,

Wetland Condition Monitoring Report December 2025

Riverwalk Residential Development

Prepared for Development Victoria

27 March 2026

Biosis offices

New South Wales

Albury
Phone: (02) 6069 9200
Email: albury@biosis.com.au

Gosford
Phone: (02) 9101 8700
Email: gosford@biosis.com.au

Newcastle
Phone: (02) 4911 4040
Email: newcastle@biosis.com.au

Sydney
Phone: (02) 9101 8700
Email: sydney@biosis.com.au

Western Sydney
Phone: (02) 9101 8700
Email: sydney@biosis.com.au

Wollongong
Phone: (02) 4201 1090
Email: wollongong@biosis.com.au

Victoria

Ballarat
Phone: (03) 5304 4250
Email: ballarat@biosis.com.au

Melbourne
Phone: (03) 8686 4800
Email: melbourne@biosis.com.au

Wangaratta
Phone: (03) 5718 6900
Email: wangaratta@biosis.com.au

Document information

Report to:	Development Victoria
Prepared by:	Karthika Jayakumar
Biosis project no.:	42595
File name:	42595.Riverwalk.Wetland.Condition.Monitoring.Dec.2025.FIN01.20260327
Citation:	Biosis 2026. Riverwalk Residential Development: Wetland Condition Monitoring Report December 2025. Document prepared for Development Victoria. Authors: Jayakumar, K. Biosis Pty Ltd, Port Melbourne, VIC. Project no. 42595

Document control

Version	Internal reviewer	Date issued
Draft version 01	CT	19/03/2026
Final version 01	CT	27/03/2026

Acknowledgements

Biosis Pty Ltd acknowledges the contribution of the following people and organisations in preparing this report:

- Development Victoria: Erene Niyonsaba

Biosis staff involved in this project were:

- Jeni Hay (project management)
- Emma Harvey (mapping)
- Thomas Hewitt (field assistance)
- Claire Tingate (quality assurance)

Biosis acknowledges the Aboriginal and Torres Strait Islander peoples as Traditional Custodians of the land on which we live and work.

We pay our respects to the Traditional Custodians and Elders past and present and honour their connection to Country and ongoing contribution to society.

Contents

Tables

Figures

Photographs

1 Introduction

1.1 Background

The Riverwalk Residential Development (the development) is located in Werribee, approximately 30 kilometres south-west of Melbourne. The development encompasses residential and commercially zoned land that has been subject to several ecological assessments (e.g. Biosis Research 2000; 2006 and 2009) and management plans (Biosis Pty Ltd 2010; 2021). Situated within the Otway Plain Bioregion and the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar wetlands, the site was identified as supporting potential habitat for the nationally threatened Growling Grass Frog *Litoria raniformis*, which may disperse through the site via the Werribee River Basin (Werribee River catchment). The development comprises approximately 198 hectares and is bordered by the Werribee River to the east, the Princess Highway to the north, and Princess Freeway to the south.

The development was subject to approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2007 (EPBC Approval: 2006/3176). It has since been subject to five variations to the conditions of approval. Condition 2 of the current conditions of approval (approved 18 March 2022) requires the *design and implementation of a suitable Growling Grass Frog management regime for the wetlands*, including implementation of the *Riverwalk Residential Development: Growling Grass Frog Litoria raniformis Wetlands Management Plan (revised)* (Biosis Pty Ltd 2021; Wetlands Management Plan).

In accordance with the EPBC Act approval conditions and as outlined in the Wetlands Management Plan (Biosis 2021), three stormwater treatment wetlands incorporating habitat features suitable for Growling Grass Frog are required to be constructed within the development. These wetlands are required to be monitored by a qualified zoologist every six months for the first two years following their construction. The Wetlands Management Plan states that the monitoring must include an assessment of the vegetation condition and the availability of refuge/shelter sites around the perimeter of the wetlands to ensure habitat establishment and maintenance is suitable.

Biosis has proposed a two-year monitoring program commencing in 2025 for the constructed wetlands, including Wetlands 1 and 3. Wetland 2 is not included in this current monitoring report as it remained under construction as of December 2025. As of February 2026, Development Victoria announced the completion of all construction and landscaping works for Wetland 2. As such, habitat monitoring for Wetland 2 will commence in May/June 2026 during the next monitoring period.

This document has been prepared for Development Victoria to address the monitoring requirements outlined in the Wetlands Management Plan (Biosis 2021) and presents the results from the December 2025 monitoring.

1.2 Objectives

The objectives of the wetlands condition monitoring are to:

- Undertake a site assessment to:
  - Confirm suitability of the constructed stormwater treatment wetlands as potential Growling Grass Frog habitat, including suitable habitat attributes such as vegetation condition (including diversity and cover), shelter sites, and water levels and quality.
  - Determine the suitability of surrounding terrestrial habitat.

  - Advise of any unsuitable management practices, such as invasion by unsuitable plants, pest animal activity or damage from other external factors.
- Provide recommendations for maintenance of wetland habitat, including weeding, mowing and supplementary plantings or additional refuge sites (if required).
- Summarise the wetland condition monitoring results into a report to document compliance with the EPBC Act Conditions of Approval (EPBC Approval: 2006/3176) in relation to Riverwalk.

1.3 Growling Grass Frog

The Growling Grass Frog is a ground-dwelling frog, recognisable by its large size (up to 10 centimetres), prominent eardrum, warty back, and dull to bright olive-green colouration. It is listed as vulnerable under the EPBC Act and the Victoria's *Flora and Fauna Guarantee Act 1988* (FFG Act). Prior to European settlement, Growling Grass Frogs were widely distributed across south-eastern Australia, including Tasmania. However, over the past three decades, the species has declined markedly across much of this former range. This is particularly evident in south and central Victoria where populations have experienced widespread declines and local extinctions due to factors such as habitat loss, fragmentation and degradation of habitat, infection by the amphibian chytrid fungus *Batrachochytrium dendrobatidis*, salinisation, pollution of waterbodies and waterways (e.g. fertilisers, pesticides and toxicants), and impacts from climate change. Populations are threatened by increasing urban or industrial developments, particularly throughout Melbourne's urban growth areas (DSE 2012).

Research on population structure and spatial occurrence emphasises the importance of landscape scale connectivity for the species (Heard & Scroggie 2009). Across most of Victoria, Growling Grass Frog occur in metapopulations made up of discrete populations connected by migration. Metapopulations exhibit changes over time and can go extinct and be recolonised from connected populations (DEWHA 2009, Heard & Scroggie 2009).

