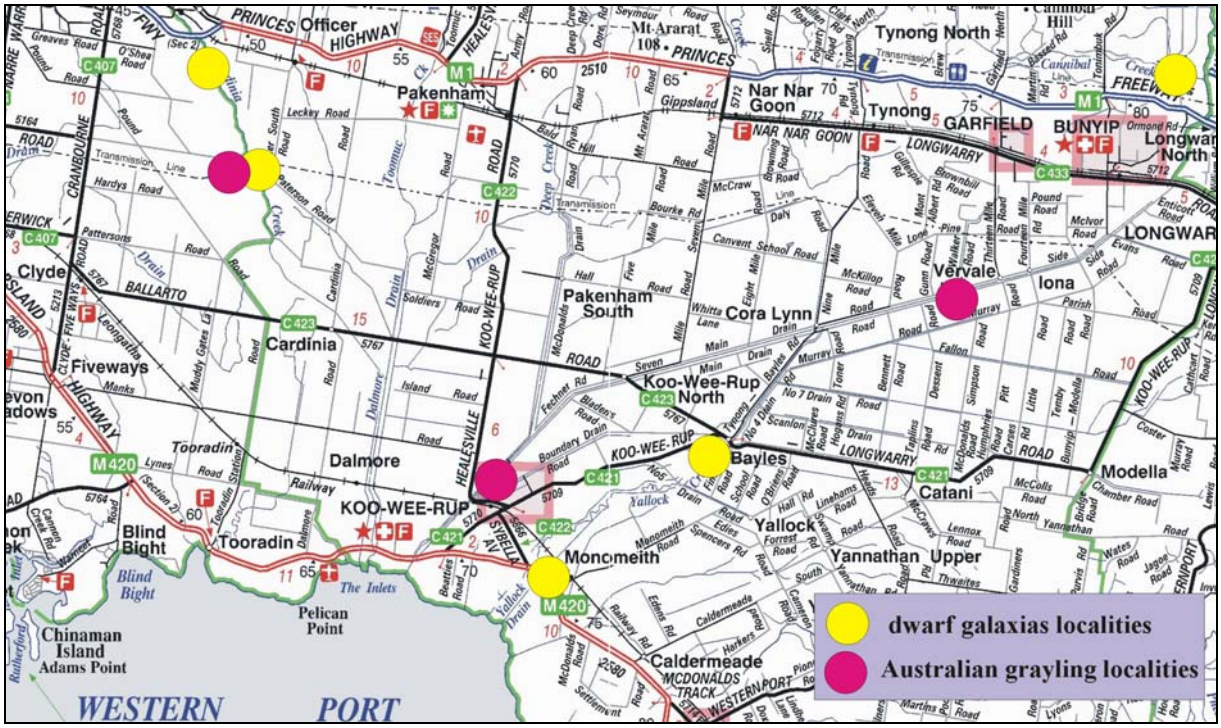

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Figure 2. The known localities for the threatened dwarf galaxias and Australian grayling.

Platypus have been recorded in the Bunyip River, predominantly in the reach upstream of Iona (Geoff Williams, pers. com. 2005). As instream barriers within the Bunyip River have been rectified to assist aquatic fauna passage in recent times, the downstream range of platypus could eventually extend down to Koo Wee Rup township (Geoff Williams, pers. com. 2005).

There is no records of water rats (*Hydromys chryogaster*) for the Bunyip River catchment (Atlas of Victorian Wildlife Database, DSE, 2005).

There is only one record of the long necked tortoise in the Bunyip River catchment, recorded in the Bunyip River at Vervale in 2000 (Atlas of Victorian Wildlife Database, DSE, 2005).

There is one species of crayfish, the Yarra spiny cray, which has been recorded in the freshwater reaches of the Bunyip River (Victorian Aquatic Fauna Database, DSE, 2005).

3.0 FIELD STUDY

3.1 Sites surveyed

A total of 20 sites were examined on 17-18 October 2005. Sites numbers were allocated from the Pakenham Bypass to the South Gippsland Highway. Table 2 lists the location of the sites and the topographical map reference for each.

Figure 3 shows the fish survey sites between the Pakenham Bypass and McDonalds Drain. Deep Creek was surveyed at one site (Site 1), as was the Hall Road Drain (Site 2). Nine localities alongside the Healesville Koo Wee Rup Road were examined (Sites 3-11).

Figure 4 shows the survey sites from McDonalds Drain to the South Gippsland Highway. One site was surveyed on each of McDonalds Drain (Site 12) and Nine Mile Road Drain (Site 13). Three localities were surveyed on the Bunyip River (Sites 16-18). Two localities were surveyed on the Town Drain (Sites 14-15) and the Rossiter Road Drain (Sites 19-20).

Table 2. Fish survey sites in the vicinity of the Healesville Koo Wee Rup Road.

