AQUATICA ENVIRONMENTAL

Australian Grayling *Prototroctes maraena* Targeted Survey

South Gippsland Highway Realignment Koonwarra, Victoria

Report prepared for VicRoads

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AQUATIC ECOSYSTEM & ENVIRONMENTAL MANAGEMENT CONSULTING

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Cover photograph: Australian Graying from Tarwin River (A. Jenkin)

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1. Introduction

1.1 Project background

VicRoads is in the planning stage of a proposed 3.4 kilometre realignment of the South Gippsland Highway south of Koonwarra Victoria (Figure 1). A previous ecological assessment, undertaken as part of this project, acknowledged that Australian Grayling *Prototroctes maraena* were known to occur in the Tarwin River system (Indigenous Design 2017). Further, the assessment determined there was a moderate to high likelihood the species was present and/or utilised reaches of the Tarwin River in proximity to the project area.

VicRoads subsequently submitted a referral to the Federal Minister under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) dated 13 October 2017. The referral summarised that the 'action' was not a controlled action (referring only to Australian Grayling) as:

> "*No works are proposed to be undertaken within the bed and banks of the Tarwin River that will provide a barrier to fish migration and with the implementation of construction environmental plan(s) and controls to minimise sedimentation and erosion impacts to the Tarwin River, impacts to the Australian Grayling are considered to be negligible.*"

On 9 January 2018 the Federal Minister decided that the proposed action was a controlled action, and that it would be assessed by preliminary documentation. As a component of preparing the preliminary documentation, Aquatica Environmental undertook a targeted survey for Australian Grayling in the vicinity of the project area. This report outlines the findings of that survey.

1.2 Study Area

The study area (Figure 1) is located approximately 0.5 kilometres south of Koonwarra, 4.5 kilometres north of Meeniyan and approximately 120 kilometres southeast of Melbourne, Victoria. The Tarwin River West Branch transects the study area and proposed road alignment at two locations including once near its confluence with Blackspur Creek.

The main river channel is relatively narrow (circa 10 metres) and incised, however the wider floodplain through the study area is prone to flooding and inundation, during times of higher rainfall and the river can flow up to several hundred metres wide.

The predominant land uses surrounding the study area are agricultural (mostly cattle), small-scale hobby farm, rural residential, and the South Gippsland Rail Trail recreational reserve occurs through the study area. The majority of native vegetation has been cleared, although remnants still remain in and around the study area, particularly along the Tarwin River West Branch, Blackspur Creek and along the South Gippsland Highway and South Gippsland Rail Trail.

