



VICTORIAN DESALINATION PROJECT LISTED SPECIES MONITORING REPORT

2013 SUMMARY

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ABOUT THE PROJECT



INTRODUCTION

The Victorian Desalination Project (VDP) provides a rainfall independent water supply to Melbourne, Geelong and some regional areas to supplement the State's existing catchments, if required. With the ability to provide high quality water on demand and a design life for key plant components of 100 years, the VDP is a valuable resource in times of future drought.

In addition to supplementing water supply, the VDP is designed to minimise any adverse impacts on the environment. This is achieved through world-class environmental design, leading edge technology and thorough environmental planning. In particular, the VDP includes rigorous monitoring of protected flora and fauna species in the project area through-out all phases, from design and construction to operation and maintenance.

PURPOSE

Following the preparation of a detailed Environmental Effects Statement (EES) by the Department of Environment and Primary Industries (formerly the Department of Sustainability and Environment) in 2008 which involved over 80 specialist studies, the VDP was approved under the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) as a controlled action. Due to the potential of the VDP to affect listed threatened species under Sections 18 and 18A of the EPBC Act, the preparation of a Management Strategy for EPBC Act Listed flora and fauna was required.

A condition of approval under the EPBC Act required the development of a Management Strategy. Accordingly, the EPBC Act Listed Species (Flora and Fauna) Management Strategy, which details strategies for the management and monitoring of these species, is part of the Environmental Management Plan (EMP) for the VDP. This strategy was implemented, monitored and reported on across the VDP site, marine environment, pipeline and power supply (utilities) corridor during the design and construction phase from 2009 to 2012.

Following completion of construction in 2012, the VDP is now in the Operation and Maintenance phase. Construction phase monitoring was audited and reported on by the project's Independent Reviewer and Environmental Auditor (IREA). The completion of construction removed risks to EPBC Act listed species with post-construction monitoring of listed species only required on the utilities corridor under the EPBC Act approval. The Operations and Maintenance EMP governs all other environmental monitoring for the project and the IREA's environmental auditing role continues for the VDP's 30-year contract period. It is therefore timely to review the results of operational monitoring to consider both the impact to date on listed threatened species within the VDP utilities corridor, and the effectiveness of the mitigation measures.

This annual summary provides the most up-to-date information on the state of EPBC Act listed flora and fauna in the project utilities corridor and tracks the progress of monitoring activities in the post-construction project phase to the end of 2013.

ABOUT THE PROJECT

BACKGROUND

The VDP showcases some of the most leading edge environmentally sensitive design and technology in Australia. AquaSure Pty Ltd (AquaSure) was selected in 2009 to finance, design, build, maintain and operate the plant over 30 years. Construction of the plant near Wonthaggi on the Bass Coast commenced in 2009 and was completed in December 2012.

With a production capacity of 150 billion litres a year and the capability to expand to 200 billion litres a year, the plant is not only the largest desalination plant in Australia but is also considered to be one of the largest Public Private Partnership projects in recent years.

The low profile, 38 hectare plant is the most environmentally sensitive and energy efficient of its kind in Australia. The plant uses reverse osmosis desalination technology to turn seawater into freshwater. It comprises two underground tunnels located 15 metres below the sea bed and associated marine intake and outlet structures located more than 20 metres below the sea's surface. Seawater is drawn in through these underground tunnels, fine particles are removed through filtration before the water passes through the reverse osmosis membrane. The water is then treated to Australian drinking water standards. Water is pumped to Melbourne and the surrounding South Gippsland and Westernport communities through an 84-kilometre, two-way pipeline, if required.

To minimise adverse impacts on the landscape, cultural heritage, fauna and flora and local communities, the plant's 29 buildings are set amongst 225 hectares of revegetated ecological reserve. The land forming this reserve has been rehabilitated following years of degradation from grazing and mining. In addition to reinstating native vegetation and integrating the plant into the landscape, the ecological reserve provides recreational and visual amenity to the public, including more than eight kilometres of cycling and pedestrian trails. The plant's design also features one of the largest green roofs created in Australia, covered with native vegetation to protect the plant from corrosion, conserve energy and reduce noise to the surrounding natural area. The project includes an 84km underground water transfer pipeline and an 87km underground power supply which are co-located in one easement for most of their length. The location of this utilities corridor was subject to significant investigation to mitigate the risk of environmental impacts. The infrastructure is generally located in agricultural land and construction and rehabilitation techniques also assisted to reduce the risk of impacts.

