GREAT OCEAN GREEN
Aquatic fauna study of the Barham River and Anderson Creek, Apollo Bay

Barham River estuary, Apollo Bay

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EXECUTIVE SUMMARY

The Barham River estuary is considered to be of high value for estuarine fish species, particularly for estuary perch, black bream and yellow eyed mullet. The estuary provides opportunity for the movement of migratory native fish species into the freshwater environments of both the Barham River and Anderson Creek. Spawning and recruitment of estuarine species in the Barham River estuary is poorly understood.

Although the nationally threatened Australian grayling was not recorded in this study, it is expected to utilise the estuary and freshwater reaches of the Barham River.

Freshwater streamflow, saline groundwater inflow, periods in which the estuary is opened and closed to the ocean and the flooding of low lying areas may all contribute to maintaining the ecology of the Barham River estuary. A balance between these factors is needed in the Great Ocean Green development to ensure protection of aquatic fauna in the Barham River and Anderson Creek.

CONTENTS

1.0 INTRODUCTION

An aquatic study of the Barham River and Anderson Creek was undertaken for Great Ocean Green. The prime purpose of this study was to determine the aquatic values of the Barham River and Anderson Creek. This report contains details of the findings of an aquatic survey, discussion upon the benefits and potential effects of the development upon the Barham River estuary and recommendations for further research.

2.0 BACKGROUND

2.1 Study area

The Barham River catchment is in the Otway Basin. The West and East Branches of the Barham River flow in a southerly direction from the Otway Ranges near Beech Forest before joining about 3 km to the west of Apollo Bay. The lower reaches of the Barham River which includes the estuary, is within the area designated for the Great Ocean Green development. Anderson Creek is a small tributary that enters the Barham River to the south-west of the Apollo Bay township in the northern part of the development area. Figure 1 shows the Barham River, Anderson Creek and the location of the proposed Great Ocean Green development.

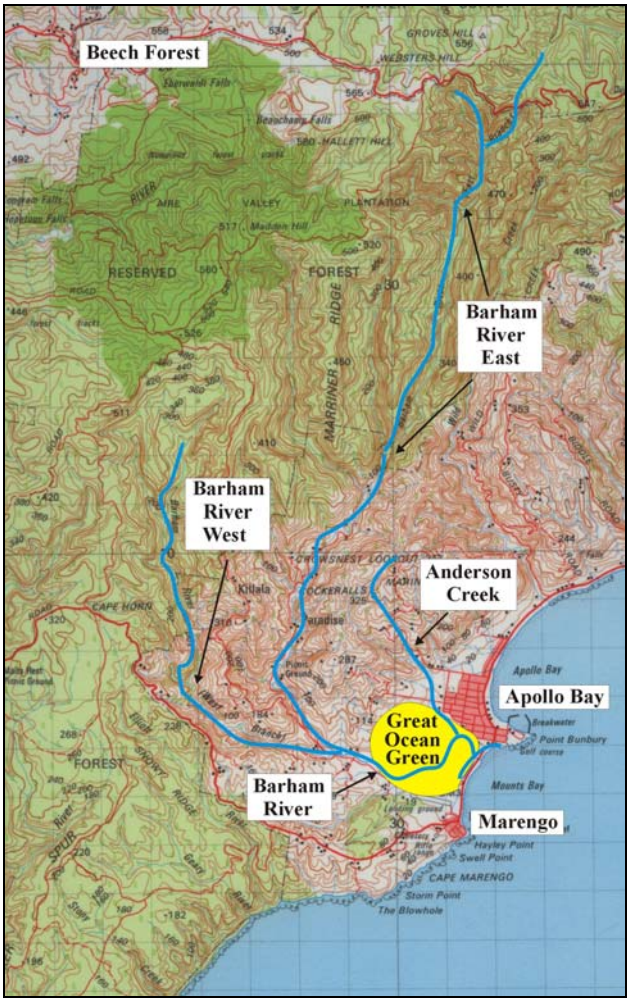

Figure 1. Barham River and the location of the Great Ocean Green.