1.3.1 Habitat requirements

The species relies on permanent or semi-permanent still or slow flowing waterbodies that typically support adequate emergent, submerged and floating vegetation. Open and partially rocky areas are often preferred for basking, and open grassland habitat surrounding waterbodies is utilised for foraging and dispersal. Individuals overwinter beneath thick vegetation, logs, rocks and other ground debris, and increase activity during warmer months as breeding occurs in spring and summer (DSE 2012).

Growling Grass Frog are usually found among vegetation within or at the edges of permanent waterbodies such as still or slow-flowing streams and lakes. Artificial water bodies such as farm dams and quarries can also support populations. Habitat characteristics, such as the presence of fringing aquatic vegetation and submerged vegetation, can also have a positive impact on the likely use of a waterbody by Growling Grass Frog, but may not be as important as the distance to the nearest population (Robertson et al. 2002, Heard et al. 2010). This suggests that dispersal between waterbodies is important for the maintenance of population processes.

While Growling Grass Frog rely on aquatic habitats for breeding, they are often encountered within several hundred metres of waterbodies and can move across open terrestrial habitat. They are highly mobile and capable of travelling up to one kilometre in 24 hours (DSE 2012). This mobility allows them to travel between waterbodies and interact with nearby populations, with most groups forming part of a broader metapopulation. Maintaining connectivity between waterbodies is critical to the long-term survival of this species.

1.3.2 Habitat within the Riverwalk Estate

Growling Grass Frog habitat within the (now) Riverwalk Estate study area was previously assessed by Biosis (Biosis Research 2006; 2009; 2010). It was concluded that the section of the Werribee River bordering the eastern extent of the development provides dispersal habitat for the species, however, due to its history of modification it lacks suitable characteristics to provide high quality breeding habitat (Biosis Research 2010). In summary, potential habitat for the Growling Grass Frog within the study area was determined to be confined to the immediate vicinity of the Werribee River (Biosis 2021).

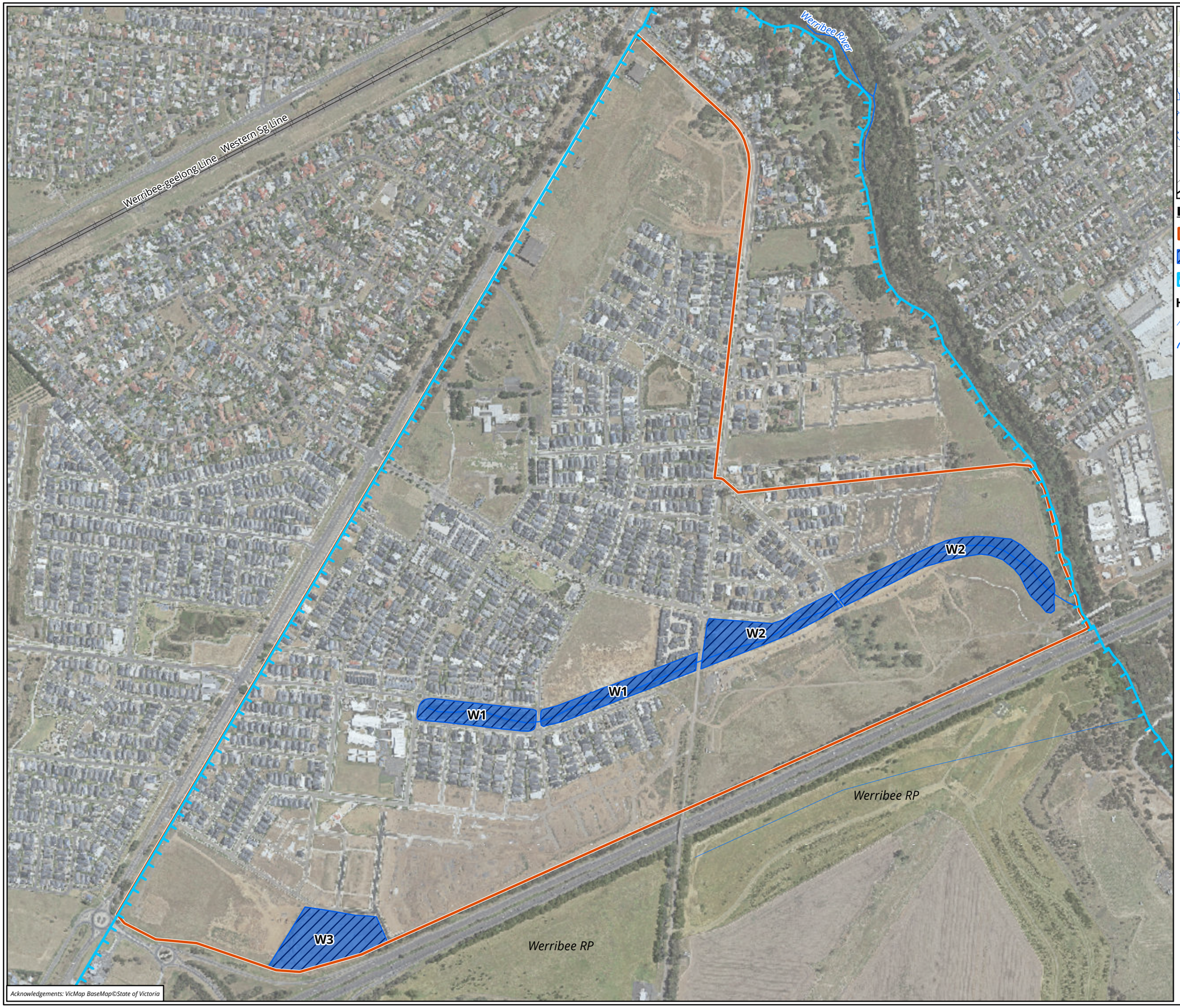
To support habitat connectivity given the proximity of the development to the Werribee River, three stormwater treatment wetlands that incorporate habitat features suitable for Growling Grass Frog have been constructed within the Riverwalk Estate. These are summarised below:

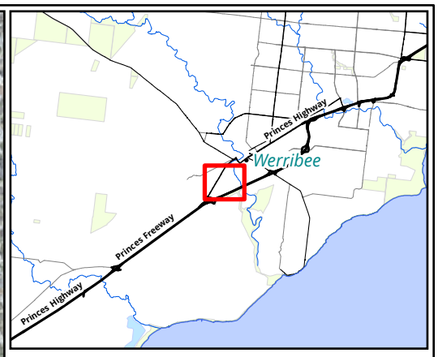
- **Wetland 1 (W1)** – narrow modified drainage line extending west from the Werribee River approximately 650 metres in length. Construction completed in 2018.
- **Wetland 2 (W2)** - modified drainage line extending immediately west from the Werribee River approximately 900 metres in length. Provides direct connectivity to the Werribee River and surrounding terrestrial habitat. Under construction during December 2025 survey, completed as of February 2026.
- **Wetland 3 (W3)** – well established wetland with a series of permanent pools with dense emergent vegetation in the southwest corner of the development, adjacent to the Princess Freeway. Surrounded by residential development and provides little connectivity to habitat in the surrounding landscape. Construction completed in 2023.