BASIS FOR MONITORING

In line with AquaSure's pledge to deliver, operate and maintain the most technically advanced, environmentally sensitive and energy efficient desalination facility in Australia, VDP has undergone rigorous environmental assessment under both Victorian and Commonwealth law.

The project was assessed under the Environmental Effects Act 1978 (Vic), following the preparation of a detailed EES prepared by the Department of Environment and Primary Industries in 2008. The EES involved more than 80 specialist studies, including flora and fauna, cultural heritage, social impact, hydrological, geotechnical and marine investigations to examine the potential impact of, and mitigation measures for building and operating the plant.

Overall, the EES indicated there were a number of social and economic benefits for the area as a result of the project, and that the potential adverse environmental impacts were generally short-term and limited to the period of construction. The EES was made available for public comment. Twenty community groups, five Councils and 74 individuals gave submissions to an inquiry over a 15-day public hearing. As a part of this process, the Victorian Government appointed an independent Expert Group to provide advice on the design and soundness of the EES. This group was confident that, subject to the implementation of an Environmental Management Framework, the VDP would significantly benefit the State and the EES's scope was such that it was unlikely that significant and unexpected marine impacts would occur.

The EES assessment was used as the basis for the project's approval under Commonwealth law. The Project was approved under the EPBC Act as a controlled action, due to its potential to affect listed threatened species under Sections 18 and 18A of the EPBC Act. As a result, a condition of approval under this legislation was the preparation of a Management Strategy for EPBC Act listed flora and fauna. This strategy is included in the Design and Construction Environmental Management Plan for the project.

For the Design and Construction phase, monitoring and reporting was addressed through an EPBC Act Listed Species (Flora and Fauna) Management Strategy, included as part of the Flora and Fauna Sub Plan attached to both the publicly available Design and Construction Plan and General Area Environmental Management Plan and the Design and Construction Utilities Environmental Management Plan. This was audited monthly by project's IREA and annual compliance reports were submitted to the Commonwealth. For the Operation and Maintenance phase, this condition is addressed through the Environmental Monitoring Schedule, attached to the Operation and Maintenance Environmental Management Plan.

The preparation of an Annual Report, which tracks progress against compliance with the EPBC Act Listed Species (Flora and Fauna) Management Strategy, is also a part of this condition.





The EES identified records of threatened fauna within the VDP project area and studies were conducted to confirm areas of known habitat for each species. These areas were identified as potentially sensitive for threatened fauna and strict control measures were implemented to protect habitat and animals before and during construction works. Measures included locating infrastructure in other areas to remove the risk completely and, where this was not possible, altering construction methods or salvaging threatened fauna and moving them to safe areas away from the impact zones. Locations where threatened fauna were detected during VDP works, or where a species had been recently documented by independent studies, were subject to post-construction monitoring. These sites were mainly concentrated around the Koo-Wee-Rup area and surrounds and monitoring was conducted on four nationally threatened vertebrates Southern Brown Bandicoot, Growling Grass Frog, Australian Grayling and Eastern Dwarf Galaxias.

Another condition of the EPBC Act Listed Species Management Strategy is the post-construction monitoring of the introduced Cinnamon Fungus. Nineteen sites were identified as potentially high risk areas and these were sampled for the presence of the fungus within the VDP utilities pipeline corridor. This summary provides the methods and findings of post-construction monitoring conducted to late 2013 on the five species investigated.

THE AREA



LEGEND

-  Southern Brown Bandicoot
-  Growling Grass Frog
-  Australian Grayling, Eastern Dwarf Galaxias
-  Cinnamon Fungus monitoring sites
-  VDP Pipeline

The Australian Grayling *Prototroctes maraena* is a small to medium-sized, slender, elongated fish lacking any distinctive markings. The species is generally silver in colour, dusky-brown to olive on its back and greenish to bronze on its sides (Allen et al., 2002). Individuals can grow up to 30cm, but are generally 17-19cm long (DoE, 2013). Juveniles can be mistaken for smelts, mullets and introduced trout (Allen et al., 2002).

Australian Grayling

The Australian Grayling is considered as vulnerable to extinction under the EPBC Act and threatened under the FFG Act. The species is present in mainland Australian rivers and streams on the eastern and southern flanks of the Great Dividing Range, from Sydney, southwards to the Otway Ranges of Victoria but is absent from the inland Murray-Darling system (DoE, 2013).

HABITAT PREFERENCES AND LIFECYCLE

The Australian Grayling is amphidromous (fish that live and spawn in freshwater environments as adults and travel between marine and freshwater environments as juveniles) and potentially migrates long distances downstream for spawning and long distances upstream as juveniles. The species does not display site fidelity to spawning streams and is distributed across a wide geographical area.