Site	Waterway	Location	Map and No.	East	North
1	Deep Creek	100 m reach upstream of Healesville Koo Wee Rup Road, next to the abattoir.	Pakenham 7921-1-NE	367100	5780200
2	Hall Road drain	On northern side of Ellett Road, 100 m east of Healesville Koo Wee Rup Road.	Tooradin 7921-1-SE	367695	5778642
3	Healesville Koo Wee Rup Drain	On eastern side of Healesville Koo Wee Rup Road, 500 m north of Hall Road.	Tooradin 7921-1-SE	367615	5779070
4	Healesville Koo Wee Rup Drain	On eastern side of Healesville Koo Wee Rup Road, halfway between Hall Road and Ellett Road.	Tooradin 7921-1-SE	367501	5778096
5	Healesville Koo Wee Rup Drain	On eastern side of Healesville Koo Wee Rup Road, 100 m north of Ellett Road.	Tooradin 7921-1-SE	367433	577704
6	Healesville Koo Wee Rup Drain	On western side of Healesville Koo Wee Rup Road, opposite Ellett Road.	Tooradin 7921-1-SE	367407	5777469
7	Healesville Koo Wee Rup Drain	On western side of Healesville Koo Wee Rup Road, 50 m north of Ballarto Road.	Tooradin 7921-1-SE	367327	5776794
8	Healesville Koo Wee Rup Drain	On western side of Healesville Koo Wee Rup Road, between Ballarto Road and Island Road.	Tooradin 7921-1-SE	367065	5775087
9	Healesville Koo Wee Rup Drain	On western side of Healesville Koo Wee Rup Road, between Island Road and Manks Road.	Tooradin 7921-1-SE	366825	5773562
10	Healesville Koo Wee Rup Drain	On western side of Healesville Koo Wee Rup Road, between Manks Road and Railway Road.	Tooradin 7921-1-SE	366582	5771928
11	Healesville Koo Wee Rup Drain	Immediately downstream of Healesville Koo Wee Rup Road.	Tooradin 7921-1-SE	366428	5771008
12	McDonalds Drain	Immediately downstream of Healesville Koo Wee Rup Road.	Tooradin 7921-1-SE	366463	5771003
13	Nine Mile Road drain	100 m reach downstream of Healesville Koo Wee Rup Road.	Tooradin 7921-1-SE	366562	5771053
14	Town drain	Immediately downstream of Healesville Koo Wee Rup Road.	Tooradin 7921-1-SE	366631	5771008
15	Town drain	Approximately 700 m upstream of Healesville Koo Wee Rup Road.	Tooradin 7921-1-SE	367371	5771333
16	Bunyip River	Approximately 100 m south of Healesville Koo Wee Rup Road.	Tooradin 7921-1-SE	363470	5770892
17	Bunyip River	Approximately 900 m north South Gippsland Highway.	Tooradin 7921-1-SE	365372	5769694
18	Bunyip River	Approximately 400 m north of South Gippsland Highway.	Tooradin 7921-1-SE	365104	5769397
19	Rossiter Road drain	100 m south of 80 km signpost.	Tooradin 7921-1-SE	366494	5770028
20	Rossiter Road drain	Intersection of Rossiter Road and the South Gippsland Highway.	Tooradin 7921-1-SE	365800	5769453

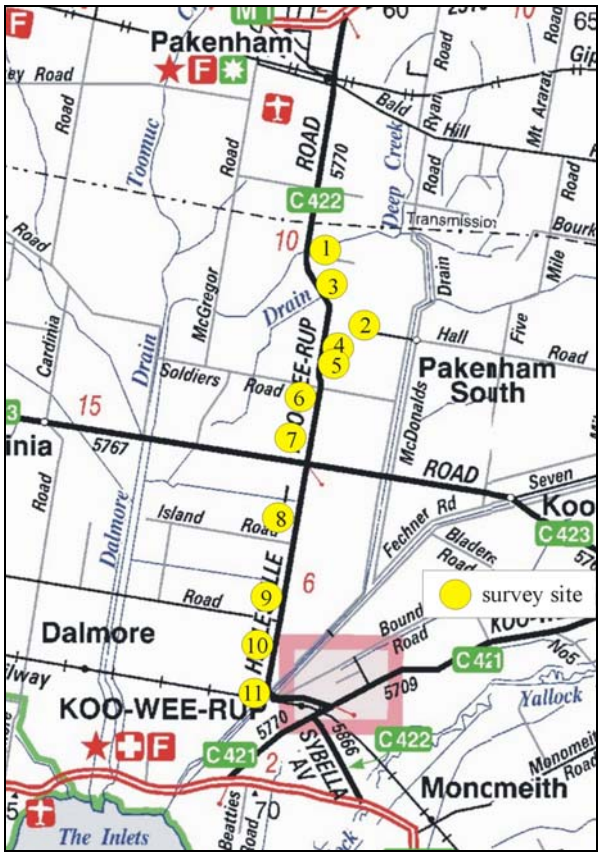

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Figure 3. Aquatic fauna survey sites between Pakenham Bypass and McDonalds Drain.

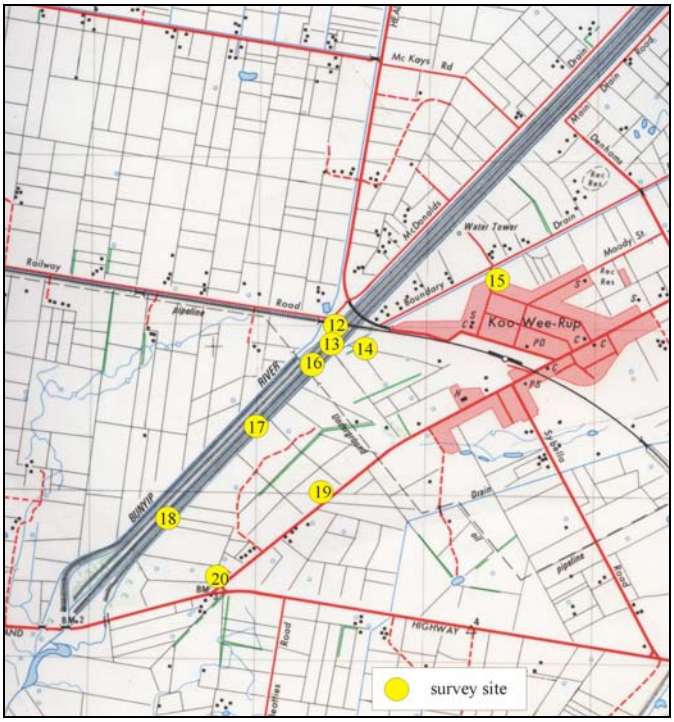


Figure 4. Aquatic fauna survey sites between McDonalds Drain and the South Gippsland Highway.