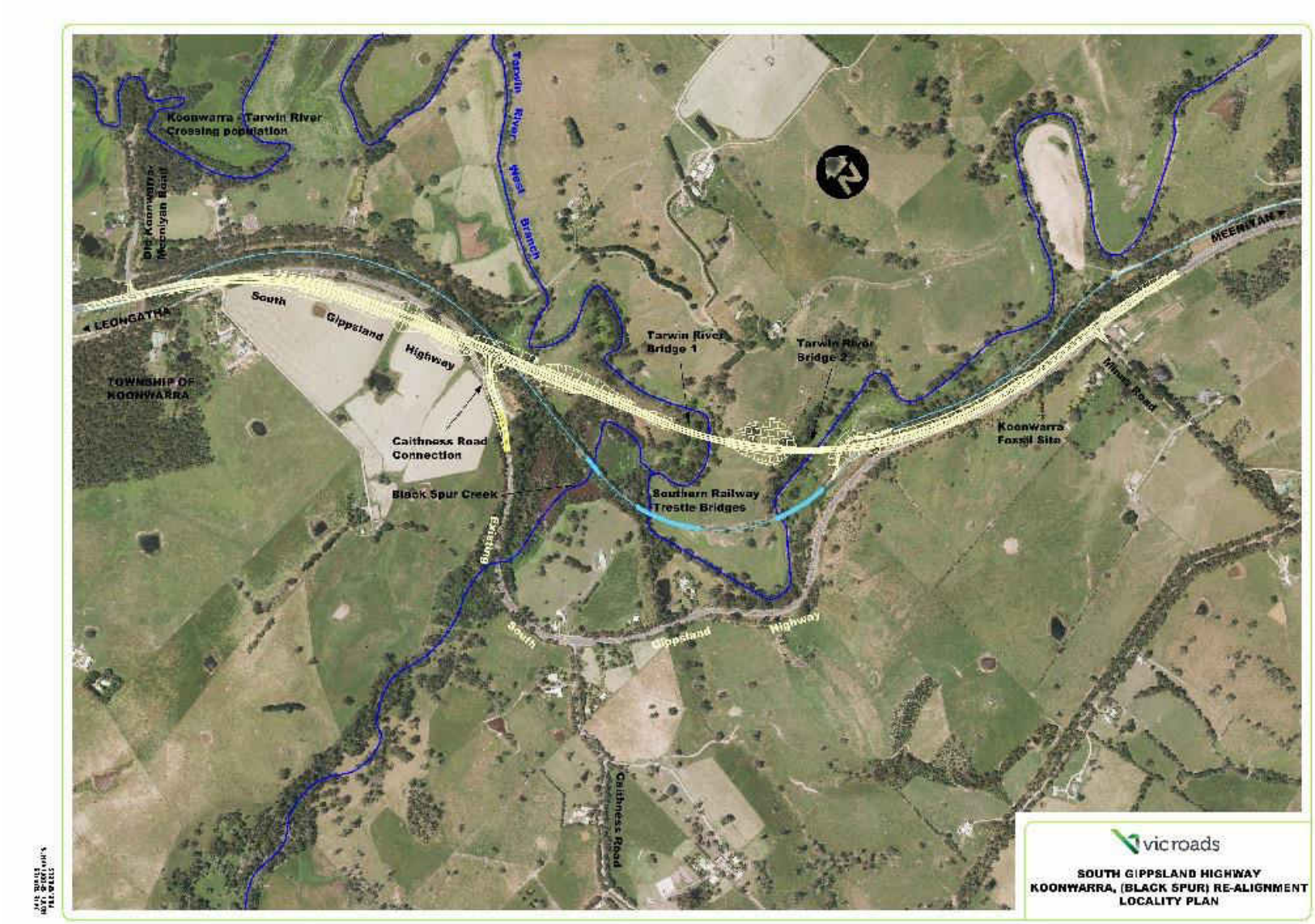

Figure 1 Project area (Source: VicRoads)

1.3 Objectives

The key objectives of this survey were to:

- Undertake a targeted survey to assess the habitat condition/s for and presence of Australian Grayling;
- Assess the potential impacts and significance of impacts of the proposed realignment project on Australian Grayling and/or their habitat; and
- Develop measures sufficient to manage and mitigate the identified impacts to the species.

1.4 Acknowledgments

We would like to acknowledge and thank the following people:

- Chris Bloink and Katie Stevenson (Ecology Australia) for the provision of their boat and bank electrofishing services and assistance during the survey.
- Tarmo Raadik (DELWP/ARI) for information on Australian Grayling in the study area

2. Species Description

The Australian Grayling is a small to medium-sized, slender, silvery fish with soft-rayed fins lacking any spines growing commonly to between 17-19 cm, but up to 33cm. A sexually dimorphic fish, the majority of its life is spent in freshwater, however, at least some of its larval and juvenile stage is spent in coastal seas (Backhouse et al. 2008).

The species is most commonly associated with cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones. In the Tarwin River system they have also been associated with muddy-bottomed, heavily silted habitat (Jackson 1980; and as observed during this survey).

Spawning occurs in freshwater environments between February and May, depending on location, and is generally accepted to be triggered by an increase in the volume and flow rate of streams, possibly combined with a decrease in water temperature (Backhouse et al. 2008). The exact timing is dependent on location and annual conditions and although specific information was identified on the seasonal timing of Australian Grayling in the Tarwin River and its tributaries, water temperature taken as part of the Victorian WaterWatch program between 2014-2016 indicate the Tarwin River West branch experiences a regular seasonal water temperature drop in about April each year (Figure 2).

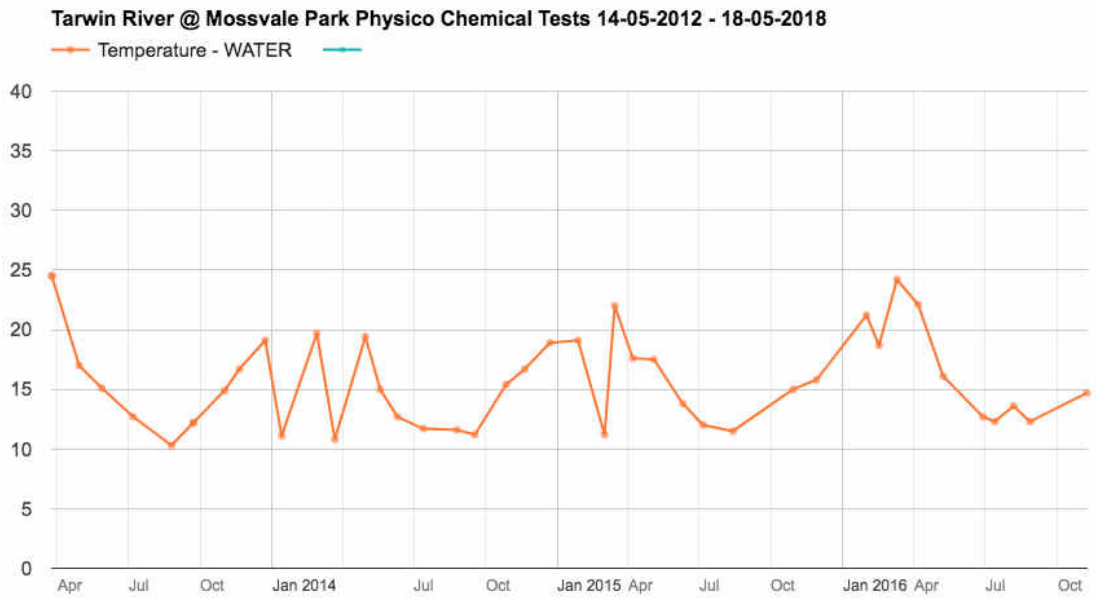

Figure 2 Tarwin River West Branch water temperature at Mossvale Park (Source: http://www.vic.waterwatch.org.au/site/211764)

Upon hatching larvae are swept downstream into estuarine areas where they disperse in the marine environment until approximately six months of age. Juveniles then migrate back into freshwater in about November, where they remain for the remainder of their lifecycle (Backhouse et al. 2008). It is believed that most adults die after their second year, usually after only having spawned for a single season, with a small percentage of the population living for four to five years (Backhouse et al. 2008).

2.1 Distribution

The species is known from coastal rivers and creeks with permanent or intermittent connection to the sea, south and east of the Great Dividing Range (McDowall 1996). The

Tarwin River is listed as an 'important river for Australian Grayling, in the species' recovery plan (Backhouse et al. 2008) and there are historical records from Meeniyan (mostly upstream) to tributaries north of Hallston and Childers (Figure 2; DELWP 2018).