The fish is likely to use a diverse range of habitat types throughout various stages of its lifecycle, although some habitats such as those that support spawning, refuge and juveniles are likely to be limited in distribution and crucial to the species life cycle (Backhouse et al., 2008).

Adult fish undertake large-scale downstream migration to complete spawning in low freshwater reaches immediately above an estuary. Spawning takes place between late summer and winter (April–May) and coincides with increased flow and decreased water temperature (Koster and Dawson, 2011 and O'Connor et al., 2012).

Following spawning, most individuals return to their upstream habitats and move within less than a 1km home range outside of the spawning period. Fertilised eggs develop and hatch at the bottom of stream beds (McDowall, 1996) and the juvenile fish are carried downstream to estuarine/marine environments (Jackson and Kohen, 1988; O'Connor et al., 2012).

Juveniles mature in estuarine/marine environments for up to six months before migrating upstream, between October and November, to freshwater environments where they remain as adults (Bera 1982; Bishop and Bell, 1978; Crook et al., 2006; Koster and Dawson, 2011).

DISTRIBUTION WITHIN PROJECT AREA

The VDP utilities corridor intersects three waterways considered known habitat for the Australian Grayling. The species historically recorded upstream in the Bunyip Main Drain, Lang Lang River and Cardinia Creek. The species is considered likely to persist in these waterways.

Monitoring for Australian Grayling took place at three sites along each of these waterways, comprising an area upstream of the impact, the disturbed impact zone and a site downstream of the impact.

Post construction monitoring of Australian Grayling began in March 2012 and involves daytime surveys every three months using electrofishing, bait-trapping and fyke netting methods to catch fish and assessments of site habitat condition and water quality (see Section 4) to monitor any detectable changes.

RESULTS

The species was not detected during the monitoring period. This result is consistent with the outcomes of previous surveys conducted as part of the VDP. This species is notoriously hard to detect and is only anticipated to utilise monitored water bodies on an intermittent basis. The monitored water reaches are not considered to support optimal habitat conditions for the species.

SUMMARY

If present, Australian Grayling are only likely to pass through impact areas briefly during upstream and downstream migration events. Non-detection of the species at the monitoring locations is not considered to indicate an adverse impact from the construction of the utilities corridor. Continued monitoring could reveal usage of the monitored waterways by the species; however the presence of spawning grounds is considered unlikely.

The Eastern Dwarf Galaxias *Galaxiella pusilla* is a small, slender fish with a tapered body that lacks scales. The fish has soft rayed fins and a single dorsal fin positioned close to the fishes tail (Saddler et al., 2010 and Allen et al., 2002). The females are typically larger than males growing up to 40 mm long compared to 34 mm. The males are more colourful having three parallel stripes along their body and an orange, red, gold coloration, whereas the stripes and bright colours are less distinct or absent on females (Saddler et al., 2010).



Eastern Dwarf Galaxias

The Eastern Dwarf Galaxias is listed as vulnerable to extinction under the EPBC Act and threatened under the FFG Act. The Eastern Dwarf Galaxias has been recorded in mainland Australia from the Mitchell River Basin in central Gippsland of Victoria, to the Cortina Lakes near the Coorong in South Australia (DoE, 2013). In Victoria the species only occurs in waters south of the Divide and west of Lakes Entrance and is present in at least eight creeks on the Mornington Peninsula (DEPI, 2013).

HABITAT PREFERENCES AND LIFE CYCLE

Dwarf Galaxias inhabit slow flowing, typically shallow, permanent and semi-permanent waterbodies (Allen et al., 2002) including drains, wetlands and the backwaters of streams and creeks. Waterbodies typically have a dense cover of large aquatic plants. Dwarf Galaxias have been found to be present in Crayfish burrows during temporary dry conditions. Linkages to other more permanent waterbodies also appear important (Saddler et al., 2010). Their diet consists predominately of micro and macro invertebrates (Saddler et al., 2010).

Eastern Dwarf Galaxias is a short lived species that typically dies after one spawning event following its first year of life (Allen et al., 2002). Fish spawn between late winter and early spring with females laying 65-250 eggs on hard surfaces to which they stick. Egg-laying can last between 7 and 14 days and hatching occurs 2-3 weeks later. The entire life cycle of Eastern Dwarf Galaxias is completed in freshwater (Saddler et al., 2010).