2.2 Aquatic fauna of the Barham River and Anderson Creek

The fish fauna recorded in the Barham River and Anderson Creek is listed in Table 1 (Victorian Aquatic Fauna Database, Department of Sustainability and Environment (DSE), 2005).

Of the 24 native fish species that have been recorded, all have lifestages in the Barham River estuary. There is only 2 known exotic fish species, the eastern gambusia (*Gambusia holbrooki*) and brown trout (*Salmo trutta*), both of which are exclusively freshwater species.

Six fish species have been recorded in Anderson Creek.

Table 1. Fish fauna recorded in the Barham River and Anderson Creek (DSE, 2005).

Scientific name	Common name	Barham River freshwater reaches	Barham River estuary	Anderson Creek
Native fish species				
Acanthopagrus butcheri	black bream		X	
Afurcagobius tamarensis	Tamar River goby		X	
Aldrichetta forsteri	yellow eye mullet		X	
Ammotretis rostratus	bay flounder		X	
Anguilla australis	short finned eel[m]	X		X
Anguilla reinhardtii	long finned eel[m]		X	
Arripis georgianus	Australian herring		X	
Arripis trutta	Australian salmon		X	
Favonigobius lateralis	goby		X	
Galaxias brevipinnis	climbing galaxias[m]	X		X
Galaxias maculatus	common galaxias[m]	X		X
Galaxias truttaceus	spotted galaxias[m]	X		X
Gymnapistes marmoratus	ocean perch		X	
Macquaria colonorum	estuary perch		X	
Mordacia mordax	short headed lamprey[m]	X		
Mugil cephalus	sea mullet		X	
Parablennins tasmanianus			X	
Philypnodon grandiceps	flat headed gudgeon		X	
Prototroctes maraena[1 2 3]	Australian grayling[m]	X	X	
Pseudaphritis urvilli	tupong[m]	X	X	X
Pseudogobius olorum	Swan River goby			
Pseudocaranx dentax	silver trevally		X	
Retropinna semoni	Australian smelt		X	
Synaptura nigra	sole		X	
Tasmanogobius lasti	Last goby		X	
Exotic fish species				
Gambusia holbrooki	eastern gambusia	X		X
Salmo trutta	brown trout	X		

[1] listed as threatened in Australia (EPBC Act, 1999)

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

[3] listed under FFG Act, 1988

[m] migratory species

Only one native fish species in the Barham River is considered threatened. The Australian grayling (*Prototroctes maraena*) is listed as a vulnerable threatened species under the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act, 1999. Australian grayling is also considered a vulnerable threatened species in Victoria (DSE, 2003) and is listed for protection under the Victorian Flora and Fauna Guarantee (FFG) Act, 1988. The species has been recorded near the picnic ground and the gauging weir near Paradise in the Barham River East Branch (Victorian Aquatic Fauna Database, DSE, 2005).

There is 8 migratory native fish species (which have lifestages in both freshwater and saltwater environments) that have been recorded in the Barham River. The species include the short finned eel (*Anguilla australis*), the long finned eel (*Anguilla reinhardtii*), the climbing galaxias (*Galaxias brevipinnis*), the common galaxias (*Galaxias maculatus*), the spotted galaxias (*Galaxias truttaceu*s), the short headed lamprey (*Mordacia mordax*), Australian grayling and tupong (*Pseudaphritis urvillii*).

Apart from fish species, there is little known of other aquatic fauna that may occur in either the Barham River or Anderson Creek. There is a record of platypus about 3 km upstream of Apollo Bay (Atlas of Victorian Wildlife (DSE), 2005) in the Barham River, but no records of tortoises or crayfish for the waterway. Shrimp (*Paratya australiensis*) are recorded for the freshwater reaches of the Barham River.