2.2 Status

2.2.1 Legislative Status

Australian Grayling is listed as 'Vulnerable' under the EPBC Act, in the National Recovery Plan (Backhouse et al. 2008), on the Advisory List for Threatened Vertebrate Fauna in Victoria (DSE 2013) and is listed as a threatened species under the *Flora and Fauna Guarantee Act 1988* (FFG Act). Australian Grayling is also listed as 'Near Threatened' on the International Union for the Conservation of Nature Red List of Threatened Species (IUCN 2016).

2.2.2 Regional Status

The VBA (DELWP 2018) returned a large number of historical records of Australian Grayling, mostly in the upper reaches of the Tarwin River West Branch and its tributaries and ranging between 1972 to 2007 (Figure 2; noting the three pink records were from this survey).

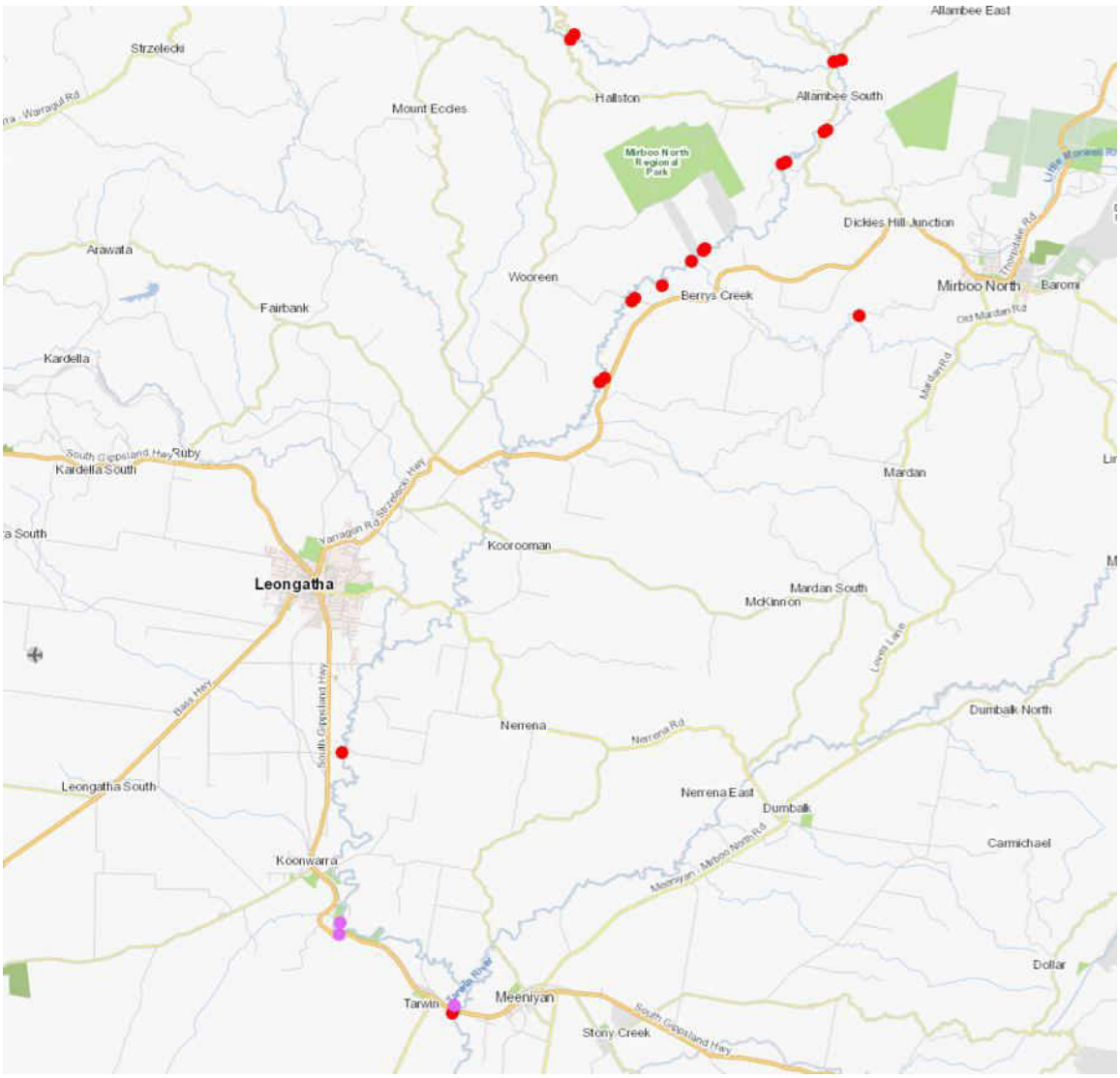

Figure 3 VBA records of Australian Graying (red dots) and the records obtained during this survey (pink dots) (Source: DELWP 2018)

2.3 Key Threats

Key threats to Australian Grayling include (DoE 2018; Backhouse et al. 2008):

- Habitat destruction and degradation;
- Barriers to fish movement/migration;
- River regulation;
- Poor water quality;
- Siltation;
- Introduced fish;
- Climate change;
- Disease; and
- Recreational fishing.

3. Methodology

3.1 Desktop Review

A review of available information was undertaken to provide context to the targeted survey. Sources of information referred to during the desktop review included:

- The Victorian Biodiversity Atlas (DELWP 20018);
- The previous High Risk-Based Pathway Biodiversity Assessment undertaken for the project, that included reference to Australian Grayling (Indigenous Design 2017);
- Targeted Grayling survey undertaken in Blackspur and Gwyther Creeks in 2000 (Ecology Australia 2000); and
- Communications with fish specialists at Department of Environment, Land, Water and Planning's (DELWP) Arthur Rylah Institute (ARI).