DISTRIBUTION WITHIN PROJECT AREA

Surveys completed for the VDP have recorded Eastern Dwarf Galaxias in Yallock Creek. The species has been detected from pre and post construction monitoring. During construction, Yallock Creek was dry and one Eastern Dwarf Galaxias was salvaged and relocated (EHP, 2011). Lang Lang River was identified as supporting suitable habitat for the species during pre-construction assessments, however, the species has not been detected within the waterway during the VDP monitoring events. Post-construction monitoring of Eastern Dwarf Galaxias in the two waterways commenced in March 2012 to investigate potential impacts to their pre-construction status. At each of the waterways three sections, comprising an area upstream of the VDP works, the disturbed zone (impact site) and a section downstream were monitored. Locations within each waterway were selected based on the presence of suitable habitat, flow and water depth.

Post-construction monitoring is conducted every three months using electrofishing, dip netting and overnight bait-trapping methods to catch fish. Assessments of site habitat condition and water quality (see Section 4) are also conducted to monitor any detectable changes and inform management recommendations.

RESULTS

Eastern Dwarf Galaxias was recorded to be in high abundance where a total of 255 Eastern Dwarf Galaxias were captured post-construction between January and October 2013 in Yallock Creek. This waterway was observed to be highly ephemeral (dries out in warmer months) and the species' population fluctuated with water levels and flows. The project is not considered to be having a significant impact on this species.

Within Lang Lang River the habitat is considered sub-optimal for Eastern Dwarf Galaxias with an absence of in-stream vegetation and a fast flow rate not conducive to their presence. This observation is consistent with non-detection of the species during previous VDP monitoring periods. Absence of Eastern Dwarf Galaxias at the Lang Lang River is not considered an indication of project impact and monitoring will continue to investigate whether the species returns to this former habitat over the next four years.

SUMMARY

The number of Eastern Dwarf Galaxias' captured at Yallock Creek increased over the post-construction monitoring period. It is difficult to determine if the increase is indicative of the species recovery following construction at this location or, if differences in results are attributable to other factors such as survey timing, increased water level, climatic variation and upstream influences. Given the general observed increase in abundance for all sections of the waterway over the monitoring year, it is likely the species was responding to environmental variables. The Eastern Dwarf Galaxias population within Yallock Creek is expected to be naturally dynamic, increasing during periods of high flow and good habitat availability and sharply decreasing in response to drought. Importantly, when environmental conditions are favourable, the species has been shown to utilise the waterway and pass through the 'impact' area. It should be noted that monitoring indicates that Eastern Dwarf Galaxias has a preference for the sites up and downstream of the impact area.

FAUNA SPECIES

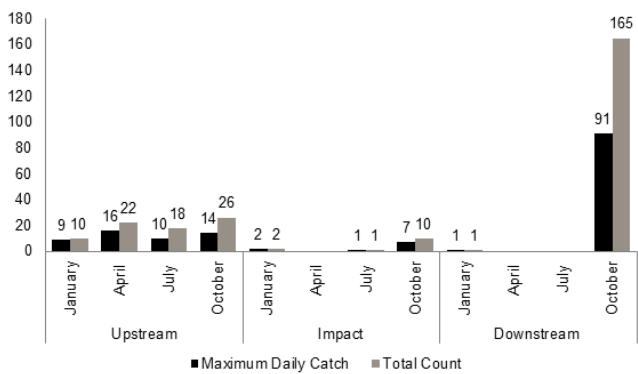


FIGURE 1 DISTRIBUTION OF EASTERN DWARF GALAXIAS RECORDS WITHIN THE YALLOCK CREEK.


Fish captured within the impact site only accounted for five percent of all fish captured (total count) over the monitoring period. This may indicate a reluctance to use the areas of open water associated with the impact zone where refuge provided by aquatic plants is absent and the risk of predation is greater. Predation and competition with introduced species, particularly Mosquito Fish *Gambusia holbrooki*, which was observed in high numbers (total count of 1745 fish), is considered a significant threat to the population’s long-term survival in Yallock Creek. The presence of introduced fish is not attributable to the VDP and is a state-wide problem in many waterways and waterbodies.

The absence of Eastern Dwarf Galaxias in the Lang Lang River is consistent with the outcomes of previous monitoring sessions for the project. Habitat assessments indicated the waterway does not support optimal habitat for the species due to a lack of aquatic plant cover and a highly fluctuating flow rate.



FEMALE (LEFT) AND MALE (RIGHT) EASTERN DWARF GALAXIAS





The Growling Grass Frog *Litoria raniformis* is a member of the ‘Bell Frog’ species complex. Females are larger than males and can grow to 10 cm) from nose to tail-bone (Barker et al., 1995). Adult colouration is variable and frogs can be brown, as well as the usual green, but individuals consistently have a pale green central back stripe (see Plate 4) often with rows of large dark spots on their back (Barker et al., 1995).