It should be noted that whilst Growling Grass Frog may occasionally utilise stormwater assets, stormwater treatment wetlands do not typically function as, and are not considered to be suitable primary habitat. This is largely due to the dominance of emergent vegetation, pollution and input of high nutrients, and abundance of exotic fish that predate eggs and tadpoles (DELWP 2017).

Whilst the primary purpose of these waterbodies is stormwater treatment, they have also been designed and managed to provide potential habitat for Growling Grass Frog, with potential connectivity the Werribee River, which provides important habitat and facilitates frog movement along the river corridor and surrounding habitat.

The Growling Grass Frog wetlands being monitored in line with the Wetlands Management Plan are shown in Figure 1.





Legend

- Study area
- Wetlands
- RAMSAR site boundary

Hydrology

- Drain/channel
- River or creek

Figure 1 Werribee Riverwalk wetlands

0 60 120 180 240 300

Metres

N

Scale: 1:8,000 @ A3

Coordinate System: GDA2020 MGA Zone 55

biosis

APEM Group

Matter: 42595,
Date: 20 June 2025 ,
Prepared for: KJ, Prepared by: EH, Last edited by: eharvey
Layout: 42595_F1_GGF_Wetlands
Project: P:\42500s\42595\Mapping\
42595_Riverwalk_2022_2025_ComplianceReport.aprx

2 Methods

2.1 Habitat assessment

A habitat assessment of the stormwater treatment wetlands (W1 and W3) within the development was undertaken on 16 December 2025 by ecologist Thomas Hewitt to assess their suitability for Growling Grass Frog habitat including:

- Vegetation condition (including diversity and cover)
- Suitability and establishment of shelter sites
- Suitability of surrounding terrestrial habitat
- Evidence of any unsuitable management practices, invasion by unsuitable plants, pest animal activity or damage from other external factors.

2.2 Water quality monitoring

Water quality tolerances of Growling Grass Frog are poorly understood and trends in the relationship between water chemistry and Growling Grass Frog occupancy are unclear (Hamer et al. 2015). Moreover, populations occur throughout various water quality conditions (DELWP 2017). In general, waterbodies characterised by low turbidity, nitrate, ammonia, and other nutrients, and low or moderate salinity levels are considered most suitable for Growling Grass Frog. The recommended water quality targets outlined in the *Growling Grass Frog Habitat Design Standards Melbourne Strategic Assessment* (DELWP 2017) include:

- Minimise pollutant input
- Minimise soluble and total metals
- pH 6.0 to 8.5
- Moderately saline, up to 5000 microsiemens per centimetre (µS/cm)
- Turbidity <40 Nephelometric Turbidity Units (NTUs)
- Ammonia <0.01 milligrams per litre (N-1) as NH_4^+
- Total Nitrogen <1.0 milligrams per litre
- Total Phosphorous <0.1 milligrams per litre
- *E. coli* organisms/100 millilitres Primary Contact <150, Secondary Contact <1000.

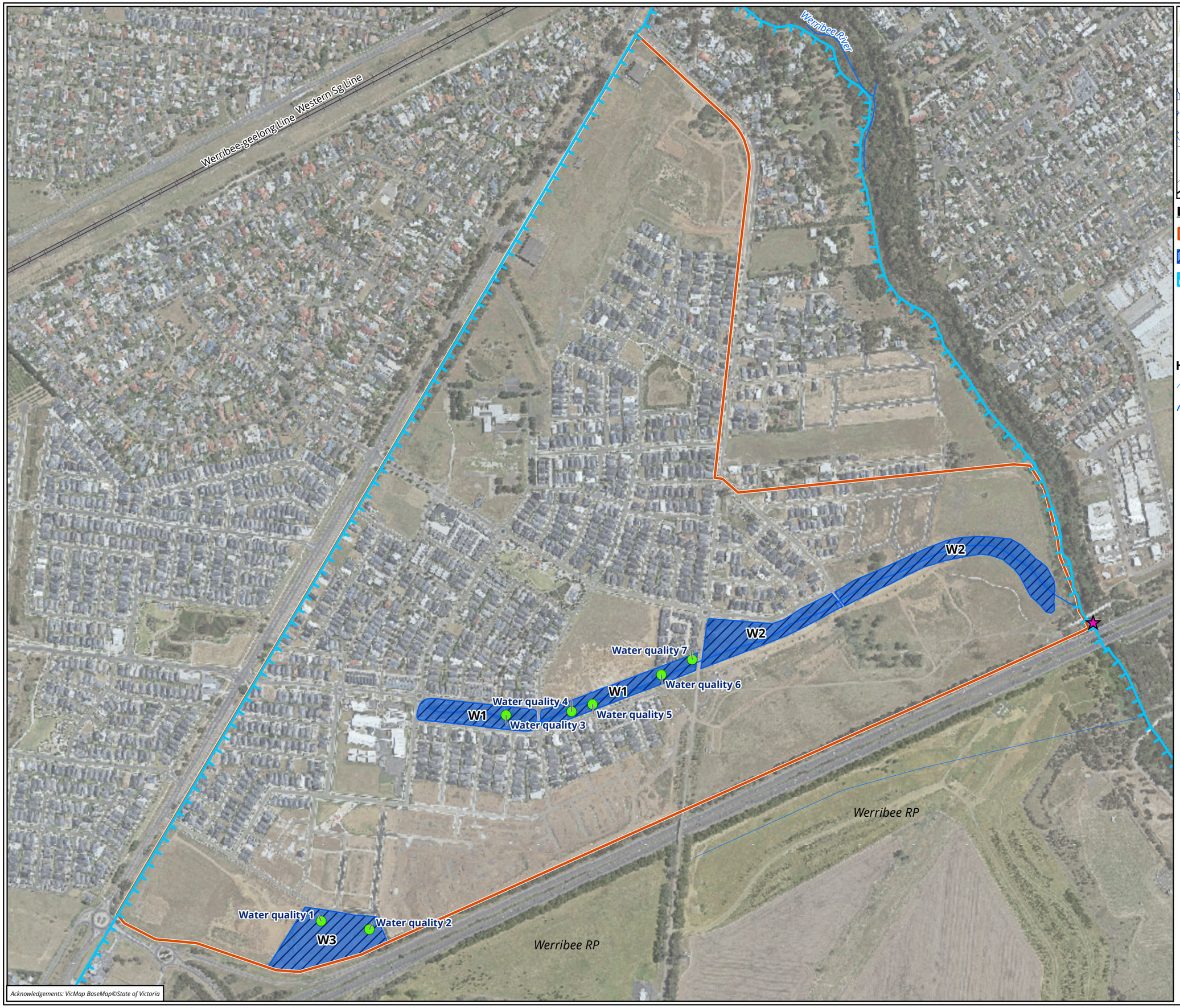
While these targets are provided within the *Growling Grass Frog Habitat Design Standards Melbourne Strategic Assessment* (DELWP 2017), wetlands that primarily function as stormwater treatment systems may not consistently achieve all guideline values and are likely to fluctuate overtime, such as following major rainfall events. Therefore, parameters were generally assessed against best practice standards (>80% Total Suspended Solids removal, >45% Total Phosphorus and Total Nitrogen removal, and no gross pollutants), as outlined in the Wetlands Management Plan (WMP; Biosis 2021).