3.2 Survey techniques

Sampling of waterways between the Pakenham Bypass and the South Gippsland Highway required the use of a variety of gear types. A Smith Root 12A backpacker electrofisher, fyke nets, a seine trap and a dip net were employed. By using a variety of gear types, a wide range of species of various sizes could be captured.

At all survey sites, fish were identified and counted. The smallest and largest of each species was measured and weighed.

A brief description of the survey techniques is included below:

Electrofishing
The use of a backpack electrofisher is very effective for fish capture in shallow waterbodies, particularly those with good water clarity. The technique is limited to waters in which an electrical current can be generated (conductivity range of 10-1600 μS/cm). Electrofishing was used at two localities, Deep Creek (Site 1) and Nine Mile Road Drain (Site 13).

Fyke nets
Fyke nets are funnel shaped nets that trap fish. The nets used had a 3 mm mesh capable of catching a wide diversity of fish of various sizes. Fyke nets were used in the Bunyip River (Sites 16-18).

Seine trap
A 9 mm mesh seine trap was used to catch downstream fish migrants in the Bunyip River (Site 16).

Dip net
Dip netting is ideal for sampling shallow, snaggy waterways which can not be effectively sampled by other fish capture techniques. Dip nets can gather fish that are hiding within vegetation and lying on bottom substrates. Dip netting is a particularly important fish collection technique in environments in which small fish like the dwarf galaxias occur. Dip netting was used in all the roadside drains (Sites 2, 4-12, 14-15, and 19-20).

4.0 SURVEY FINDINGS

Table 3 lists the fauna captured during this study. In total, there were 9 native fish species and 3 exotic fish species captured. Appendix 2 lists the aquatic fauna captured at each survey site. No threatened native species were recorded in the study area.

The most diverse aquatic fauna was captured in the Bunyip River. Several native fish species were found in Deep Creek, McDonalds Drain, Nine Mile Road Drain and the Healesville Koo Wee Rup Drain. No aquatic fauna was captured in either the Hall Road Drain or the Rossiter Road Drain.

Exclusively estuarine species included the yellow eyed mullet (*Alderichetta forsteri*), toadfish (Family Aracanidae) and the Tamar River goby (*Favonigobius tamarensis*), all of which were only captured in the Bunyip River.

Migratory native fish species recorded including the short finned eel, the long finned eel (*Anguilla reinhardti*i), the common galaxias, the short headed lamprey and tupong. The long finned eel and the short headed lamprey were only captured in the Bunyip River. Tupong were only captured in Deep Creek and Nine Mile Road Drain. The short finned eel and common galaxias were the most widespread native migratory species being found in the Bunyip River, Deep Creek, the Healesville Koo Wee Rup Road Drain and Nine Mile Road Drain.

One exclusively native freshwater species, the southern pygmy perch was recorded in the Healesville Koo Wee Rup Road Drain.

Exotic fish species included brown trout found in the Bunyip River, with goldfish and the eastern gambusia common to Deep Creek, the Healesville Koo Wee Rup Road Drain, McDonalds Drain and Nine Mile Road Drain.

One long necked tortoise was observed in Nine Mile Road Drain. Platypus and crayfish were not captured in any of the waters surveyed.

Table 3. Aquatic fauna captured in each waterway.

Scientific name	Common name	Deep Creek	Hall Road Drain	McDonalds Drain	Nine Mile Road Drain	Healesville Koo Wee Rup Drain	Bunyip River	Town Drain	Rossiter Road Drain
Native fish species									
Alderichetta forsteri	yellow-eyed mullet**e**						X		
Anguilla australis	short finned eel**m**	X			X	X	X	X	
Anguilla reinhardtii	long finned eel**m**						X		
Aracanidae	toadfish**e**						X		
Favonigobius tamarensis	Tamar River goby**e**						X		
Galaxias maculatus	common galaxias**m**	X		X	X	X	X		
Mordacia mordax	short headed lamprey**m**						X		
Nannoperca australis	southern pygmy perch					X			
Pseudaphritis urvillii	tupong**m**	X			X				
Exotic fish species									
Carassius auratus	goldfish	X		X	X	X			
Gambusia holbrooki	eastern gambusia	X		X	X	X		X	
Salmo trutta	brown trout						X		
Tortoise									
Chelodina longicollis	long necked tortoise				X#				

e estuarine species
m migratory species
X# observed but not captured

5.0 DISCUSSION

5.1. Threatened fish species

The only two threatened native fish species known to the Bunyip River catchment (dwarf galaxias and Australian grayling) were not found in the study area.

The study area is within the Ararat Creek sub catchment (Figure 5), a region in which dwarf galaxias have never been recorded (Aquatic Fauna Database, DSE, 2005). Given the flood event in February 2005 allowed headwater fish species to be washed into the study area (as occurred for the southern pygmy perch), the absence of dwarf galaxias from all waters surveyed in this study supports past findings that the species does not occur within the Ararat Creek sub catchment.

The dwarf galaxias has been recorded in Cannibal Creek, a sub catchment of the Bunyip River upstream of the Princes Highway (McGuckin, 2003) and also in the Yallock Creek sub catchment (McGuckin, 2004). However, there is no opportunity for the movement of the species back into the Ararat Creek sub catchment from either of these sub catchments. Based on the survey findings of this study plus the absence of historical data for dwarf galaxias in the Ararat Creek sub catchment, the dwarf galaxias is not expected to occur anywhere between the Pakenham Bypass and the South Gippsland Highway.