Growling Grass Frog

The Growling Grass Frog is listed as vulnerable to extinction under the Commonwealth EPBC Act and threatened in Victoria under the FFG Act. The species has declined dramatically in the northern and north-eastern plains of Victoria (DEC 2005) and disappeared from upland areas of eastern Victoria (Clemann & Gillespie, 2012).

HABITAT PREFERENCES AND LIFECYCLE

The species lives in a wide range of still waterbodies, including lagoons, swamps, lakes, ponds, farm dams, irrigation channels and quarries, as well as slow-flowing sections of streams and rivers (DEC 2005). Tadpoles are large and can grow to 10 cm long. They typically metamorphose into juvenile frogs after 2-3 months (Pyke 2002, in Heard et al., 2010), however this can take up to 15 months. Important habitat features generally contain high densities of emergent and waterside vegetation.

Remnant populations of Growling Grass Frog are present in scattered localities throughout lowland regions including the greater Melbourne area, and the south-east, north-west and central regions of Victoria (DEWHA 2009). The Pakenham-Cranbourne area supports remnant Growling Grass Frog populations and the species is present in various sections of creeks, drains and artificial dams in the Koo-Wee-Rup area.

DISTRIBUTION WITHIN PROJECT AREA

Five locations including drains, creeks and farm dams in the Koo-Wee-Rup area are being monitored for Growling Grass Frog for five years post-construction of the utilities corridor. These are locations where the species was detected and/or salvaged between 2010 and 2011 before and during construction of the utilities corridor (EHP, 2011).

Monitoring is required to determine if Growling Grass Frog has naturally recolonised disturbed waterways, to measure the success of translocation protocols, investigate reproductive success of the frog within the utilities construction corridor and to ensure management actions and habitats are suitable for the local Growling Grass Frog population (AquaSure, 2012).

Post-construction monitoring of Growling Grass Frog began in October 2012 and involves day and night surveys four times a year at all sites to investigate ages of individuals using various methods including active searching for frogs, listening for calling males and playing their calls for a response, spotlighting, tadpole trapping. In addition, the condition of their habitat and water quality is assessed (see Section 4) to monitor any detectable changes.

RESULTS


Growling Grass Frog adults were detected at four of the five monitoring sites. However, the species was only detected throughout the monitoring period at one site (with the exception of January 2013) due to decreasing water levels at all sites during the summer months. This indicated that most sites only support temporary or semi-permanent habitat for the frog.

Habitat condition at all sites was modified with a high percentage of terrestrial weed vegetation within 5 m of the water's edge. The percentage cover of aquatic vegetation varied between sites. The water's surface at three of the five sites supported high densities of over-shading tall emergent vegetation not favoured for breeding by Growling Grass Frog; this included one site where the species was not detected post-construction. The remaining two sites supported floating and or submerged vegetation favoured for Growling Grass Frog egg-laying; however receding low water levels prevailed during peak breeding months.

SUMMARY

The non-detection of Growling Grass Frog post November 2012 at three of the four sites, where the species was recorded at the commencement of post-construction monitoring, could be due to the prevalence of sub-optimal habitat conditions in-stream and a gradual reduction in water levels. Low water levels probably reduced the suitability of aquatic habitat for egg laying and tadpole development due to wide-fluctuating water temperatures and an increased risk of predation by water birds and fish.

Monitoring did not identify successful breeding of the species within the study area due to the absence of tadpole or metamorphling detection. This is consistent with pre-construction data where the ages of all individual Growling Grass Frog observed were either adults or sub-adults. While aquatic vegetation was present at all sites, with the exception of the immediate narrow impact zones at some sites, lower than average rainfall was experienced (data for Cranbourne Botanic Gardens, Bureau of Meteorology website 2013) between September 2012 and January 2013 which coincided with the Growling Grass Frog breeding season. Low rainfall may have contributed to a reduction in successful breeding at the monitoring sites due to reduced opportunities for egg development and tadpole survival. It has not been possible to draw conclusions on post-construction impacts of the utilities corridor and low Growling Grass Frog numbers. This is due to lower than average annual rainfall experienced in the monitoring period and subsequently low water levels at the five sites. Continued monitoring is required to investigate whether there have been any impacts from construction of the utilities corridor on local Growling Grass Frog populations.