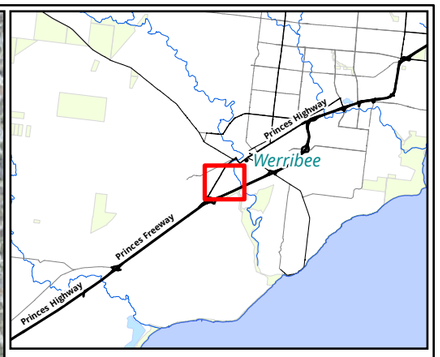
Water quality measurements collected for Wetland 1 and Wetland 3 during the habitat assessment have been presented in Appendix 2. Five locations were sampled within Wetland 1 and two within Wetland 3 (Figure 2). Multiple samples were collected within each wetland to account for variation in water quality across the waterbody. Samples were collected using a Horiba U-52 multi-parameter Water Probe, calibrated

prior to sampling. Readings were taken with the probe submerged approximately 30 centimetres below the water surface. The parameters recorded at each water quality monitoring point included pH, dissolved oxygen (DO), temperature (°C), turbidity (NTU) and salinity measured as electrical conductivity (µS/cm). All water quality measurements and samples were recorded / collected in accordance with *Victorian EPA publication IWRG701: Sampling and analysis of waters, wastewaters, soils and wastes* (EPA Victoria 2009).

Additional detailed water quality data was provided by ALS Global (ALS), who conduct water quality monitoring on behalf of Development Victoria. Samples were collected from multiple locations along the Werribee River. The parameters provided by ALS included Ammonia NH_3 (milligrams of nitrogen per litre), total nitrogen (milligrams of nitrogen per litre), total phosphorous (milligrams of phosphorous per litre) and *E. coli* (organisms per 100 millilitres). Data collected from the sampling site labelled Werribee River - River D/S Outfall Under Freeway (WQWERRVV3) on 18 December 2025 have been presented in this report (Table 4). ALS data collected from the Werribee River – Riverwalk Floodway Outlet was presented in the May 2025 report (Biosis 2025), however, this site was dry during the December 2025 monitoring. The alternative ALS sampling site, Werribee River – River D/S Outfall Under Freeway, was selected to be presented in this report as it is located downstream of the constructed wetlands, ensuring accordance with the EPBC approval condition 3(ii) (EPBC Approval: 2006/3176).

Comparison of water quality within the constructed wetlands between the May 2025 and December 2025 monitoring could not be undertaken, as direct water quality measurements from the constructed wetlands were not collected during wetland monitoring in May 2025. The results of water quality monitoring in December 2025 may be used as a baseline for comparison with future monitoring, noting that as stormwater treatment wetlands, water quality parameters will vary markedly depending on factors such as rainfall, flooding and nutrient inputs (Biosis 2021).





Legend

- Study area
- Wetlands
- RAMSAR site boundary
- Biosis water quality monitoring point
- ALS water quality monitoring point

Hydrology

- Drain/channel
- River or creek

Figure 2 Water Quality Monitoring points

0 60 120 180 240 300

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA2020 MGA Zone 55

N

biosis

APEM Group

Matter: 42595,
Date: 02 March 2026 ,
Prepared for: KJ, Prepared by: EH, Last edited by: eharvey
Layout: 42595_F2_WaterMonitoring
Project: P:\42500s\42595\Mapping\
42595_Riverwalk_2022_2025_ComplianceReport.aprx

3 Results

The following presents the findings of the habitat assessment for Wetlands 1 and 3, including an evaluation of their condition and suitability as habitat for the Growling Grass Frog and a comparison to the monitoring results from May 2025.

A summary of the wetland condition monitoring results is provided in Appendix 1 (Table 1), and detailed water quality monitoring data has been presented in Appendix 2. A list of flora species recorded during the site assessment is provided in Appendix 3 (Table 5).

Photos from the December 2025 assessment are provided in Appendix 4.

3.1 Wetland 1 – W1 Coldstream Creek

Management updates

Since the last monitoring, DV confirms that contractors have continued with regular and frequent weed control / maintenance of Wetland 1. Namely, thinning out phragmites/common reeds by 10-20% in August 2025, which focused on dense strands particularly around Farm Road. Regular weed control has been ongoing in aquatic and terrestrial areas. In addition, weed control of milk thistle, wire weed, mustard weed, orange pimpernel, rye grass and Chilean needle grass has been noted in the contractor's maintenance reports. Where spraying of weeds was necessary, the contractor has used glyphosate bi active herbicide near the waterways, which is a frog friendly weed control product. Planting that has been undertaken includes Common Tussock-grass *Poa Labillardieri* infill where required.