3.2 Sampling Sites

Ten sties were investigated during the survey including two in Blackspur Creek (which were not sampled as they were dry), seven in the Tarwin River West Branch and one in the Tarwin River (Figure 4). The eight sampling sites were selected based on the presence of habitat characteristics that would potentially suit Australian Grayling and stream access (noting much of the main channel was very steep banked and chocked with logjams).

Table 1 outlines the sites, their location and brief description.

Table 1 Sampling sites

Site	Waterway	Coordinates (Lat/Long)	Nearest River Distance to Realignment	Notes
BSC1	Blackspur Creek	38°33'29.33"S 145°57'1.91"E	400 m	Dry
BSC2		38°33'29.85"S 145°57'15.04"E	100 m	Dry
TRWB1	Tarwin River West Branch	38°33'1.67"S 145°57'26.37"E	1.9 km	Upstream of Buckingham and Fowlers Road
TRWB2		38°33'3.55"S 145°57'42.19"E	1.5 km	Upstream of Buckingham and Fowlers Road
TRWB3		38°33'15.50"S 145°57'27.56"E	1 km	Upstream of Buckingham and Fowlers Road
TRWB4		38°33'20.94"S 145°57'20.35"E	750 m	Downstream of River crossing of Buckingham and Fowlers Road
TRWB5		38°33'36.79"S 145°57'23.06"E	In the realignment	In upstream realignment crossing of the river
TRWB6		38°33'45.47"S 145°57'21.08"E	900 m	Between the two realignment crossings of the river
TRWB7		38°33'47.46"S 145°58'5.32"E	2.5 km	River 'dogleg' accessed across rail trail opposite Minns Road
TR1	Tarwin River	38°34'52.85"S 145°59'30.56"E	8.5 km	Under highway bridge, upstream of fish ladder

3.3 Fish Sampling

The targeted Australian Grayling survey was undertaken over three days and two nights on 25th to 27th April 2018. Sampling was undertaken at eight sites, including seven on the Tarwin River West Branch and one on the Tarwin River (Figure 4).

The fish survey methods used aligned with the Australian Grayling survey protocols outlined in the Survey Guidelines for Australia's Threatened Fish (DSEWPaC 2004) and included boat, bank and backpack electrofishers. Electrofishing is the preferred capture method, however, at some sites, where electrofishing was not able to be deployed, overnight fyke nets and bait traps were set and dip-netting was undertaken. It is acknowledged these are not ideal methods for capturing Australian Grayling.

The method/s deployed at each site are outlined in Table 2.

Table 2 Sampling method/s and total sampling effort deployed at each sampling site

Site	Boat Electrofisher (electro on time)	Bank Electrofisher (electro on time)	Backpack Electrofisher (electro on time)	Fyke Nets (set hours)	Bait Traps (set hours)
TRWB1	-	-	-	36 hours	72 hours
TRWB2	-	515 seconds	-	-	-
TRWB3	-	-	415 seconds	18 hours	72 hours
TRWB4	-	-	-	20 hours	80 hours
TRWB5	-	494 seconds	-	-	-
TRWB6	-	541 seconds	-	-	-
TRWB7	-	-	350 seconds	17 hours	68 hours
TR1	603 seconds	-	-	-	-
Total Effort	**603 seconds**	**1,550 seconds**	**765 seconds**	**91 hours**	**292 hours**

At each site reference photographs were also collected (Appendix B).

Backpack electrofishing and netting/trapping was conducted in accordance with Aquatica Environmental's Wildlife and Small Institutions Animal Ethics Committee (WSIAEC) approval (28.14), FFG Act and Wildlife Act 1975 research permit (No. 10007600) and Fisheries Act 1995 research permit (No. RP1213).

Boat and bank electrofishing, was conducted in accordance with Ecology Australia's WSIAEC approval (11.16), FFG Act research permit (10007806), Fisheries Act research permit (1142) and Scientific Fieldwork Procedures License (20097).

3.4 Water Quality Monitoring

In situ water quality was recorded at each sampling site using a calibrated TPS-90FLT water quality logger. The following water quality parameters were recorded:

- pH (pH units);
- Electrical conductivity (µS/cm);
- Dissolved oxygen (ppm)
- Oxygen saturation (% sat.);
- Turbidity (NTU);
- Temperature (°C).