2.3 Auxiliary projects for the Barham River

Barwon Water plans to develop a water reserve upon the upper reaches of the Barham River West Branch to meet the future needs of water supply for both Apollo Bay and Skenes Creek (Barwon Water, 2002). At present water is pumped from the Barham River immediately downstream of the junction of the East and West Branches of the Barham River. Under the bulk water entitlement 800 ML a year is allocated, although the current usage for Apollo Bay and Skenes Creek is 600 ML year (Cameron Howie, pers. comm. 2005). The environmental flow needs of the Barham River estuary have been evaluated (Sherwood *et al.*, 2003).

Corangamite CMA is planning to resnag a 250 m reach of the Barham River near Gambier Street, Apollo Bay, to enhance habitat for estuary perch (Denis Lovic pers. comm., 2005). Additional fish survey work is anticipated to be undertaken both before and after the works.

3.0 FIELD STUDY

This field study was undertaken to determine the existing fish fauna of the Barham River and Anderson Creek. Survey data for the freshwater reaches of these waterways has not been collected in the past 5 years or within the Barham River estuary in the last 20 years (Aquatic Fauna Database, DSE, 2005). In the past, no survey has been undertaken of the fish fauna of both the estuary and freshwater reaches of the Barham River and Anderson Creek.

At the time of this study (18-20 May 2005), the Barham River estuary was closed to the ocean with low lying backwaters inundated adjacent to the Council Caravan Park and upon a part of the Great Ocean Green development area (as shown in Figure 2).

3.1 Survey sites

A total of 9 survey sites were sampled in this study, 8 upon the Barham River and one on Anderson Creek (shown in Figure 2). Table 2 lists the location and grid reference of each of the survey sites.

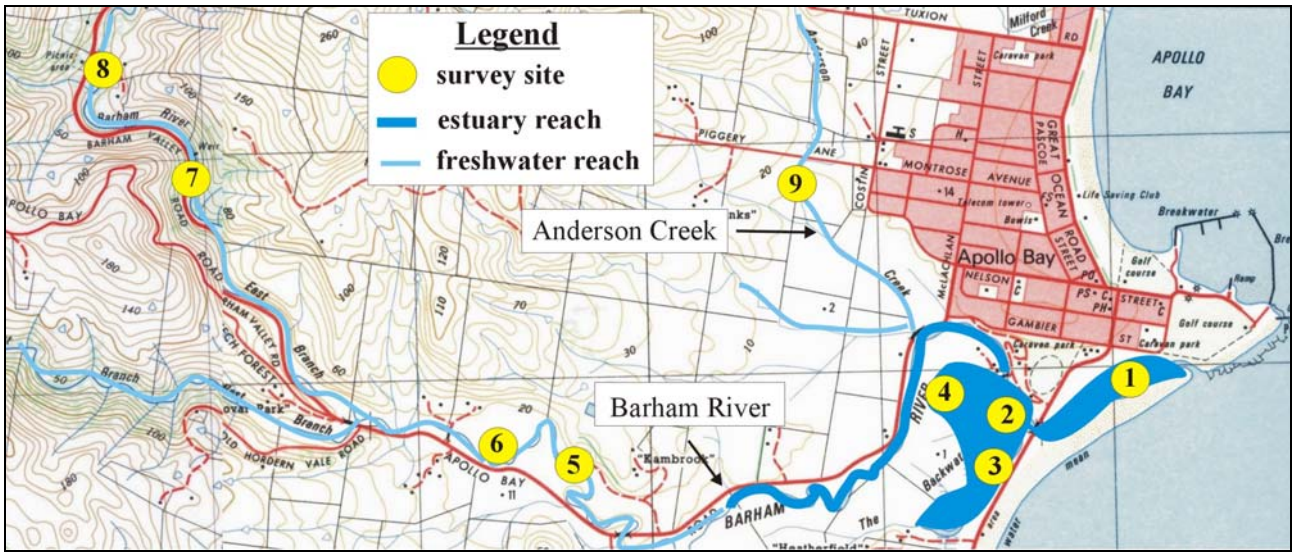

Figure 2. Aquatic survey sites in the Barham River and Anderson Creek (18-20 May 2005).