Vegetation condition

The mean vegetation cover within Wetland 1 remained consistent with previous monitoring in May 2025 at approximately 80% cover, with the wetland continuing to support dense and well-established vegetation. The emergent aquatic and semi-aquatic vegetation remained at 100% cover; however, some areas that were open during previous monitoring were observed to have been further colonized by emergent wetland plants. In addition to Twig-sedge *Machaerina articulata* and Common Reed *Phragmites australis* that were previously observed to dominate this zone, River Club-sedge *Schoenoplectus tabernaemontani* and Club Sedge *Bolboschoenus* spp. were notably prevalent.

The submergent and floating vegetation zone remained sparsely vegetated, with submerged aquatic vegetation estimated to be less than 1% cover and floating aquatic vegetation accounting for approximately 1%. The fringing terrestrial ground cover reduced from 70% to 50% but was dense in some areas containing predominantly Common Tussock-grass *Poa labillardierei*. The fringing terrestrial vegetation comprised predominantly native grasses and sedges such as Spiny-headed Mat-rush *Lomandra longifolia*, Spear Grasses *Austrostipa* spp. and Wallaby Grasses *Rytidospermas* spp; but also included introduced species such as the invasive Chilean Needle-grass *Nasella neesiana*. Fringing canopy remained sparse, with approximately 1% cover. The surrounding terrestrial habitat had an estimated 20% rock cover and 5% bare ground. The overall vegetation condition was generally healthy and well established.

Water levels and quality

The wetland consisted of a modified drainage line, interspersed with a series of five concreted deeper and fully inundated retention basins, with variable depths estimated at approximately 1 to 2 metres. The central creek channel supported dense emergent vegetation with minimal open water and limited surface flow. Majority of the central channel was dry at the time of the assessment, with some minor depressions holding pools of water approximately 0.2 to 0.3 metres deep. No notable variation in water levels was observed between wetland monitoring in May 2025 and December 2025. Water within the deeper retention basins appeared to be of moderate quality and may have been impacted by the high waterbird activity and accumulation of faecal material observed during the present assessment.

Water quality measurements collected from Wetland 1 were generally within the thresholds recommended by DELWP (now Department of Energy, Environment and Climate Change, DEECA) (DELWP 2017), with turbidity approaching the upper target value (Table 2). Measurements from Wetland 1 were broadly comparable to ALS data collected from the Werribee River, except for conductivity, which was substantially lower in the stormwater wetland. In contrast, turbidity was notably higher in the stormwater wetland than in the Werribee River (Table 2; Table 4). Water quality measurements from the Werribee River downstream of the Princes Freeway outfall were generally within the guideline parameters (DELWP 2017), except for Total Nitrogen, which exceeded the target value (Table 4). However, Total Nitrogen concentrations remained within the recommended standards for stormwater wetlands outlined in the WMP.

Suitability for Growling Grass Frog

The overall wetland structure, including aquatic and terrestrial plant diversity provides suitable habitat for Growling Grass Frog. The abundance of rocks fringing the wetland and tall terrestrial vegetation provides suitable basking and shelter sites. However, the persistence of overabundance emergent vegetation may compromise habitat quality overtime by reducing open water availability, increasing shading of aquatic zones, and potentially outcompeting more beneficial submerged or floating vegetation, which remains sparse.

Wetland 1 (and the future Wetland 2) provides the most direct dispersal habitat to facilitate movement from the Werribee River for Growling Grass Frog. However, with Wetland 2 currently under construction and the Coldstream Creek channel itself remaining entirely dry during the assessment, functional connectivity is marginal.

Several minor concerns were noted from the December 2025 site visit. Chilean Needle-grass *Nasella neesiana* and African Fireweed *Senecio madagascariensis*, both listed as Restricted noxious weeds under the Victorian *Catchment and Land Protection Act 1994* (CaLP Act), were recorded within the fringing vegetation. Litter and other contaminants were observed near the culverts, and algal blooms were present in most shallow sections, which may affect water quality.

It was evident that effective weed control had been undertaken with the overall weed cover being low, however some off target damage was noted with Spear Grasses *Austrostipa* spp. observed to be sprayed. The eastern stretch contained more open areas and suitable microhabitats such as rocks, cracks and vegetation, in contrast to the western stretch which had fewer open grassy areas.

3.2 Wetland 2 – W2 Coldstream Creek

Wetland 2 was not assessed during the December 2025 monitoring due to it being under construction. As of February 2026, civil and landscaping works are now complete, so monitoring of Wetland 2 will commence when the next monitoring is due in June 2026.

3.3 Wetland 3 – W3 Southern Wetlands

Management updates

Since the last monitoring, DV confirms that contractors have continued with regular and frequent weed control and maintenance of Wetland 3. Methods include hand weeding, brush cutting and mowing, and where contractors have sprayed weeds, they have confirmed they have used frog friendly products. The Northern and Western batters were infill planted in October 2025 to increase the density of the embankments. Contractors also continue to monitor the eucalyptus trees surrounding the wetland to ensure they are controlled and do not shade the wetland.

Vegetation Condition

Wetland 3 exhibited high biomass with the mean vegetation cover estimated to be approximately 80%, a 10% increase since the previous monitoring in May 2025. Emergent vegetation made up about 80% of the cover, dominated by River Club-sedge *Schoenoplectus taberamontanii*, Jointed Twig-sedge *Machaerina* spp. Poong'ort *Carex tereticaulis* and Club Sedge *Bolboschoenus* spp. Common Water-ribbons *Cycnogeton procerum* and Common Spike-sedge *Eleoacharis acuta* were recorded along the margins of the wetland. Submerged aquatic vegetation reduced to approximately 1%, consisting mostly of Water Milfoil *Myriophyllum* spp. and Pondweed *Potamogaeton* spp. Floating vegetation remained limited, especially within deeper ponds, with Duckweed *Callitriche stagnalis* recorded at no greater than approximately 1%. The fringing terrestrial understory was estimated to have increased to 45% cover, composed of native grasses such as Kangaroo Grass *Themeda triandra* and *Austrostipa* spp. Canopy cover was absent, and the surrounding area included approximately 50% rock cover and 10% bare ground.