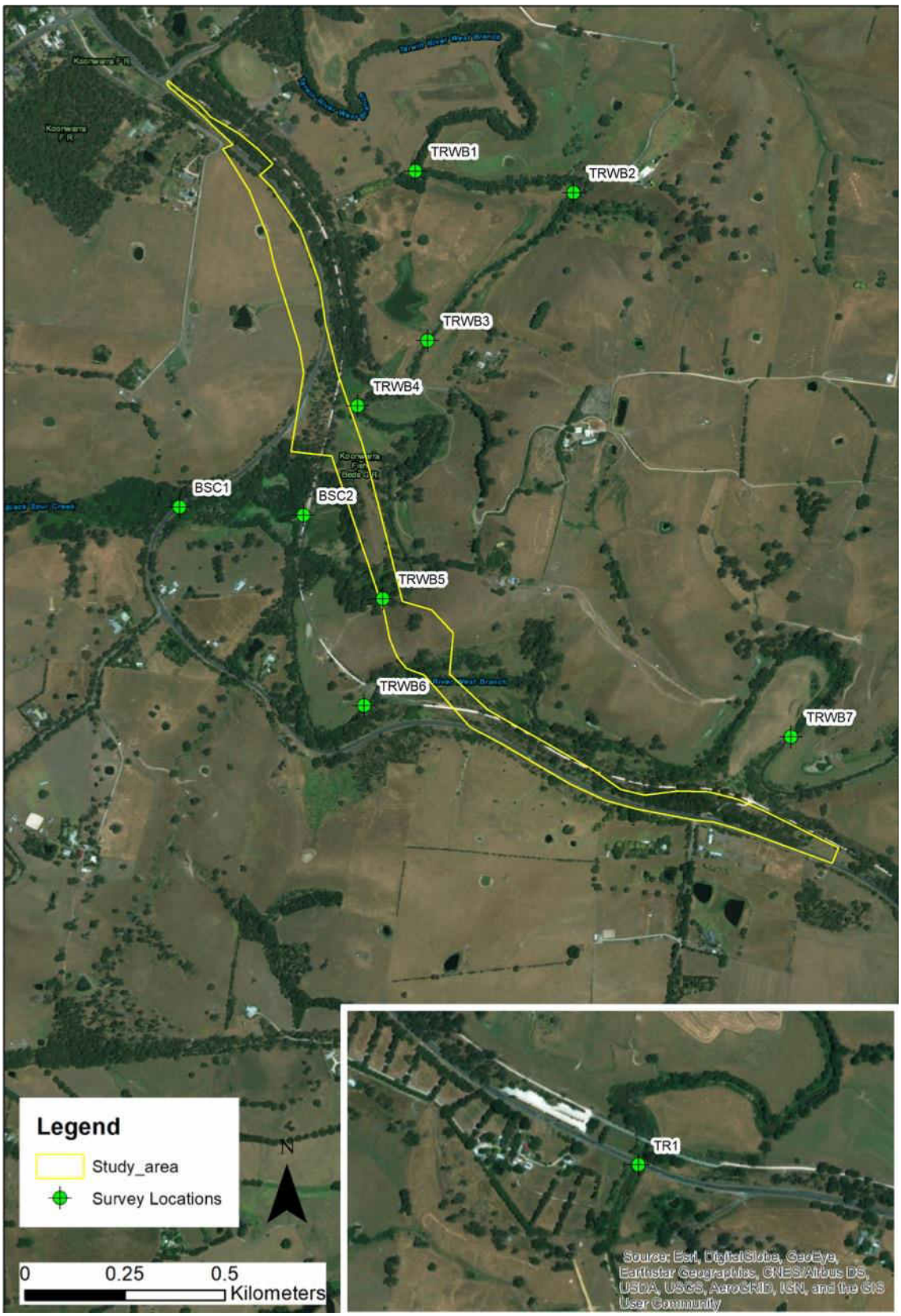

Figure 4 Survey sites

4. Results

4.1 Desktop Review

The desktop review identified that Australian Grayling have historically been recorded in the Tarwin River West Branch, with the nearest record being from 2007, approximately 4.5 km upstream of Koonwarra (see also Figure 2).

Previous surveys of Blackspur Creek (Ecology Australia 2000 and T. Raadik 2018, pers com, 6 April) failed to detect Australian Grayling. The 2000 Ecology Australia report summarised that:

> *"Blackspur Creek did not support any native fish for national or State significance".*

Researchers from DELWP's ARI, who have also surveyed Blackspur Creek suggested that the ephemeral stream is not commonly used by Australian Grayling, and if there were any impacts on the species in Blackspur Creek, they could probably move downstream back into the Tarwin, or recruit again easily from the Tarwin (T. Raadik 2018, pers com, 6 April).

4.2 Targeted Survey

The targeted survey recorded three Australian Grayling (Table 3). One each were caught at sites TRWB5 and TRWB6 (within the project area) and one in the Tarwin River downstream of the confluence with the Tarwin River West Branch (site TR1). The two upstream specimens were young of the previous year (89mm, 5.9 and 7.0g, <1 year old, Plate 1) and the specimen in the Tarwin River was assessed as a two year old (144mm, 34.6g, circa 2 year old, Plate 2).

Other aquatic species recorded during the survey included:

- Australian Smelt *Retropinna semoni*;
- Common Galaxias *Galaxias maculatus*;
- European Carp *Cyprinus carpio*;
- Longfinned Eel *Anguilla reinhardtii*;
- Southern Shortfinned Eel *Anguilla australis*;
- Tupong or Colongi *Pseudaphritis urvillii*;
- Freshwater shrimp *Paratya sp.*; and
- Victorian Smooth Froglet *Geocrinia Victoriana* (heard only, in the wider project area).

Table 3 Results of the targeted Australian Grayling survey

Site	Waterway	Sampling methods Used	Species Recorded
BSC1	Blackspur Creek	None (dry)	None
BSC2		None (dry)	None
TRWB1	Tarwin River	Fyke net, bait trap and dip-net	Common Galaxias (2)

Site	Waterway	Sampling methods Used	Species Recorded
TRWB2	West Branch	Bank electro	European Carp (1) Southern Shortfin Eel (6) Australian Smelt (3) Common Galaxias (34) Tupong (4)
TRWB3		Fyke net, bait trap and dip-net	Australian Smelt (1) Common Galaxias (11)
TRWB4		Fyke net and bait trap	Australian Smelt (1) Common Galaxias (20)
TRWB5		Bank electro	**Australian Grayling (1)** Southern Shortfin Eel (20) Australian Smelt (4) Common Galaxias (13) Tupong (4)
TRWB6		Bank electro	**Australian Grayling (1)** European Carp (1) Southern Shortfin Eel (2) Australian Smelt (6) Common Galaxias (8)
TRWB7		Fyke net, bait trap and backpack electro	European Carp (2) Southern Shortfin Eel (2) Longfinned Eel (2) Common Galaxias (11)
TR1	Tarwin River	Boat electro	**Australian Grayling (1)** European Carp (1) Southern Shortfin Eel (9) Australian Smelt (17) Common Galaxias (6)