Table 2. Fish survey sites (Topographical map Otway 7620 1:100 000).

Site Number	Date surveyed	Waterway	Location	East	North
1	19-20/05/2005	Barham River estuary reach	Lower Barham River estuary, below the Great Ocean Road.	732125	5705875
2	19-20/05/2005	Barham River estuary reach	Upper Barham River estuary, above the Great Ocean Road.	731700	5705800
3	18-19/05/2005	Barham River estuary reach	Shallow backwater of upper estuary, parallel to Great Ocean Road.	731562	5705585
4	19-20/05/2005	Barham River estuary reach	Shallow backwater of upper estuary, to the south of Apollo Bay Road.	731325	5705875
5	18-19/05/2005	Barham River freshwater reach	Barham River, to the north of Apollo Bay Road on Neville Day property.	729631	5705588
6	18-19/05/2005	Barham River freshwater reach	Barham River, to the north of Apollo Bay Road on Neville Day property.	729485	5705675
7	18/05/2005	Barham River freshwater reach	200 m reach downstream of weir on Barham River East Branch, alongside Barham Valley Road.	727975	5707000
8	18/05/2005	Barham River freshwater reach	500 m reach upstream and downstream of picnic ground at Paradise.	727700	5707375
9	20/05/2005	Anderson Creek freshwater reach	100 m reach downstream of Piggery Lane.	730689	5706917

3.2 Sampling techniques

Aquatic sampling was conducted with gill nets, fyke nets, a seine net and a backpack electrofisher. By using a variety of gear types, it was hoped that a range of aquatic fauna would be captured. In the Barham River estuary, gill nets, fyke nets and seine netting were used (sites 1-4). Electrofishing and fyke nets were used in the freshwater reaches of the Barham River and Anderson Creek (sites 5-9).

Gill nets
Gill nets are ideal for capturing large bodied fish species like estuary perch and black bream. Four gill nets between 20-25 m in length, with mesh sizes that ranged between 50-100 mm were set in depths up to 3 m during a daylight period (11.00 am to 5.30 pm) and for one overnight period (5.30 pm to 7.00 am). Gill nets were used in the Barham River estuary (sites 1 and 3).

Fyke nets
Fyke nets are funnel shaped nets that trap a variety of aquatic fauna. Shoreline environments of less than 1.5 m were prime areas for the overnight setting of fyke nets. The bag end of each fyke net was raised above water level, to ensure that possible bycatch like tortoises and platypus would not be harmed. Fyke nets were set in the Barham River estuary (sites 3 and 4) and also in the freshwater reach of the Barham River East Branch (sites 5 and 6).

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 that can be waded and in which an electrical current can be generated (conductivity range of 100-1600 μS/cm). Electrofishing was undertaken in the Barham River East Branch (sites 7 and 8) and in Anderson Creek (site 9).

Seine netting
Seine netting is a particularly useful fish capture technique in shallow waters. Small fish that may sometime avoid capture in nets can often be captured with this technique. Seine netting was only conducted on the sand flats at the lower end of the Barham River estuary (site 1).

3.3 Sampling limitations

Due to high water levels, the main channel of the Barham River above the bridge crossing from the Caravan Park was not accessible from the launch point down near the Great Ocean Road. Consequently, the Barham River reach near Gambier Street and along the lower 1 km of the Apollo Bay Road was not surveyed in this study. It is anticipated that this area will be surveyed in the next few months prior to the resnagging of a 250 m reach immediately upstream of Gambier Road (Denis Lovric pers. comm., 2005).

4.0 RESULTS

Ten native fish species and one exotic fish species were recorded in this study. All 5 of the native fish captured in the freshwater reaches of the Barham River and Anderson Creek are migratory species. Migratory species common to both waterways include the short finned eel, the common galaxias, the spotted galaxias and tupong. One migratory species, the pouched lamprey (*Geotria australis*) which has not previously been recorded, was captured in the Barham River East Branch (sites 7 and 8). The exotic brown trout was found in all freshwater reaches of both the Barham River and Anderson Creek.