Water levels and quality

The wetland consisted of three deeper basins in the north, east and south of the site, surrounding a large wetland supporting five deeper connected pools. The five central pools were connected by contiguous emergent vegetation supporting shallow water approximately 0.3 to 0.5 metres deep in places. The smaller basins in the north, east and south of site were connected to the central wetland component by rocky overflows with large, embedded rocks. The overflows were dry at the time of the assessment.

The permanent water level metres indicated the target 1.5 metre depth was being maintained, as per the civil drawings for a typical open water zone in Wetland 3. No notable variation in water levels was observed between wetland monitoring in May 2025 and December 2025. Varying levels of turbidity were visually evident in the deeper retention basins, and water quality in the central wetland component appeared suitable as indicated by vegetation health and visual inspection.

Water quality measurements collected from Wetland 3 were generally within the thresholds recommended by DELWP (2017). Similar to Wetland 1, measurements from Wetland 3 were comparable to ALS data collected from the Werribee River, except for conductivity being substantially lower and turbidity being notably higher in the stormwater wetland (Table 3; Table 4). Comparison of the two stormwater wetlands (Wetland 1 and 3), turbidity and dissolved oxygen were marginally lower in Wetland 3.

Suitability for Growling Grass Frog

Wetland 3 is well established and offers some suitable habitat components for Growling Grass Frog, with the southern wetlands in the most suitable condition providing areas of open water and submerged and floating

vegetation. However, the persisting overabundance of emergent vegetation may compromise habitat suitability over time.

The rocky features installed around the wetland remains largely unchanged, consisting primarily of large, embedded rocks with little structural complexity that is unlikely to provide the range of microhabitats needed for effective basking, overwintering or predator avoidance. The overabundance of fringing terrestrial vegetation may further limit movement to available sites. Increasing rocky refuge habitat, ideally in the form of rock piles extending into the wetland margins, would improve habitat value.

This wetland boarders the Princess Freeway in the south and is surrounded by roads and residential development in the north, east and west. As such, Wetland 3 offers very little connectivity to the Werribee River. Due to the lack of clear connectivity to the Werribee River, it is recommended that ongoing management efforts remain focused on vegetation and water quality control (see Section 4.3), as the addition of rocky refuges is unlikely to provide significant benefit in this context.

Wetland 3 showed a few minor issues that may require attention. Weed cover was very low, and there was evidence of recent weed control (spraying), which contractors have confirmed frog-sensitive products were used. Similar to Wetland 1, algal blooms and accumulated debris were present within Wetland 3, which may negatively affect water quality overtime. The current assessment recorded several birds (e.g. pigeons and ducks) within the wetland appearing disoriented. The previous assessment documented multiple deceased birds within the wetland, however, there is insufficient evidence to conclude causation of mortality. Continued monitoring is recommended to determine whether these observations represent isolated incidents or an emerging issue, and whether they are related to or impacting overall wetland condition.

4 Conclusion and recommendations

Development Victoria will continue monitoring wetland conditions in accordance with the WMP (Biosis 2021). The results will inform the ongoing state of the wetlands and guide the need for any management interventions.

The following provides ongoing recommended actions for managing the wetlands and habitat features, with the intention of providing or improving potential habitat to support the Growling Grass Frog. Noting that the primary purpose of wetlands is facilitating stormwater treatment, recommendations should be implemented where practicable.

Since the last monitoring, DV confirms that contractors have continued with regular and frequent weed control and maintenance of Wetlands 1 and 3, including rubbish management and water quality monitoring. Biosis recommends continuing with these practices, with the following specific targets and actions.

4.1 Wetland 1

- **Vegetation management**: overabundant emergent vegetation could be reduced by approximately 10-20%, continue to focus on dense stands of Common Reed to improve habitat diversity and light availability, particularly around Farm Road. If practical, supplementary planting of native submerged and floating aquatic plants is recommended in deeper retention basins to enhance habitat suitability. Tree canopy cover adjacent to the wetland should continue to be monitored and ideally maintained below 10% within a 5 to 10 metre buffer zone to prevent excessive shading of the wetland. Ongoing weed control should continue, targeting invasive species such as Chilean Needle-grass and African Fireweed in areas extending west of Wetland 1, minimising off target damage to native vegetation and using 'frog-friendly' weed control products as confirmed with contractors. It is recommended that algal abundance continue to be monitored. Management interventions may be considered in the future if algal growth becomes dominant or adversely affects water quality or overall habitat condition.
- **Rubbish removal and water quality**: Implement regular rubbish removal to maintain water quality and monitor waterbird activity, managing impacts from droppings where feasible.
- **Sediment control:** Ensure sediment and erosion control measures remain effective during nearby construction to protect wetland habitat quality.
- **Water quality monitoring**: Incorporate ongoing water quality data to guide adaptive management actions as required.

4.2 Wetland 2

Monitoring of Wetland 2 will commence when the next wetland monitoring is due in June 2026.

4.3 Wetland 3

- **Vegetation management**: Reduce dense emergent vegetation by 10-20%, especially dense areas in the centre of the wetland, and if practical follow this with supplementary planting of native floating aquatic plants (where water depths are suitable). Continue to monitor the Young Eucalyptus saplings on the eastern and western sides to ensure the canopy cover maintained ideally below 10% to avoid

excessive shading. Continue targeted weed control to keep weed cover low, promptly addressing any newly established invasive species, and use 'frog-friendly' weed control products as confirmed with contractors.

- Bird mortalities: Continue monitoring to determine whether the observed bird mortalities represent isolated incidents or an ongoing issue.
- **Rubbish removal**: Increase rubbish collection frequency around the wetland perimeter, especially near the southwest corner adjacent to the freeway, to reduce pollution and maintain water quality.
- **Water quality monitoring**: Incorporate ongoing water quality data to guide adaptive management actions as required.

References

Biosis Research 2000. *A flora and fauna assessment of Werribee Fields, Werribee, Victoria.* Report to Burns Bridge. Authors: Williams, L. M. & Mueck, S. G. Biosis Research Pty Ltd, Melbourne.

Biosis Research 2006. *Flora and fauna assessment for the proposed Riverwalk residential subdivision, Werribee, Victoria.* Report to VicUrban. Authors: Mueck, S. G. & Gilmore, D. C. Biosis Research Pty Ltd, Melbourne.

Biosis Research 2009. *Flora and fauna assessment for the proposed Riverwalk residential subdivision, Werribee, Victoria.* Report to VicUrban. Authors: Mueck, S., Gilmore, D. & Bloink, C. Biosis Research, Melbourne.