Plate 1 Australian Grayling from Site TRWB5 (A. Jenkin)

Plate 2 Australian Grayling from Site TR1 (A. Jenkin)

4.3 Water Quality

The results of the in situ water quality monitoring are provided in Appendix A and indicate that water quality at the time of the survey was well within the tolerances for Australian Grayling and within the range expected of a relatively healthy river system.

As an aside, the subject reach of the Tarwin River West Branch (Basin 27, reach 11) was assessed as in overall 'moderate' condition based on the Index of Stream Condition (ISC) assessment (DEPI 2010).

4.4 Overall Survey Finding/s

Based on the desktop review, discussions with DELWP/ARI and targeted survey, the results indicate the reaches of the Tarwin River West Branch at, and in the vicinity of the project area provide both permanent/resident and transient/migration habitat for Australian Grayling.

Habitat in the immediate vicinity of the proposed new bridge locations includes the range of requirements needed to support a resident population (e.g. alternating pools and riffles, instream snags, good water quality, etc.). The large number of historical upstream records, 2-year old specimen recorded downstream and 1-year old specimens recorded in the project area during this survey also indicated that Australian Grayling must at times, migrate through the project area. Combined, the desktop, habitat and survey results indicate that Australian Grayling are likely both residing and migrating through the project area as part of their annual migrations.

Based on these findings the project and proposed works should proceed on the assumption that Australian Grayling are permanently present in the reaches of the river that occur in the vicinity of the project area.

5. Potential Impacts

The proposed South Gippsland Highway realignment will cross the Tarwin River West Branch at two locations (see Figure 1 and Appendix C). The current design include the construction of two permanent bridges and one temporary crossing (single span). Placement of the permanent bridge pylons will require no earthworks or structures, and no vegetation removal directly in the river channel. Some earthworks and mitigation structures (i.e. sediment fencing and bunding) may be required near the top of the channel.

The assessment of potential impacts and mitigation measures (Section 6) are based on the assumption that no direct 'instream' impacts are anticipated to Australian Grayling and/or their habitat, and that potential impacts could only occur through indirect means.

Table 4 outlines the potential indirect impacts that have been identified for the project.

Table 4 Potential impacts

Impact	Impact Description
Timing of construction may impact breeding / spawning of threatened species	As no works or structures are proposed for in the channel, no significant impacts are expected to occur that would then impact upon fish behaviour or passage. In the instance of any channel-side works that may cause fish to scare, the fish would likely depart the area for the period of the disturbance to continue their breeding/spawning/migration activity elsewhere up/downstream. As Australian Grayling larvae are light sensitive, preferring shade/sheltered habitats, any earth/structural works that occur between dusk to dawn, under artificial lighting, may impact upon fish migration.
Sedimentation of river during construction and post works	Sedimentation/siltation, and subsequently reduced water quality are recognised as key threats to Australian Grayling (DoE 2018; Backhouse et al. 2008). Sediment could be discharged into the river during earthworks in the floodplain such as vegetation removal and installation/construction of piers, piles, earthworks, etc. Higher rainfall and flow events during works (i.e. that raise above the channel and into the floodplain), have the potential to disturb project sediments further afield and impact upon surface water quality in areas of Australian Grayling habitat both at and downstream of the project area.
Removal of riparian vegetation	Although no riparian vegetation clearing will occur in the channel, clearing may need to occur in the floodplain. Removal of floodplain riparian vegetation (where present) may result in a reduction in aquatic habitat quality (reduced cover/shading) and may contribute to the cumulative reduction in the river's overall condition.
Unmanaged disturbance to river banks	Although works are not proposed to occur in the channel, works at the top of the channel, may encroach on the upper river bank (e.g. work buffer zones, fencing, etc.). If not appropriately protected/fenced, these works have the potential to result in unmanaged disturbance to the river bank.

Impact	Impact Description
Contamination of waterway	Reduced water quality is recognised as a key threat to Australian Grayling (DoE 2018; Backhouse et al. 2008). Spills of fuels, oils and other construction-related contaminants are possible during works and have the potential to impact water and habitat quality in the river and its downstream receiving waterways.
Reduced downstream water quality	Construction poses a risk to water quality through the removal of vegetation, suspension of sediments or the release of pollutants into the waterways. This has the potential to impact both immediate and downstream aquatic habitat areas and downstream receiving waterways. The operational phase of the project (i.e. post construction) also presents possible threats to water quality through erosion while the site is re-established and/or due to vehicle/road use related pollutants once in operation (e.g. oils/fuels in stormwater, litter, etc.).
Alteration to 'natural' flow/hydrological regime	As no works or structures are proposed for in the channel, no impacts are expected to occur that alter the river's natural flow during normal flow scenarios (i.e. flow within the main river channel). Depending on timing and flows at the time of work, the project may temporarily impact on the natural 'flooding' flow of the waterway through the project area during higher flow events (e.g. those flow events where water levels rise to inundate the floodplain). The installation of bunding, cofferdams and other floodplain structures may prevent natural flows and/or cause the flows to take another path.
Incursion by weeds	A wide range of common weed species are present in the project area including blackberry and willow. Works in the project area and/or insufficient/inappropriate rehabilitation of works areas have the potential to allow further inclusion of weeds if not managed appropriately.