Estuary perch, black bream and yellow eye mullet have previously been found to be the dominant fish species of the Barham River estuary (Tunbridge and Glenane, 1988). This was again confirmed in this study.

Freshwater bycatch from this study included platypus (*Ornithorhynchus anatinus*) and shrimp. Four platypus were captured on Neville Day's property, downstream of the junction of the Barham River East and West Branches. Shrimp were captured at all freshwater sample sites.

Table 3 shows the aquatic fauna captured in this study. A full listing of aquatic species for each survey site is listed in Appendix 1.

Table 3. Aquatic fauna captured in the Barham River and Anderson Creek.

Scientific name	Common name	Barham River freshwater reaches	Barham River estuary	Anderson Creek
Fish species				
Acanthopagrus butcheri	black bream		X	
Aldrichetta forsteri	yellow eye mullet		X	
Ammotretis rostratus	bay flounder		X	
Anguilla australis	short finned eel[m]	X	X	X
Galaxias maculatus	common galaxias[m]	X	X	X
Galaxias truttaceus	spotted galaxias[m]	X		X
Geotria australis	pouched lamprey[m]	X		
Macquaria colonorum	estuary perch		X	
Philypnodon grandiceps	flat headed gudgeon		X	
Pseudaphritis urvilli	tupong[m]	X	X	X
*Salmo trutta**	brown trout	X		X
Invertebrates				
Paratya australiensis	freshwater shrimp	X	X	X
Aquatic mammals				
Ornithorhynchus anatinus	platypus	X		

* exotic species

5.0 DISCUSSION

5.1 Important fish species

5.1.1 Australian grayling

The Australian grayling is considered a threatened fish species at both a national and state level. Australian grayling were last recorded in the Barham River in 1999 at the gauging weir near Paradise (Aquatic Fauna Database, DSE, 2005). The species has previously been recorded at the same site in 1997 and at the picnic ground at Paradise in 1996 (Aquatic Fauna Database, DSE, 2005). Australian grayling have also been recorded in other streams of the Otway Basin, notably in nearby Wild Dog Creek and Skenes Creek in 1984, and in the Aire River in 1987 (Aquatic Fauna Database, DSE, 2005).

Australian grayling are likely to exist in the Barham River system; however, they were absent from the few localities that were sampled in this study.

5.1.2 Estuary perch

Estuary perch were captured in the estuary upstream of the Great Ocean Road. Of the 17 estuary perch captured all were adults between 320 and 485 mm in length. Male estuary perch mature at 220 mm and females at 280 mm (McDowall, 1996). The fish captured in this study were suspected to be congregating in readiness for winter spawning. No juvenile fish were captured.

Estuary perch are believed to breed in sea water at the mouth of estuaries in July and August (McDowall, 1996). Seasonal closures which prevent tidal inflows may have marked effects on breeding success of estuary perch (Department of Conservation and Natural Resources, 1991). However, for the Barham River, the preferred breeding areas are suspected to be upstream of the Great Ocean Road bridge, as no fish were captured on the ocean side of the bridge. It is unknown whether breeding success in the Barham River occurs in years in which the estuary remains closed to the ocean. Inundated backwaters may provide food for larval fish.

5.1.3 Black bream

Black bream were captured in the reach immediately upstream of the Great Ocean Road. As the 35 fish captured were between 230 and 370 mm, all are believed to be sexually mature. Black bream take approximately 7 years to reach the current legal recreational capture length of 240 mm and reach sexual maturity at 3 years (Department of Conservation and Natural Resources, 1991a). No juveniles were captured in this study.

The breeding requirement of black bream are not reliant upon the Barham River estuary being opened to the ocean. Black bream spawn between August and January typically at a third to half of the salinity of ocean water (Cadwallader & Backhouse, 1983). In the Barham River, these salinities are expected to be available between the freshwater and saltwater interface of the estuary. The flooding of estuary backwaters is expected to provide habitat and food for larval fish.