Southern Brown Bandicoot, eastern form, is one of five sub-species of Southern Brown Bandicoot formally recognised in Australia that occurs in NSW, Victoria and South Australia (DoE, 2013). It is a medium-sized compact marsupial, with coarse brown hair, a long nose and tapering body. The larger males generally weigh between 500 and 1850 grams (g) and females 400-1200 g. The sub-species typically occurs in healthy and open woodland habitat and uses dense low vegetation for cover and sheltering and is primarily distributed in coastal regions in Victoria. However, the Southern Brown Bandicoot has also been shown to be adaptable to altered habitats and currently persists in low lying swamp dominated vegetation in and around the townships of Koo Wee Rup, Tooradin and Bunyip Main Race. At sites in this area the species persists in very narrow roadside vegetation dominated by dense weedy thickets of Toowoomba Canary Grass, Hawthorn and impenetrable patches of Blackberry.

Southern Brown Bandicoot

The Southern Brown Bandicoot eastern sub-species is listed as endangered to extinction under the Commonwealth EPBC Act and threatened under the Victorian FFG Act. The sub-species was believed to have once been the most common bandicoot in southern Australia (Krefft, 1866), but was considered rare by the 1920s (Jones, 1924). It was considered a common mammal in the outer south-eastern suburbs of Melbourne until the late 1960s (Seebeck, 1977). Since then, the sub-species has suffered a dramatic decline in distribution and abundance due to land clearance, urbanisation and predation by foxes (Coates and Wright, 2003) and cats.

The known distribution of the Southern Brown Bandicoot in Victoria is divided into five loose sub-populations centred around Portland – Mount Gambier, Grampians National Park, Otway Ranges, South-central (Port Phillip – Western Port – Wilson’s Promontory) and East Gippsland. Individuals monitored for the desalination project are part of the Koo-Wee-Rup/Bunyip population cluster of the south-central sub-population.

HABITAT PREFERENCES AND LIFE CYCLE

Animals are mainly solitary and typically nocturnal; although some populations are known to be active during the day as at Cranbourne Botanic Gardens. Individual Southern Brown Bandicoot home-ranges vary in size depending on resource availability and can overlap with others. The breeding season generally begins in July and can continue through to February. Gestation lasts approximately 15 days before birth. The newborn crawls to the mother’s pouch to grow for about two months before moving to ground nests dug partially underground and loosely lined with grass, bark and other available material. Typically two to three young are raised and grow rapidly before reaching sexual maturity. The species is known to only live to between 2 and 3.5 years old.

DISTRIBUTION WITHIN PROJECT AREA

Three locations are being monitored for Southern Brown Bandicoot for five years post-construction of the utilities corridor in areas where waterways were crossed. These are creeks in the Wenn Drain area, the McDonalds Drain area and Main Drain Road area where the species was either salvaged pre-construction (EHP, 2011) or known to be present in suitable habitat (EHP, 2010). Monitoring is required to determine if Southern Brown Bandicoot has naturally recolonised disturbed habitat within the construction corridor and to ensure that management actions and habitats are suitable for the local population (AquaSure, 2012).

Post-construction monitoring of Southern Brown Bandicoot began in July 2012 and involves day and night surveys three times a year using methods involving trapping live animals, collecting hairs and video footage of bandicoots and spotlighting. Assessments of habitat condition are also conducted.

RESULTS

All sites have historically been extensively modified or disturbed and are located within road or drainage reserves adjacent to agricultural land and gazetted roads. Suitable habitat in the form of dense shrub and ground vegetation cover was present at all sites and was generally linear and narrow, running parallel with drains and roads. The levee banks of the disturbed utility corridors were observed to re-vegetate post-construction and provide connective corridors for foraging and dispersing bandicoots; albeit weedy.

Southern Brown Bandicoot were live-captured at all three sites and comprised a total of seven adult males, three adult females (two with pouch young) and three sub-adult males. Bandicoot hairs were also captured at all sites and video footage was captured at one site. Two bandicoot predators were also recorded, comprising foxes at all sites and cats at two of the three locations.

SUMMARY

Results indicate that Southern Brown Bandicoot is present in habitat, within and adjacent to, the utilities corridor at all sites and is successfully breeding in the post construction phase due to the presence of mothers with young and sub-adults. Continued management of the planted vegetation to encourage native ground plants and shrubs to grow on the drain levee tops and slopes within the utilities corridor will enhance habitat condition and restore robust connective corridors for bandicoots. Post-construction monitoring for a further four years will continue to inform the adaptive management of the utility corridor habitat restoration works for Southern Brown Bandicoot.



SOUTHERN BROWN BANDICOOT CAPTURED BY NIGHT CAMERA

The VDP utilities corridor traversed numerous waterbodies considered to have known or high habitat values for the EPBC Act and State listed species Growling Grass Frog, Australian Grayling and Eastern Dwarf Galaxias. Water quality testing in accordance with the post-construction monitoring conditions of the VDP EMP (AquaSure, 2012) was conducted every three months in 10 locations at each of the impacted waterways and waterbodies between October 2012 and October 2013, where water levels allowed.