6. Avoidance and Mitigation Measures

As no works or vegetation clearing are proposed to occur within the river channel and any impacts to Australian Grayling are considered to be of an indirect nature, no 'species specific' conservation/environmental management plan is deemed necessary or proposed to be developed. The following avoidance and mitigation measures are provided to reduce possible indirect impacts to river condition, water quality, fish habitat and fish behavior and should be incorporated into the contractor's Environmental Manage Plan(s) (EMP):

Design / Pre-construction Phase

- Design the new South Gippsland Highway alignment, two permeant bridges, one temporary bridge, any associated temporary structures and works area/s to have the smallest footprint possible.
- Water Sensitive Road Design is to be applied to the design of the new alignment and bridges.
- Bridge design (permanent bridges) should include provision of systems to prevent discharge and/or treat or pre-filter stormwater runoff and/or spills to prevent the risk of contributing pollutants to the river.
- Water quality monitoring should be undertaken to collect baseline data at monitoring sites:
    - Upstream and downstream of the limits of the project area; and
    - At appropriate locations in the waterway within the project including immediately upstream and downstream of each point source (or flow) entering along the length of waterways within the project area.
- Baseline water quality data should be collected weekly for at least one month (four weekly samples) prior to the commencement of project area establishment and should include those parameters outlined in Table 5.

Table 5 Water quality monitoring parameters and methods (Source: VicRoads)

Parameter	Unit of Measure	Method
Turbidity – NTU	NTU	Measure with on-site meter
Electrical Conductivity (EC) – µS/cm	µS/cm	Measure with on-site meter
pH	pH units	Measure with on-site meter
Dissolved oxygen (DO) – mg/L	mg/L	Measure with on-site meter
Temperature -	°C	Measure with on-site meter
Litter (definition, including solid inert waste)	Visual (prevent litter from entering waterways and drainage systems)	
Oils and Greases	Visual (No visible free oil or greases)	
Rainfall	Mm per day	Measure with on-site meter capable of logging rainfall at a minimal interval of 10 minutes

Construction Phase

- Stage construction so that earthworks in the floodplain, for the temporary and permanent bridges, are undertaken and completed (i.e. stabilised and/or reinstated) outside of the key breeding/spawning and migration periods for Australian Grayling and during the historically lower rainfall time of the year (i.e. between December to March based on average annual rainfall at Leongatha, source: BOM 2018).
- Any earthworks within five metres of the river channel will require a task-specific EMP that includes the installation of exclusion fencing for No-Go Zones (NGZ) and sedimentation controls.
- Protect aquatic and river habitat (i.e. 5m buffer from river channel) through minimising the construction footprint and installing NGZ exclusion and sediment fencing.
- All soil, spoil, top dressing, fuel/oil and machinery are to be stored above the 1:100-year flood level (i.e. outside of the floodplain) and in a suitably bunded and protected location.
- Any Construction works that occur on the river's floodplain shall include emergency measures within the Contractor's EMP to protect earthworks and works areas from inundation and/or protocols for site closure for predicted higher rainfall and river flow events.
- The contractor's EMP should include provision for weather and river condition monitoring using data from the Bureau of Meteorology and/or West Gippsland Catchment Management Authority.
- Measures should be implemented to contain and filter any onsite surface water before release to the river. Water discharged from the site should be monitored and meet the relevant 'Cleared Hills and Coastal Plains' objectives of the State Environmental Protection Policy (Water of Victoria) (EPA 2003).
- For any temporary structure, erosion and sediment controls are to be in place to minimise the amount of erodible surfaces during construction.
- Reinstate and re-establish works areas/vegetation immediately after completion of temporary or permanent works.
- Water quality and rainfall monitoring should be undertaken to monitor for river impacts during construction and include the parameters outlined in Table 5. Monitoring sites should be those established for the baseline data and include the same parameters. Water quality should be collected at the following frequencies:
    - Prior to work commencing (see Design / Pre-construction Phase and Table 5);
    - Weekly during construction;
    - For rain events during working hours - within one hour of rain event commencement and every four hours during continuous rain; and
    - For rain events outside of work hours - within 12 hours hour of rain event commencement and every four hours during continuous rain.
- Ensure the contractor's EMP includes provision for emergency response/s in the event of an incident that impacts water quality or aquatic habitat (e.g. a spill of sediment release).

Post Construction/Operational Phase

- Undertake monitoring of any floodplain rehabilitation works for a minimum of two years post completion of construction/project area reinstatement to ensure floodplain and works area(s) revegetation is successful and erosion is not occurring. Monitoring should include assessment of revegetation and weeds, erosion and river bank stability.

Given that no works are intended to occur in the river channel and there will be no direct impacts to Australian Grayling, no further monitoring of the species is recommended. Should a major incident occur during pre, during or post construction phases (e.g. major flood, land slip, spill, etc.), a monitoring program must be designed, in conjunction with the relevant authorities (e.g. DELWP, Fisheries, etc.) and implemented to assess the level of impact to Australian Grayling.

7. Significant Impact Assessment

Table 6 below provided a revised assessment of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) significant impact assessment previously undertaken as part of the High Risk-Based Pathway Biodiversity Assessment (Indigenous Design) incorporating this report's more recent findings.