5.1.4 Yellow eyed mullet

Although only 13 individuals were captured in this study, this species would appear to have a wide variety of age classes throughout the estuary. Fish sizes ranged from juveniles of just 42 mm in length through to adults up to 315 mm in length. The species is expected to have successfully bred over the past few years.

5.1.5 Migratory native fish

Four migratory fish species, the short finned eel, the common galaxias, the spotted galaxias and the pouched lamprey were captured in freshwater reaches of the Barham River and Anderson Creek. Their presence is indicative of unimpeded fish passage from estuarine reaches into the freshwater reaches of the Barham River and Anderson Creek. In recent years, the installation of a rock fishway at the gauging weir upon the Barham River East Branch has allowed fish passage into the headwaters of this waterway. A piped culvert and a concrete structure at Piggery Road, Apollo Bay is expected to prevent migratory fish from moving further into the headwaters of Anderson Creek.

The presence of most of the migratory species that have historically been recorded in the Barham River and Anderson Creek is indicative that the estuary is regularly open for movement of these species.

5.2 Inundation of the Barham River floodplain

Freshwater inflows from the Barham River and Anderson Creek have an effect upon the opening and closing of the Barham River estuary with the ocean. Inundation of the paddocks in the upper reaches of the estuary may occur when streamflows are not sufficient to allow the estuary to drain into Bass Strait. Pictures 1-3 show inundation of the low lying areas in the vicinity of the proposed Great Ocean Green development at the time of this study.

Seasonal inundation of the low lying areas of the Barham River may be an important mechanism in the recruitment success of species like estuary perch and black bream. Inundated backwaters could be expected to contribute faecal contamination to the estuary, however, in the days and weeks that follow, the breakdown of grass material will provide food for the estuary, food that could potentially be very important for the recruitment of larval fish from one year to the next. Furthermore, these flooded shallow backwaters offer protection for small fish to avoid predatory fish that are in the main channel of the estuary.

5.3 Saline intrusion

Physico-chemical characteristics described for the Barham River (Sherwood *et al.*, 2003) are typical of those exhibited by saline pool streams from northern and southern Victoria (McGuckin, 1990, 1991). It is possible that saline intrusion to the deeper points in the estuary is an important source of maintaining salinity levels within the estuary, with the possible salt wedge being of much less importance.

Saline groundwater intrusion to the Barham River estuary may be the source supply of salinity when the estuary is closed to the ocean. It is suspected that at these times, freshwater inflows will be pushed onto low lying areas, maintaining the salinities within the main channel of the estuary. At higher streamflows, the freshwater is expected to mix with the underlying saline water and roll deoxygenated saline water into the ocean, effectively flushing the estuary. When freshwater inflows diminish, saline groundwater is expected to again re-enter the base of the deeper pools of the estuary, irrespective of the estuary being open or shut to the ocean.

Picture 1. Barham River backwater inundation in the vicinity of the proposed development.

Picture 2. The Barham River overflowing into surrounding low lying areas.

Picture 3. Flooding from Barham River towards the Council Caravan Park.

5.4 Great Ocean Green development

5.4.1 Positive environmental value

The proposed Great Ocean Green development is expected to protect values of the Barham River estuary and freshwater reaches of both the Barham River and Anderson Creek.

Positive environmental attributes of the development include:

- provision of a 11 Ha reserve around the backwater. This fringing estuary habitat will allow reestablishment of riparian habitat that was lost when the area was cleared for farmland.

- removal of grazing animals from the floodplain is expected to effectively remove faecal contamination that currently enters the estuary when the floodplain is inundated.

- constructed shallow backwater habitat may provide a nursery for small fish. These waterways could be designed so that they do not interfere with saline groundwater intrusion to the deeper pools of the Barham River nor affect the opening and closing of the estuary.

- potential monitoring of nutrient levels and the aquatic community in the estuary would be undertaken on a regular basis, studies that have been generally overlooked and neglected in the past.

5.4.2 Potential impacts considerations

The proposed construction and management of a golf course and residential development needs to be undertaken in a manner that considers the ecological importance of the Barham River estuary.