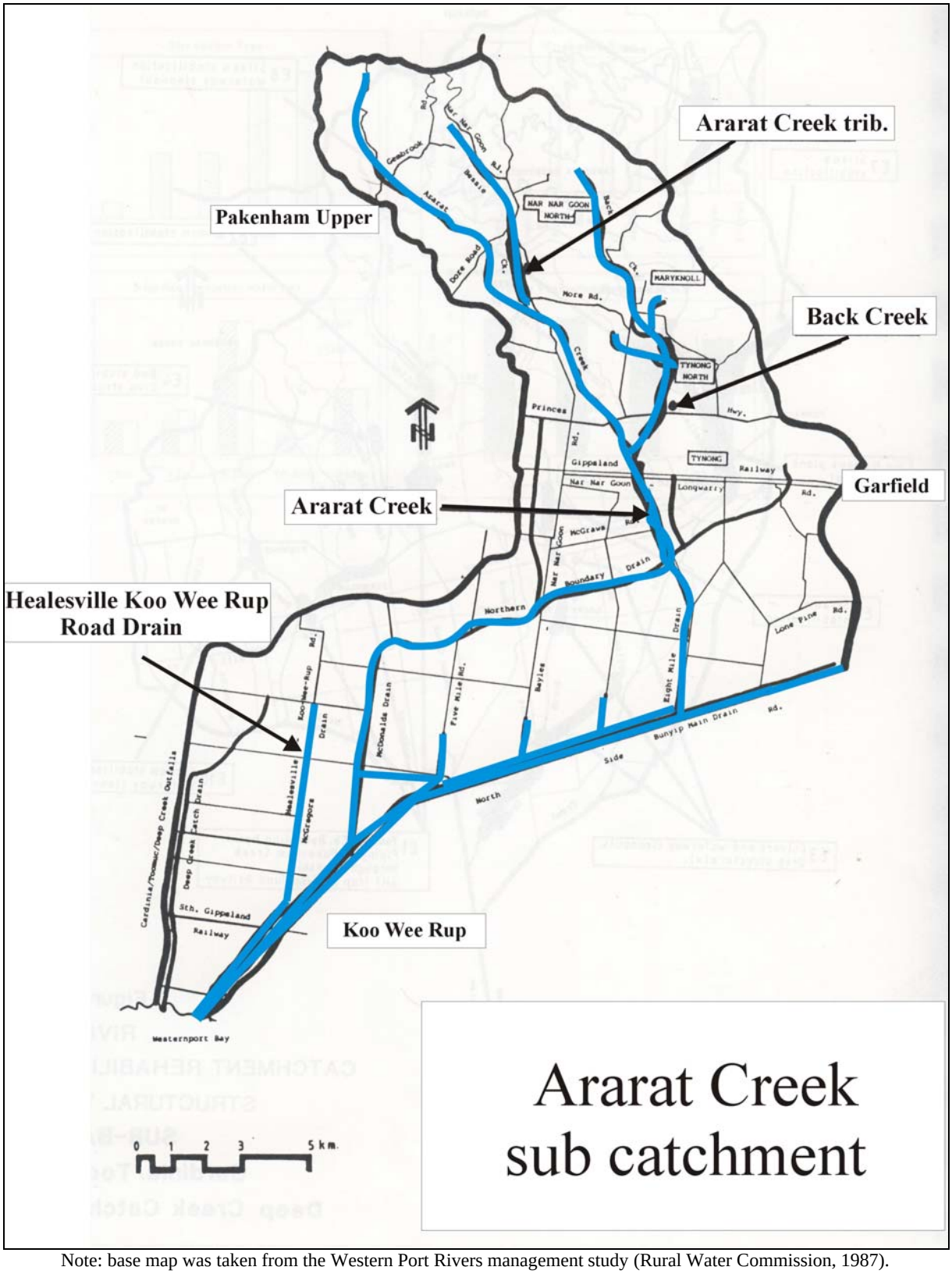
The Australian grayling requires passage in the Bunyip River. Australian grayling have been recorded in the Bunyip River near the water tower at Koo Wee Rup and further upstream near Vervale (Raadik, 1999). Although upstream movement of juveniles is believed to occur between October and December (Koehn and O'Connor, 1990) which coincided with the timing of the field investigation, it is not known whether the movement occurs at a particular water temperature, or is related to certain moon phases or tidal conditions. The apparent absence of the species in the areas surveyed is, therefore, not surprising, as the species can be very elusive. Passage for Australian grayling in the Bunyip River is the most important aquatic fauna issue within the study area.

5.2 New fish record for Bunyip Basin

The capture of the long finned eel in the Bunyip River is of regional significance and is a new record for the Bunyip River Basin. The long finned eel is a common Victorian species which is normally restricted to waters to the east of Wilsons Promontory. Historically, there is only 2 known records of the species west of Wilsons Promontory, one in Cardinia Creek in 1985 and the other in the Barham River in 1975 (Victorian Aquatic Fauna Database, DSE, 2005).

Long finned eels have probably been present within the Bunyip River over the past 5 years, as 3 distinct age groups were evident in this study (fish of 530, 740 and 1180 mm). The current distribution is only known for the reach downstream of the Healesville Koo Wee Rup Road. Further surveys are needed to determine the upstream range of the species.

Changed ocean currents are suspected to be responsible for long finned eels moving into the Bunyip River from Westernport Bay. It is speculated that the cooler Southern Ocean currents have been pushed to the south during the recent drought years, allowing fish carried by the warmer eastern coastline currents to move west of Wilsons Promontory. If this theory is correct, further records of long finned eels can be expected in other coastal waters to the west of Wilsons Promontory. Fish surveys in the next few years will determine whether a range extension of the species to western Victoria has occurred.



Note: base map was taken from the Western Port Rivers management study (Rural Water Commission, 1987).

Figure 5. Ararat Creek sub catchment.