Biosis Research 2010. *VicUrban's Riverwalk Residential Subdivision: Environmental Management Plan.* Report to VicUrban. Authors: Mueck, S. & Costello, C. Biosis Research, Melbourne.

Biosis 2021. *Riverwalk Residential Development: Growling Grass Frog (Litoria raniformis) Wetlands Management Plan (revised)*, Report prepared for Dalton Consulting Engineers Pty Ltd and Development Victoria. Authors: Sofo, K and McCutcheon, C. Biosis Pty Ltd, Melbourne, VIC. Project no. 14485/34929.

Biosis 2025. 'Riverwalk Residential Development: Wetland Condition Monitoring Report 2025',.

DELWP 2017. 'Growling Grass Frog Habitat Design Standards', Victoria Department of Environment, Land, Water and Planning. Melbourne, Victoria. https://www.msa.vic.gov.au/__data/assets/pdf_file/0045/699993/Growling-Grass-Frog-Habitat-Design-Standards.pdf.

DEWHA 2009. 'Background Paper to EPBC Act Policy Statement 3.12 – Nationally Threatened Species and Ecological Communities. Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (Synemon plana)', https://www.dcceew.gov.au/sites/default/files/documents/background-paper-golden-sun-moth.pdf.

DSE 2012. 'National Recovery Plan for the Southern Bell Frog *Litoria raniformis* ', Authors: Clemann N, Gillepie G R, Victorian Government Department of Sustainability and Environment. Melbourne, VIC. https://www.dcceew.gov.au/environment/biodiversity/threatened/recovery-plans/national-recovery-plan-southern-bell-frog-litoria-raniformis.

EPA Victoria 2009. 'Sampling and analysis of waters, wastewaters, soils and wastes', Environmental Protection Authority, Melbourne, VIC. https://www.epa.vic.gov.au/about-epa/publications/iwrg701.

Hamer A, Heard G, Urlus J, Ricciardello J, Schmidt B, Quin D, & Steele W 2015. 'Manipulating wetland hydroperiod to improve occupancy rates by an endangered amphibian: modelling management scenarios', *Journal of Applied Ecology*, 53, 6: 1842–1851.

Heard G & Scroggie M 2009. *Assessing the impacts of urbanisation on Growling Grass Frog metapopulations*, Report prepared for the Victorian Department of Sustainability & Environment. Arthur Rylah Institute for Environmental Research, Heidelberg.

Heard G, Scroggie M, & Clemann N 2010. *Guidelines for managing the endangered Growling Grass Frog in urbanising landscapes*, Report prepared for Arthur Rylah Institute for Environmental Research. Heidelberg, VIC.

Robertson P, Heard G, & Scroggie M 2002. *The ecology and conservation status of the Growling Grass Frog (Litoria raniformis) within the Merri Creek Corridor. Interim report: distribution, abundance and habitat requirements. Wildlife Profiles Pty Ltd and the Arthur Rylah Institute for Environmental Research.*, Wildlife Profiles Pty Ltd and the

Arthur Rylah Institute for Environmental Research. Report to the Department of Natural Resources and Environment, East Melbourne, Victoria.

Appendices

Appendix 1 Wetland condition summary (December 2025)

Table 1 Wetland condition summary from December 2025 monitoring

Parameter	Wetland 1	Wetland 2	Wetland 3
Vegetation cover	**Emergent vegetation**: 100% Mostly Jointed Twig-sedge and Common Reed.	NA	**Emergent vegetation**: 80% Mostly River Club-sedge, Club Rush, and Water Ribbons.
	Submerged aquatic vegetation: 1% Limited visibility due to high turbidity		**Submerged aquatic vegetation**: 1% Limited visibility due to high turbidity
	Floating aquatic vegetation: 1%		**Floating aquatic vegetation**: 1% Mostly Duckweed.
	Fringing vegetation: Fringing terrestrial understorey: 75% Mostly native grasses and sedges to 1 m. Fringing canopy cover: 1%		**Fringing vegetation:** Fringing terrestrial understorey: 45% Mostly native grasses including Kangaroo Grass *Themeda triandra*, Spear Grasses, Common Tussock-grass, and Knobby Club Sedge. Fringing canopy cover: 0%
	Mean vegetation cover: 80%		**Mean vegetation cover**: 80%
Inundation depth	Deeper retention basins variable estimated 1 to 2 m deep. Central drainage line mostly dry with minor depressions holding pools of water approximately 0.2 to 0.3 m deep.	NA	Deeper retention pools maintained approximately 1.5 m. Variable shallow water in connecting areas approximately 0.3 to 0.5 m deep.
Perimeter ground cover	Rock cover: 20%	NA	Rock cover: 5%
	Bare ground cover: 5%		Bare ground cover: 10%

Parameter	Wetland 1	Wetland 2	Wetland 3
Overall condition	Deeper retention pools fully inundated, though central drainage line mostly dry as of December 2025. All vegetation generally in good condition and well established. Control and removal of excess growth of Common Reed would be required to allow for dispersal from the Werribee River, as per Wetlands Management Plan (Biosis 2021). Ongoing rubbish removal required.	N/A	Wetlands fully inundated and species composition and structure well established all generally suitable as potential habitat. Ongoing rubbish removal and management of emergent vegetation cover required.

Appendix 2 Water quality monitoring data

Table 2 Water quality monitoring data collected from Wetland 1 on 16 December 2025

Parameter	Sampling point					Average
	3	4	5	6	7	
Temperature (°C)	18.69	19.33	20.37	19.22	19.67	19.45
pH	7.29	7.03	7.28	7.18	7.32	7.22
Turbidity (NTU)	17.10	53.70	70.80	17.70	12.50	34.36
Electrical conductivity (µS/cm)	110	70	107	78	79	89
Dissolved oxygen (mg/L)	13.09	9.36	8.40	7.73	7.51	9.22
Dissolved oxygen Calc (%)	147.20	104.60	95.70	86.20	84.40	103.62

Table 3 Water quality monitoring data collected from Wetland 3 on 16 December 2025

Parameter	Sampling point		Average
	1	2	
Temperature (°C)	17.24	16.72	16.83
pH	7.12	7.02	7.07
Turbidity (NTU)	7.90	8.60	8.25
Electrical conductivity (µS/cm)	94	115	105
Dissolved oxygen (mg/L)	7.94	7.68	7.81
Dissolved oxygen Calc (%)	85.20	81.00	83.1

Table 4 Water quality monitoring data (18/12/2025) for Werribee River – River D/S Outfall Under Freeway.