WATER QUALITY INDICATORS	UNITS	PARAMETER	SOUTH EASTERN RURAL	LOWLAND AND PHILLIP ISLAND
Total Distilled Solids	mg/L	Maximum	<500	<500
Dissolved Oxygen	% saturation	Minimum	>80	>80
pH	pH units	Range	6.5-9	6.5-9
Temperature	Degrees Celsius	Variation	<N+2.0	<N+2.0
Turbidity	NTU	Annual median	<15	<15

TABLE 1: PROJECT WATER QUALITY CRITERIA

Key: N= background level i.e upstream conditions

WATER QUALITY

Water quality monitoring was conducted at all sites monitored for threatened fish and/or Growling Grass Frog. At each site five water parameters, temperature, pH, electrical conductivity (EC), dissolved oxygen (DO) and turbidity were monitored against the State Environment Protection Policy (Waters of Victoria), 1999 guidelines (SEPP WoV). The SEPP WoV applies to the management of water within the western port and catchment in Victoria where the monitoring study area is located.

In addition, specific water quality monitoring criteria were produced for the project (EP, 2010) that considered various legislation and policies including:

- Index of stream condition (DNRE, 1999)
- Index of Wetland Condition methodology (DSE, 2006)
- Standard Rapid Bio assessment for macroinvertebrates (EPA, 2003)
- Environmental guidelines for major construction sites (EPA, 1996)
- SEPP WoV.

The project water quality criteria is summarised in Table 1.

LOCATIONS

Each fish monitoring site was surveyed at three sections, one at the location of the VDP utilities crossing point (impact site), along with one upstream and one downstream of this area. Growling Grass Frog monitoring sites were monitored upstream and downstream of the impact zone in waterways. Two adjacent dams one of which was impacted by the corridor works were also monitored.

RESULTS

Australian Grayling and Eastern Dwarf Galaxias

The results of three of the four waterways monitored showed very minor changes upstream, downstream and at the impact site between the parameters measured. All results were below the adopted guidelines with the exception of DO for all three sites and EC and turbidity for one of the sites. However, the exceeded parameters in the impact zone were also recorded in the corresponding upstream zone and therefore were not considered to be a trigger as upstream conditions are representative of background conditions.

Yallock Creek where Eastern Dwarf Galaxias was regularly recorded was mainly dry during construction and supported pooled areas of water. During the monitoring period the disconnected downstream pools showed variable water quality that exceeded thresholds but when the section became hydraulically linked conditions at all sections appeared relatively homogenous.


Based on post-construction data, none of the four waterways monitored for Australian Grayling and Eastern Dwarf Galaxias appear to have been impacted by construction activities.

Growling Grass Frog

Similar results in the waterways monitored for fish were recorded for Growling Grass Frog habitat (two of which were the same sites as fish) with measurements generally being within the required parameters, or where they were exceeded the same was observed in the upstream sections and was not attributable to the pipeline construction. One site had increased turbidity downstream that was still below the trigger value and another site had elevated EC in both sections. Water quality of the two dams monitored was fresh, with moderate turbidity, neutral pH and DO. Water quality parameters in dams can be highly variable and dependant on season, the time of day and the biological processing occurring at the time of sampling, which can affect the DO, EC and turbidity of water. Post-construction, the EC and turbidity were slightly higher in the impacted dam than the non-impacted dam.

SUMMARY

In line with the requirements of Growling Grass Frog and threatened fish monitoring in situ water quality sampling was undertaken at 10 waterways/waterbodies traversed by the utilities corridor. With the exception of Yallock Creek monitored for Eastern Dwarf Galaxias and the two dams monitored for Growling Grass Frog, water quality appeared to be consistent from upstream to downstream locations. The variance observed in the Eastern Dwarf Galaxias waterway and two dams are probably attributable to environmental factors including low water flows and levels, respectively and are not to project related impacts. Based on the outcomes of water quality monitoring there appears to be no evidence of project related impact at any of the locations sampled.



Cinnamon Fungus *Phytophthora cinnamomi* is an introduced soil-borne fungus that can affect a plant's root and vascular system, potentially leading to death in more than 1,000 species in Australia (McDougall, 2005). The pathogen is particularly prevalent in forests, woodlands and heathlands in Southern Australia receiving more than 600 mm annual rainfall, with members of the Proteaceae, Epacridaceae, Fabaceae, Xanthorrhoeaceae and Dilleneaceae families most vulnerable to the effects of Cinnamon Fungus (Cahill, 2008).