5.3. Aquatic habitat value in the study area

The Bunyip River is the most important waterway in the study area. The river is important to a number of native migratory species which need passage between freshwater and saltwater environments as part of their lifecycles. Migratory fish captured in the study area included the short finned eel, the long finned eel, the common galaxias, the short headed lamprey and tupong. Additional migratory species known to require passage in this river include the Australian grayling, the climbing galaxias, the spotted galaxias and the pouched lamprey.

The instream habitat of the Bunyip River near Koo Wee Rup is in poor condition. There is currently a sand slug moving through the study area which is responsible for the smothering of the substrate. A depaupered benthic fauna is likely. All fish are either moving upstream or downstream and there are few, if any, residential fish. Despite poor instream conditions, continued fish passage is essential to fish diversity in the upstream reaches of the Bunyip River and within the Tarago River. The Bunyip River has a high conservation value for aquatic fauna.

The fish fauna in Deep Creek was dominated by native migratory fish which included the short finned eel, the common galaxias and tupong. Two additional migratory native fish species; the spotted galaxias and the climbing galaxias have also been recorded further upstream (McGuckin, 2005a). Like the Bunyip River, Deep Creek at Healesville Koo Wee Rup Road is considered in poor ecological condition, but has moderate aquatic value, principally for passage of native migratory fish species.

Both McDonalds Drain and Nine Mile Road Drains are connected to the estuary and support several migratory native fish species. These drains have good aquatic vegetation habitat with a muddy substrate, characteristics that are not present in the nearby Bunyip River. Both drains are expected to have an intermittent flow regime, with only the lower reaches near the Healesville Koo Wee Rup Road likely to maintain pools throughout summer months. Overall, McDonalds Drain and Nine Mile Road Drain are considered to be of moderate/low conservation value.

The Healesville Koo Wee Rup Road Drain was the only waterway in which the southern pygmy perch was found. The fish found are expected to be vagrants washed downstream from Ararat Creek during the flood event of early February 2005. The only other native fish species noted in the drain were the short finned eel and the common galaxias, both of which are opportunistic species and probably moved into the drain when streamflows were linked to the estuary. As the drain is expected to dry out over summer periods, it offers only temporary habitat for native fish. The Healesville Koo Wee Rup Road Drain is considered of moderate/low aquatic value.

Hall Road Drain, Town Drain and Rossiter Road Drain are of low value for native fish and have low aquatic value. High nutrients degrade water quality in both the Hall Road Drain and the Town Drain. A blanket of pacific azolla (*Azolla filiculoides*) is expected to cause oxygen depletion in the Hall Road Drain. Suspected septic inflows are responsible for extensive plant growth in the Town Drain, which can cause oxygen depletion. The Rossiter Road Drain is not deep enough to support aquatic fauna. Water is held temporarily in the drain, but there is no intrinsic value as aquatic habitat.

6.0 MANAGEMENT ISSUES

6.1 Potential Aquatic Impacts

In Victoria, a number of potentially threatening processes need to be considered to prevent aquatic habitat degradation. Processes listed under Schedule 3 of the FFG Act, 1988 that require attention include:

1. Alteration to the natural flow regimes of rivers and streams.
2. Alteration to the natural temperature regimes of rivers and streams.
3. Increase in sediment input into Victorian rivers and streams due to human activities.
4. Habitat fragmentation as a threatening process for fauna in Victoria.
5. Input of toxic substances into Victorian rivers and streams.
6. Prevention of passage of aquatic biota as a result of the presence of instream structures.
7. Removal of wood debris from Victorian streams.

Under the Victorian Strategy for conserving and maintaining Biodiversity (Department of Natural Resources and Environment, 1997):

- Ecological processes and biodiversity dependent upon freshwater environments should be maintained and, where necessary, restored,

- There should be no further preventable decline in the viability of any rare species or of any rare ecological community,

- There should be an increase in the viability of threatened species and in the extent and quality of threatened ecological communities.

Under the VicRoads Environment Strategy 2005-2015, protection of waterways will be made using the following guidelines:

- VicRoads will require roads, noise barriers and bridges to be designed to high aesthetic standards, and will explore ways of incorporating recognised aesthetic standards into contract specifications.
- VicRoads will liaise with the Department of Sustainability and Environment in its preparation of FFG Action Statements which address problems of sedimentation.
- VicRoads will systematically identify environmental hazards associated with potential tanker spillages, and implement a risk management program to minimise their threat.

VicRoads approach to environmental management is to avoid potential impacts, and where possible it will minimise potential impacts through appropriate design and construction techniques. Auditing programs will be required during construction to ensure effective implementation of the site Environment Management Plan (EMP) and the management of potential adverse aquatic impacts.

6.2 Mitigation Measures

The main mitigation measures are for the crossings of Bunyip River, Deep Creek, McDonalds Drain and Nine Mile Road Drain and Deep Creek. Bridge crossings need to be constructed in a manner that considers the intrinsic value of instream environments.

1. Crossings need to be constructed in a manner which do not impede water movement or obstruct fish passage.
2. A single bridge should span the Bunyip River, McDonalds and Nine Mile Road drains. Opportunity may allow for the piers to be positioned between any waterways. A bridge should also span Deep Creek. There should be no piers positioned in the channels of these waterways.
3. The cross-sectional area of the bridge crossing structures should mimic that of the watercourses so that mid to low flow velocities remain unchanged while also allowing for the passing of high flows to avoid localised flooding.
4. As a precaution against flooding, the storage of fill, excavated material, fuels and oils should not be stockpiled near any waterway during road construction.
5. Work should be conducted during periods of low flow and avoided during rainfall periods. During construction, sediment fences need to be positioned to prevent sediment runoff to the waterways. Bunds or sediment ponds should not be positioned in the waterways.
6. Where possible, existing riparian stream vegetation should be retained. If necessary, vegetation should be lopped rather than removed.
7. Bridge construction should be done at a maximum distance from the streambanks, so that collapsing of the edge of the channels is prevented. A buffer zone would minimise bank erosion and avoid deposition of loose material upon the bed of waterways.
8. An EMP should be formulated to prevent environmental degradation. It should include:
    - methods to minimise or prevent untreated drainage/runoff from the new road (including sediment and hazardous wastes).
    - the movement of vehicles in the vicinity of waterways should be minimised during road construction. Passage of vehicles should occur within the smallest amount of easement possible.