Analysis	Units	Result
Temp (Field) - Temperature (Field)	°C	19.5
pH (Field) - pH (Field)	Units	7.7
EC (Field) - Electrical Conductivity (Field)	uS/cm	2600
DO (Field) - Dissolved Oxygen (Field)	mg/L	7.63
DO (Field) - Dissolved oxygen Calc (Field)	%	83.5
Turbidity (Field) - Turbidity (Field)	NTU	1
NO3 as N (SFA) - Nitrate, as N	mg N / L	1.2
NO2 as N (SFA) - Nitrite, as N	mg N / L	0.024
NH3 as N (LL) - Ammonia, as N	mg N / L	<0.002
Reactive P (LL-F) - Phosphorus, reactive as P (Filt.)	mg P / L	0.009
TN/TP (LL) - Total Nitrogen, as N	mg N / L	2.0
TN/TP (LL) - Phosphorus, total as P	mg P / L	0.046
TKN (Calc) - TKN (via Calculation)	mg/L	0.72
SS at 104+/- 2°C - Suspended Solids	mg/L	<2
MS Total Metals - Arsenic	mg/L	0.001
MS Total Metals - Cadmium	mg/L	<0.0002
MS Total Metals - Chromium	mg/L	<0.001
MS Total Metals - Copper	mg/L	<0.001
MS Total Metals - Lead	mg/L	<0.001
MS Total Metals - Nickel	mg/L	0.002
MS Total Metals - Zinc	mg/L	0.005
Colilert (2000) - E.coli	MPN/100mL	210

Appendix 3 Flora species recorded

Table 5 Flora species recorded during December 2025

Status*	Scientific name	Common name
Indigenous species		
	Atriplex semibaccata	Berry Saltbush
	Atriplex suberecta	Sprawling Saltbush
	Austrostipa spp.	Spear Grass
	Azolla rubra	Pacific Azolla
	Bolboschoenus spp.	Club Sedge
	Bursaria spinosa	Sweet Bursaria
	Carex tereticaulis	Poong'ort
	Crassula helmsii	Swamp Crassula
	Cycnogeton procerum s.s.	Common Water-ribbons
	Cyperus lucidus	Leafy Flat-sedge
	Dianella spp.	Flax Lily
	Einadia nutans	Nodding Saltbush
	Eleocharis acuta	Common Spike-sedge
	Epilobium hirtigerum	Hairy Willow-herb
	Eucalyptus spp.	Eucalypt
	Ficinia nodosa	Knobby Club-sedge
	Hardenbergia violacea	Purple Coral-pea
	Juncus spp.	Rush
	Lachnagrostis filiformis s.s.	Common Blown-grass
	Laphangium luteoalbum	Jersey Cudweed
	Lomandra longifolia	Spiny-headed Mat-rush
	Lythrum hyssopifolia	Small Loosestrife
	Machaerina articulata	Jointed Twig-sedge

Status*	Scientific name	Common name
	Oxalis spp.	Wood Sorrel
	Persicaria decipiens	Slender Knotweed
	Persicaria hydropiper	Water Pepper
	Poa labillardierei	Common Tussock-grass
	Rytidosperma spp.	Wallaby Grass
	Schoenoplectus tabernaemontani	River Club-sedge
	Senecio quadridentatus	Cotton Fireweed
	Themeda triandra	Kangaroo Grass
	Typha spp.	Bulrush
Introduced species		
	Avena spp.	Oat
	Brassica fruticulosa	Twiggy Turnip
	Bromus hordeaceus	Soft Brome
	Callitriche stagnalis	Common Water-starwort
	Capsella bursa-pastoris	Shepherd's Purse
	Cenchrus clandestinus	Kikuyu
	Centaurium tenuiflorum	Slender Centaury
RC	*Cynara cardunculus* subsp. *flavescens*	Artichoke Thistle
	Cyperus eragrostis	Drain Flat-sedge
	Epilobium ciliatum	Glandular Willow-herb
	Euphorbia peplus	Petty Spurge
	Euphorbia serpens	Matted Sandmat
	Festuca arundinacea	Tall Fescue
	Fumaria indica	Indian Fumitory
	Lactuca serriola	Prickly Lettuce
	Lolium rigidum	Wimmera Rye-grass
	Malva nicaeensis	Mallow of Nice

Status*	Scientific name	Common name
RC	*Nassella neesiana*	Chilean Needle-grass
	Plantago lanceolata	Ribwort
	Polygonum aviculare s.s.	Hogweed
	Polypogon monspeliensis	Annual Beard-grass
	Pyrus communis	Pear
	Rumex conglomeratus	Clustered Dock
	Rumex crispus	Curled Dock
RC	*Senecio madagascariensis*	African Fireweed
	Senecio vulgaris	Common Groundsel
	Sonchus oleraceus	Common Sow-thistle
	Stachys arvensis	Stagger Weed
	Symphyotrichum subulatum	Aster-weed
	Vicia hirsuta	Tiny Vetch

*RC = Regionally controlled species (Victorian *Catchment and Land Protection Act 1994* (CaLP Act))

Appendix 4 Site photos

Wetland 1

Photo 1 **Western extend of Wetland 1 showing deeper retention basin surrounded by abundant emergent vegetation and suitable rocky refuge. Photo taken 16 December 2025, facing approximately east.**

Photo 2 **Western extend of Wetland 1 near Farm Road, showing areas of bare ground and sediment control. Photo taken on 16 December 2025, facing approximately south-west.**

Photo 3 **Section of Wetland 1 immediately east of District Avenue, showing presence of algal blooms. Photo taken on 16 December 2025, facing approximately south-east.**

Wetland 3

Photo 4 **Wetland 3 showing presence of floating vegetation and overabundance of emergent vegetation, Princess Freeway in background. Photo taken 16 December 2025, facing approximately south-east.**

Photo 5 **Example of large, embedded rocks with minimal microhabitat availability for predator avoidance. Photo taken on 16 December 2025, facing approximately south-east.**

Photo 6 **Example of netted Water Ribbons plantings with surrounding emergent vegetation, Princess Freeway in background. Photo taken 16 December 2025, facing approximately south-east.**


biosis
APEM Group