A number of potentially threatening processes that could affect aquatic fauna are listed under Schedule 3 of the FFG Act, 1988. The following processes in relation to waterways require consideration in the construction and operation of the proposed development:

1. Alteration to the natural flow regimes of rivers and streams (Nomination No. 197).

2. Alteration to the natural temperature regimes of rivers and streams (Nomination. No. 230).

3. Increase in sediment input into Victorian rivers and streams due to human activities (Nomination No. 181).

4. Input of toxic substances into Victorian rivers and streams (Nomination No. 263).

5. Prevention of passage of aquatic biota as a result of the presence of instream structures (Nomination No. 292).

6. Removal of wood debris from Victorian streams (Nomination No. 118).

The Water Act, 1989 (Government of Victoria, 1989) provides a formal means for the protection and enhancement of the environmental qualities of waterways and their instream uses.

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

- Ecological processes and biodiversity dependent upon freshwater and estuarine 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.

Appropriate management practices should be adopted to minimise possible aquatic habitat deterioration from the development. Care should be taken to ensure that sediment is not washed off-site during construction. Bunding should be used to control sediment movement from floodplain floods. Bunding can also prevent the deposition of large quantities of sediment either directly into the Barham River estuary or from inflows from constructed wetlands.

It is unknown what pesticides or fertilisers will be used in dressing of fairways and greens, however, it is advisable to check that they are not deleterious to aquatic biota. Groundwater contamination also needs to be prevented.

An Environmental Management Plan (EMP) should be developed to address all environmental issues before, during and post construction.

5.4.3 Mitigation measures

1. All works need to be undertaken in a manner to ensure that no obstruction to fish passage occurs.

2. The proposed works should minimise or prevent drainage/runoff into the Barham River estuary.

3. Wetlands should be shallow throughout and not interfere with the underlying watertable.

3. Sediment fences should be installed to prevent unnecessary erosion and sedimentation during the construction period.

4. Hazardous wastes should be prevented from entering any waterway. As a precaution against flooding, the storage of fill, excavated material, fuels and oils should not be stockpiled on the Barham River floodplain.

5. Monitoring of the watertable will be necessary to ensure that water application to the golf course and residential surrounds is not causing dilution of estuary salinity.

6. It may be possible to incorporate catch drains to collect runoff from the golf course, so that contaminants are not washed into the estuary. This process could be an important day to day management practice and could also be particularly useful at protecting the estuary in the initial stage of floodwater inundation.

6.0 CONCLUSION

The Barham River estuary is considered to be of high value for estuarine fish species, particularly for estuary perch, black bream and yellow eyed mullet. The estuary provides opportunity for the movement of migratory native fish species into the freshwater environments of both the Barham River and Anderson Creek.

Although the nationally threatened Australian grayling was not recorded in this study, it is expected to utilise the estuary and freshwater reaches of the Barham River.

Processes that may affect the spawning and recruitment of important estuarine species in the Barham River estuary are poorly understood. The absence of juvenile estuary perch and black bream captured in this study, suggests that limited spawning success may have occurred in recent years.

It would appear that freshwater streamflow, saline groundwater inflow, periods in which the estuary is opened and closed to the ocean and the inundation of low lying areas may all contribute to maintaining the ecology of the Barham River estuary.

It is possible that saline groundwater, rather than a saltwater wedge is a major source of the salinity in the Barham River estuary. This has implications for the proposed development as saline groundwater may limit the depth of constructed wetlands and restrict plantings to salt tolerant species.

Furthermore, disturbance upon the floodplain may inadvertently alter the movement of groundwater which could affect the development (particularly the golf course) and also the water quality conditions in the Barham River estuary.

Recommended investigations provide a positive direction for the proposed development to be undertaken without impacting upon the ecological balance of the Barham River estuary.

7.0 RECOMMENDATIONS

- Groundwater investigations are needed to determine saline intrusion into the watertable throughout the entire development area. There are implications that could affect the depth of constructed waterways, selection of proposed plants that will grow (may need to be salt tolerate) and deleterious changes which could impact upon the ecology of the estuary.