For the Healesville Koo Wee Rup Road Drain, Hall Road Drain, Town Drain and the Rossiter Road Drain, the use of culverts could be used for crossings. Where culverts are used, they should be positioned 20 cm below the existing streambed. This will assist with the natural accumulation of sediment at the level of the streambed, allowing a depth of 10 cm for fish passage at times of base flow.

If rock beaching is to be used it should be as irregular as possible with a wide variety of crevice sizes. Local rock should be used. Uneven rock placed at the base of the bank could provide some sheltered water instream habitat.

7.0 CONCLUSION

The aquatic environment of the Bunyip River is considered of high conservation value as it supports the nationally threatened Australian grayling and a number of native migratory fish species. Deep Creek is considered of moderate conservation value. Both Nine Mile and McDonalds Drain and Nine Mile Road Drain are considered of moderate/low conservation value. The Healesville Koo Wee Rup Road Drain, Hall Road Drain, Town Drain and the Rossiter Road Drain are all of low conservation value.

Table 7 summarises impacts to aquatic communities that could occur with the proposed upgrade of the Healesville Koo Wee Rup Road between the Pakenham Bypass and the South Gippsland Highway. Given that bridges span valued waterways and culverts are used for drain crossings, impact to aquatic biota will be negligible.

Table 7. Summary findings of this study.

Site	Conservation Value	Specific Impacts	Specific Mitigation Measures	Aspects common to all streams
Bunyip River	High	- passage of migratory native fish including the nationally significant Australian grayling which is listed under the EPBC Act, 1999 and the Victorian FFG Act, 1988) -hydrological changes to streamflows and localised upstream flooding -loss of native riparian vegetation	-span bridge over Bunyip River , Deep Creek and Nine Mile and McDonalds drains. -avoiding pier in main channels of these watercourses -retain native riparian vegetation	***Potential Impacts*** - barriers that impede water flow in all waterways -pollution/rubbish dumping to waterways -smothering of aquatic habitat by silt ***Mitigation*** - prevent sediment input to waterways (use sediment fences) -avoid oil spills during works (avoid storage near waterways or on floodplains) -replanting of riparian zones with endemic native species ***Timing of works*** - works to be conducted during low flow periods (summer)
Deep Creek	Moderate	- passage of migratory native fish -hydrological changes to streamflows and localised upstream flooding		
McDonalds Drain, Nine Mile Road Drain	Moderate /Low	- habitat for some migratory fish -loss of riparian vegetation	-use culverts that allow continued fish passage -retain native riparian vegetation	
Healesville Koo Wee Rup Drain	Low	-occasional habitat for fish washed downstream during flood events -used by some migratory fish species -loss of remnant riparian vegetation	-use culverts that allow continued fish passage -retain native riparian vegetation	
Hall Road Drain, Town Drain	Low	-occasional habitat for fish	-use culverts that allow continued fish passage	
Rossiter Road Drain	Low	-loss of remnant riparian vegetation	-retain native riparian vegetation	

8.0 RECOMMENDATIONS

- Provide a referral to Department of Environment and Heritage (DEH) for the Australian grayling. The referral should state that although the species was not found in the proposed works area, the species has been previously recorded in the Bunyip River.

- Monitor water quality during the construction and operational phase to ensure that poor water quality is not entering any waterway, and therefore, not adversely impacting on aquatic values.

9.0 ACKNOWLEDGEMENTS

I would like to thank VicRoads for undertaking a study of aquatic fauna and investigating potential impacts on aquatic environments that may occur due to the upgrade of the Healesville Koo Wee Rup Road between the Pakenham Bypass and the South Gippsland Highway. Thanks are extended to Tony Hillman and Terry Dexter. I would also like to thank Geoff William from the Australian Platypus Conservancy for platypus distribution information.

The field work was conducted with the assistance of Ron Lewis.

10.0 BIBLIOGRAPHY

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APPENDIX 1. AQUATIC SURVEY DATA