Cinnamon Fungus

Because of its impacts on biodiversity, Cinnamon Fungus has been listed as a threatening process under the Commonwealth's EPBC Act and Victoria's FFG Act.

SUSCEPTIBLE HABITAT

It is predicted that the spread of Cinnamon Fungus could lead to the extinction of threatened flora species (Reiter et al., 2004), as well as impact on threatened fauna, particularly ground dwelling mammals, through the loss of important habitat attributes (Newell, 1998, Laidlaw and Wilson, 2006). Cinnamon Fungus was first recorded in Victoria in 1935 from Willows *Salix* spp., and since then has been observed impacting on vegetation in important conservation areas such as the Brisbane Ranges, Grampians, Wilson's Promontory, Great Otway, and Kinglake National Parks (Cahill, 2008). The pathogen has also been recorded in the Mullungdung forest, and Lysterfield, Blackwood Ranges and Narbethong areas (Cahill, 2008). There is little documented evidence of Cinnamon Fungus in more fragmented landscapes such as roadsides, on agricultural land or within scattered remnant trees, although this is more likely a reflection of survey effort than the absence of Cinnamon Fungus from these areas.

DISTRIBUTION WITHIN PROJECT AREA

Victoria's Department of Environment and Primary Industries identified vegetation surrounding the VDP as being at risk of loss due to Cinnamon Fungus (DSE, 2010). There is also anecdotal evidence the fungus already exists near the VPD utilities corridor along the Bass River, and could potentially be spread throughout the landscape if appropriate hygiene protocols were not adopted during the construction of the utilities corridor.

The post-construction monitoring of any dispersal of *Phytophthora cinnamomi* dieback in remnant vegetation in close proximity to pipeline and powerline earthwork sites is a requirement of the EMP for a minimum of two years after the completion of site rehabilitation works (AquaSure, 2012).

RESULTS

This summary presents the results for the first round of post-construction Cinnamon Fungus monitoring completed for the VDP utilities corridor, which was undertaken in October 2013.

A desktop search of literature was undertaken to identify locations potentially at high-risk of Cinnamon Fungus infection and vegetation loss.

Reviewed documents included:

- The State Environment Minister's response to the EES for the VDP (DPCD, 2009).
- A State-wide map modelling the likely risk of vegetation loss due to Cinnamon Fungus, produced by the Department of Environment and Primary Industries (DSE, 2010).
- Remnant vegetation mapping of the utilities corridor completed by the ecological consultancy Biosis (Biosis, 2008).
- A document ranking the susceptibility of Australian vegetation to Cinnamon Fungus (McDougall, 2005).

A drive-through of the utilities corridor to locate the monitoring sites was first conducted. Nineteen sites at high risk of Cinnamon Fungus infection were selected to be monitored for Cinnamon Fungus infection. Sites were located between the Bass Coast Rail Trail in the south, and Cardinia Road in the north, covering approximately 72 km of the alignment (see map, pg 7). Soil samples were collected for laboratory analysis at sites where symptoms consistent with Cinnamon Fungus infection were observed. Sampling was undertaken in accordance with Victoria's Public Land *Phytophthora cinnamomi* Management Strategy (DSE, 2008). Based on the outcomes of laboratory analysis, Cinnamon Fungus was not found to be present at any of the sampled sites.

SUMMARY

Sites along the VDP utilities corridor supporting vegetation susceptible to Cinnamon Function were sampled in October 2013. Despite symptoms consistent with Cinnamon Fungus dieback observed in susceptible species such as Messmate Stringybark *Eucalyptus obliqua*, Narrow-leaf Peppermint *Eucalyptus radiata* and Silver Banksia *Banksia marginata*, laboratory analysis on soil collected from these areas did not identify Cinnamon Fungus. Additional monitoring in 2014 will further clarify the presence of Cinnamon Fungus along the VDP utilities corridor. However, given that all high-risk sites have already been sampled it is unlikely that Cinnamon Fungus will be found.

05

CONCLUSION

Photographer: © Chris White

CONCLUSION

The careful watch on these species following the completion of construction in 2012 indicates the construction of the utilities corridor has not impacted significantly on the nationally threatened Southern Brown Bandicoot (eastern subspecies), Eastern Dwarf Galaxias, Australian Grayling or Growling Grass Frog. Ongoing habitat re-establishment at the impact zones will continue to improve habitat for these species

Post-construction monitoring will continue to inform the adaptive management of the VDP utilities corridor.

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