- Research is required to determine the effect of saline water intrusion upon the hydrodynamics of the Barham River when the estuary is closed to the ocean (has not been previously investigated).

- Spawning and recruitment of estuarine fish species in the Barham River requires research. A study would determine appropriate mitigation measures that can be adopted to prevent inadvertent affects to the estuary fishery.

- Monitoring of water quality will be necessary during the construction and operational phase of the development to ensure that poor water quality is not entering the Barham River estuary, and therefore, not adversely impacting on aquatic values.

8.0 ACKNOWLEDGEMENTS

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APPENDIX 1. Aquatic fauna captured in Barham River system

Site	Technique	Fish species (scientific name)	Fish species (common name)	No. of fish	Length (mm)	Weight (g)	Additional information
1	1 gill net	No fish					
	Seine netting	*Ammotretis rostratus*	bay flounder	19	75-110	9-16	
		Aldrichetta forsteri	yellow eye mullet	8	42-130	1-22	
2	3 gill nets	*Acanthopagrus butcheri*	black bream	35	230-370	280-920	
		Aldrichetta forsteri	yellow eye mullet	4	235-315	180-580	
		Macquaria colonorum	estuary perch	17	310-485	620-2300	
3	4 fyke nets (3 mm)	*Anguilla australis*	short finned eel	16	400-800		50 shrimp
		Galaxias maculatus	common galaxias	10	58-112	1-7	
		Philypnodon grandiceps	flat headed gudgeon	8	25-90	<1-9	
		Pseudaphritis urvillii	tupong	10	100-210	7-94	
4	4 fyke nets (3 mm)	*Aldrichetta forsteri*	yellow eye mullet	3	170-260	53-181	50 shrimp
		Anguilla australis	short finned eel	71	200-800		
		Galaxias maculatus	common galaxias	9	65-80	1-2	
		Philypnodon grandiceps	flat headed gudgeon	13	30-60	<1-2	
		Pseudaphritis urvillii	tupong	1	220	107	
5	4 fyke nets (3 mm)	*Anguilla australis*	short finned eel	3	150-600		2 female platypus
		Pseudaphritis urvillii	tupong	3	35-198	5-64	10 shrimp
		Salmo trutta	*brown trout	4	240-298	135-289	
6	4 fyke nets (3 mm)	*Anguilla australis*	short finned eel	5	300-980		2 female platypus
		Galaxias maculatus	common galaxias	3	60-72	<1-1	15 shrimp
		Pseudaphritis urvillii	tupong	1	206	68	
		Salmo trutta	*brown trout	3	240-370	144-476	
7	Electrofishing	*Anguilla australis*	short finned eel	8	250-800		1000 shrimp
		Galaxias maculatus	common galaxias	23	58-110	1-6	
		Galaxias truttaceus	spotted galaxias	1	85	4	
		Geotria australis	pouched lamprey	2	100-105	<1	
		Pseudaphritis urvillii	tupong	5	78-160	3-33	
		Salmo trutta	*brown trout	23	100-250	13-186	
8	Electrofishing	*Anguilla australis*	short finned eel	14	200-400		300 shrimp
		Galaxias maculatus	common galaxias	3	75-115	1-7	
		Galaxias truttaceus	spotted galaxias	1	88	6	
		Geotria australis	pouched lamprey	2	100-104	<1	
		Pseudaphritis urvillii	tupong	13	70-194	2-60	
		Salmo trutta	*brown trout	16	100-248	11-285	
9	Electrofishing	*Anguilla australis*	short finned eel	4	400-950		150 shrimp
		Galaxias maculatus	common galaxias	36	52-76	<1-8	
		Galaxias truttaceus	spotted galaxias	6	60-150	1-38	
		Pseudaphritis urvillii	tupong	4	130-142	18-26	
		Salmo trutta	*brown trout	3	205-255	94-193	

* exotic species