Site	Date	Technique	Fish captures (scientific name)	Fish captures (common name)	No. of fish	Length (mm)	Weight (g)	Bycatch
1	18/10/2005	Electrofished (100 m reach)	*Anguilla australis* *Galaxias maculatus* *Pseudaphritis urvillii* **Carassius auratus* **Gambusia holbrooki*	short finned eel common galaxias tupong goldfish eastern gambusia	45 13 1 7 28	57-900 42-100 88 88-170	 <1-3 9 9-68	1 elver
2	18/10/2005	Dip netted		No fish				
3	18/10/2005			DRY				
4	18/10/2005	Dip netted		No fish				
5	18/10/2005	Dip netted	*Nannoperca australis* **Carassius auratus* **Gambusia holbrooki*	southern pygmy perch goldfish eastern gambusia	4 1 1	 35		
6	18/10/2005	Dip netted	**Gambusia holbrooki*	eastern gambusia	25			
7	17/10/2005	Dip netted	*Galaxias maculatus* **Gambusia holbrooki*	common galaxias eastern gambusia	8 10			
8	17/10/2005	Dip netted	*Galaxias maculatus*	common galaxias	1			
9	17/10/2005	Dip netted	**Gambusia holbrooki*	eastern gambusia	55			
10	17/10/2005	Dip netted	*Anguilla australis*	short finned eel	1	350		
11	17/10/2005	Dip netted	**Gambusia holbrooki*	eastern gambusia	24			
12	17/10/2005	Dip netted	*Galaxias maculatus* **Carassius auratus* **Gambusia holbrooki*	common galaxias goldfish eastern gambusia	9 1 140	55-92 89	<1-3 8	12 shrimp
13	17/10/2005	Electrofished (100 m reach)	*Anguilla australis* *Galaxias maculatus* *Pseudaphritis urvillii* **Carassius auratus* **Gambusia holbrooki*	short finned eel common galaxias tupong goldfish eastern gambusia	17 34 3 3 210	250-850 42-87 77-118 104-165	 <1-4 3-8 16-64	
14	17/10/2005	Dip netted	*Anguilla australis* **Gambusia holbrooki*	short finned eel eastern gambusia	1 1	420		1 long necked tortoise
15	18/10/2005	Dip netted	**Gambusia holbrooki*	eastern gambusia	140			
16	17-18/10/2005	4 fyke nets	*Alderichetta forsteri* *Anguilla australis* *Anguilla reinhardtii* *Galaxias maculatus* **Salmo trutta*	yellow-eyed mullet short finned eel long finned eel common galaxias brown trout	1 3 3 206 1	260 400-800 530-1180 50-97 380	103 420-6500 <1-3 620	 28 shrimp
		seine net	*Alderichetta forsteri* *Galaxias maculatus* *Favonigobius tamarensis*	yellow-eyed mullet common galaxias Tamar River goby	7 27 1	198-240 55-75 55	46-90 1	8 shrimp
17	17-18/10/2005	4 fyke nets	*Anguilla australis* *Anguilla reinhardtii* *Galaxias maculatus*	short finned eel long finned eel common galaxias	6 1 3	110-800 740 57-71	 1300 <1-1	(1 elver) 37 shrimp
18	17-18/10/2005	4 fyke nets	*Anguilla australis* *Aracanidae* *Favonigobius tamarensis* *Galaxias maculatus* *Mordacia mordax* **Salmo trutta*	short finned eel toadfish Tamar River goby common galaxias short headed lamprey brown trout	7 1 1 8 1 1	450-750 46 48-92 345 465	 <1-2 17 940	
19	17/10/2005	Dip netted		No fish				
20	17/10/2005	Dip netted		No fish				

*exotic fish species

APPENDIX 2. PHOTOGRAPHS OF WATERCOURSES

Photograph 1. Deep Creek (Site 1).

Photograph 2 Hall Road Drain (Site 2).

Photograph 3. Healesville Koo Wee Rup Road Drain (Site 5).

Photograph 4. McDonalds Drain (Site 12).

Photograph 5. Nine Mile Road Drain (Site 13).

Photograph 6. Town Drain (Site 15).

Photograph 7. Bunyip River (Site 16).

Photograph 8. Rossiter Road Drain (Site 19).

APPENDIX 3 - ASSIGNMENT TASK BRIEF CONSULTANT TASK BRIEF

3.02.1 Purpose

Streamline Research will survey all the watercourses that are crossed by the Healesville Koo Wee Rup Road. This will include the Bunyip River, Deep Creek, channels and unnamed watercourses. The primary purpose of the study will be to determine the presence/absence of 2 important nationally threatened species, the Australian Grayling and the Dwarf Galaxias. All aquatic fauna captured will be documented.

3.02.2 Background

A planning study is being undertaken to determine options for the future upgrading of the Healesville - Koo Wee Rup Road (refer Figure 1). It is expected that the development of Healesville - Koo Wee Rup Road will consist of the duplication of the existing road between the Pakenham Bypass and McDonalds Drain. At the southern end it is proposed to construct a bypass of Koo Wee Rup on a new alignment to the west of the township between McDonalds Drain and the South Gippsland Highway.

A flora and fauna desktop review has been undertaken for the route by Ecology Australia. The findings of this review are contained in a report dated July 2005.

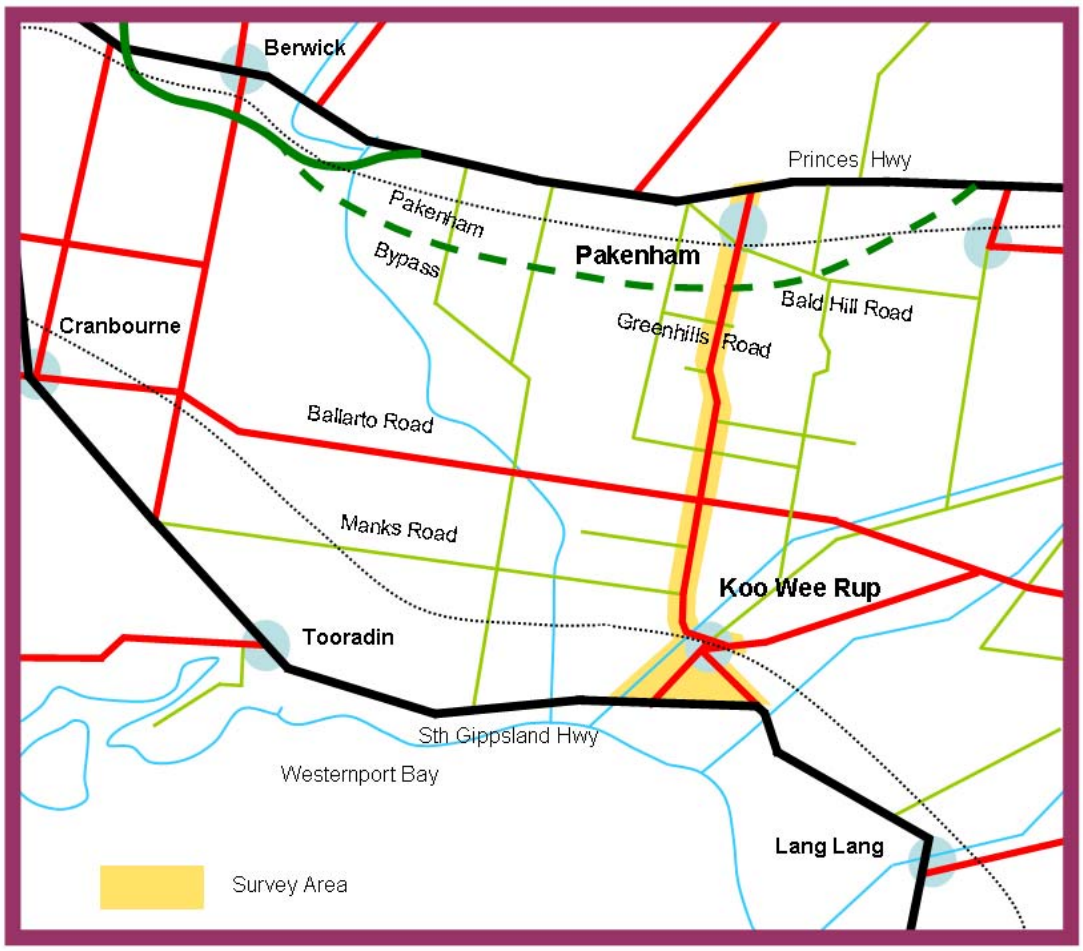

Figure 1 : Healesville – Koo Wee Rup Road, Princes Highway to South Gippsland Highway

3.02.03 Services to be Provided by the Consultant

Standard Requirements

a) VicRoads' Environment Strategy

The VicRoads' Environment Strategy sets the environment policy framework within which VicRoads operates and consultants should be familiar with the Strategy.

b) Permits

The Consultant shall ensure that they have all necessary permits for undertaking the investigations and that all work be carried out in accordance with these permits.

Survey Tasks

Field work, collation of data and reporting as set out in the Proposal.

The study area for the survey shall include:

- The existing road reservation for Healesville-Koo Wee Rup Road between the Pakenham Bypass and McDonald's Drain, and a 100 m wide strip each side of the reservation boundary.
- The area bounded by McDonalds Drain (Bunyip River), South Gippsland Highway and Sybella Avenue plus a 100m wide strip along the north-west edge of McDonalds Drain (Bunyip River).

3.02.04 Information to be Supplied by Corporation to Consultant

VicRoads will provide copies of all previous reports and other relevant information.

VicRoads will provide available aerial photos (if required) and plans showing the corridors.

Whilst not expected to be required, VicRoads will arrange, as far as possible, access to private property or will inform the consultant where access is not available or of any known special requirements for access. The Consultant will be fully responsible for contacting all owners prior to entering their property.

VicRoads will co-ordinate liaison with other specialist consultants as required.

3.02.05 Information to be Provided by the Consultant to the Corporation

The consultant shall supply VicRoads with the deliverables, as set out in 3.02.08, Deliverables.

HP It is anticipated that survey and draft report will be completed within three (3) weeks of the commencement of the contract. VicRoads will review the report and within two (2) weeks accept, reject or suggest amendments to it for inclusion into the final report. A final report shall then be submitted within two (2) weeks from the date of receipt of VicRoads response to the draft report.

3.02.06 Methodology

a) General

The Consultant shall conduct the Assignment in accordance with the methodology submitted to and approved by VicRoads, prior to the commencement of the survey.

b) Liaison with VicRoads

On all contractual matters, the Consultant shall liaise only with the Superintendent or the Superintendent's Representative.

The VicRoads Superintendent's Representative for the assignment will be Mr Tony Hillman. The contact details are as follows:

Phone:	(03) 9881 8078
Email:	tony.hillman@roads.vic.gov.au

3.02.07 Reporting

The Consultant shall notify VicRoads immediately on the commencement and completion of any field work or discovery of any significant issues which arise as a result of the investigations and notify VicRoads immediately of any other issues that VicRoads should be made aware of.

3.02.08 Deliverables

Draft and Final Reports

- One bound copy and one unbound copy of the Draft Report should be presented to VicRoads for comment and review.
- Three bound and one unbound copy of the Final Report should be presented to VicRoads including colour plans as deemed required.
- An electronic copy of the Final Report should be provided to VicRoads on a disc in Microsoft Word format and in Adobe Portable Document File (pdf) format.
- All reports shall contain an executive summary
- All reports shall contain a copy of the Consultant Task Brief as an Appendix (i.e. Section 3.02 of this contract)
- All reports shall conform to the following requirements:-
    - Binding margin : 25mm
    - Open margin : 10mm
    - In practical terms, provide the 25mm margin on both sides of each page so that VicRoads can produce double-sided documents.
    - Top margin : 10mm
    - Bottom margin : 10mm
    - Start each section on the right hand page.
    - Have fonts generally no smaller than 12 point.
    - Start Chapter 1 on the right hand page. Start all other chapters as they occur.
    - First page of Chapter 1 is Page 1.
    - All preceding pages to be in Roman numerals.
    - Odd numbered pages to be right hand pages.
    - Be consistent with style. Use Commonwealth Style manual or similar.
    - Minimise use of colour figures and photographs. Colour figures should be capable of being reproduced in black and white.
    - Supply clean artwork (not photography)
    - Supply unfolded plans if greater than A4 size.
    - Supply loose photographic prints.
    - Where continuous alignment drawings are broken down to A3 size drawings, all annotation and text shown on the continuous alignment drawings must be self contained within each A3 drawing.