Table 6 Significant impact assessment

Significant Impact Criteria	Risk to MNES without mitigation measures	Likelihood of a Significant impact (with no mitigation measures implemented)	Specific Mitigation Measure(s)	Residual Risk to MNES with mitigation measures applied	Likelihood of a Significant impact (with mitigation measures implemented)
Lead to a long term decrease in the size of an important population	The Tarwin River has been identified as an important river location for the long term survival and recovery of this species and the species is present in the vicinity of the project area. No works are planned within the channel but indirect risks (also key threats to the species) include siltation and reduced water quality.	**MODERATE**	No works will occur within the river channel. Earthworks in the floodplain will occur outside the key breeding/migration season for Australian Grayling and include installation of exclusion fencing and sedimentation controls. The contractor's EMP will include sedimentation controls, silt fencing and bunting will be employed to reduce any potential for water quality or sedimentation issues affecting the Tarwin River. There will be no direct discharge of road/bridge stormwater/spills to the river. Water Sensitive Road Design will be applied to the design No Go Zones will be established to minimise riparian vegetation loss. A Working on Waterways Permit is required from the West Gippsland Catchment Authority before construction of the two Tarwin River bridge crossings and any temporary access points can begin.	Low	**LOW**

Significant Impact Criteria	Risk to MNES without mitigation measures	Likelihood of a Significant impact (with no mitigation measures implemented)	Specific Mitigation Measure(s)	Residual Risk to MNES with mitigation measures applied	Likelihood of a Significant impact (with mitigation measures implemented)
Reduce the area of occupancy of an important population	No works to occur in the channel and no loss of aquatic habitat. The construction of two Tarwin River crossings will not physically reduce the area of occupancy for the Australian Grayling.	**LOW**	N/A	N/A	**LOW**
Fragment an existing important population into two or more populations	No works to occur in the channel and no loss of aquatic habitat.	**LOW**	N/A	Low	**LOW**
Adversely affect habitat critical to the survival of a species	No works to occur in the channel and no loss of aquatic habitat.	**LOW**	N/A	Low	**LOW**
Disrupt the breeding cycle of an important population	Possible minor and temporary impacts to upstream migrating larvae, which are light sensitive, if structural works over channel require artificial lighting.	**LOW**	No night work is to be undertaken for any works at/over the river channel during the key breeding period (i.e. no artificial lighting).	Low	**LOW**

Significant Impact Criteria	Risk to MNES without mitigation measures	Likelihood of a Significant impact (with no mitigation measures implemented)	Specific Mitigation Measure(s)	Residual Risk to MNES with mitigation measures applied	Likelihood of a Significant impact (with mitigation measures implemented)
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No works to occur in the channel and no loss of aquatic habitat.	**LOW**	N/A	N/A	**LOW**
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The disturbances associated with the proposal are unlikely to result in the further establishment of invasive pest animals.	**LOW**	N/A	N/A	**LOW**

Significant Impact Criteria	Risk to MNES without mitigation measures	Likelihood of a Significant impact (with no mitigation measures implemented)	Specific Mitigation Measure(s)	Residual Risk to MNES with mitigation measures applied	Likelihood of a Significant impact (with mitigation measures implemented)
Introduce disease that may cause the species to decline	There is no evidence to suggest that planned works would represent an increased risk of introduction of disease that may cause the community to decline.	**LOW**	N/A	N/A	**LOW**
Interfere substantially with the recovery of the species	The most significant threats to the species relate to waterway management. The planned works are terrestrially based and while impacts to surrounding waterways are a possibility they could not be considered to pose a threat such that they would interfere substantially with the recovery of the species.	**LOW**	N/A	N/A	**LOW**

8. Conclusion

The desktop review and targeted survey identified that Australian Graying are present in the reach of the Tarwin River West Branch abutting the project area. Historical and current fish records and the range of habitat required to support a population in the vicinity of the project area demonstrated that Australian Grayling are residing in the project area. In addition, due to the historical species' records upstream and downstream of the project area, the species is also undertake migration through the project area during breeding/spawning and larval migration periods.

As the project will require no earthworks or structures in the river channel, the identified potential unmitigated impacts to Australian Grayling were assessed as indirect only and related to:

- Unmanaged/controlled removal of riparian vegetation in the floodplain;
- Unmanaged/controlled disturbance to river banks;
- Siltation of river and reduced water quality/contamination during construction; and
- Alteration to 'natural' flow/hydrological regime in the floodplain during higher flow events.

A range of pre, during and post construction avoidance and mitigation measures have been developed to avoid and mitigate the identified indirect impacts (see Section 6) with the key aspects being to manage sediments/erosion, unmanaged impacts to the river channel, and site(s) reinstatement.

The significant impact assessment (Section 7) identified one potential unmitigated 'moderate' likelihood criteria (i.e. "lead to a long term decrease in the size of an important population"). This was reduced to a 'low' likelihood once mitigated. All other criteria scored 'low' likelihoods both pre and post mitigation. Accordingly, the project (or 'action') is unlikely to result in a significant impact to a matter of national environmental significance and therefore is not a 'controlled action' under the Significant Impact Guidelines (DoE 2013).

Similarly, as the project requires no works in the channel and the identified indirect impacts will be avoided and mitigated, it unlikely there will residual impact(s) to Australian Grayling and therefor no need to provide an offset under the Environmental Offset Policy (DELWP 2012).

The mitigation measures outlined herein will be incorporated, in full, into the contractor's EMP. Implementation of these mitigation measures, along with the suite of standard construction site mitigation and environmental management measures result in a 'low' likelihood of a significant impact to Australian Grayling and/or their habitat.

Given there will be no works/structures in the river channel and the proposed mitigation measures result in a low likelihood of a significant impact, there is no requirement for further studies relating to Australian Grayling.

9. References

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Appendices

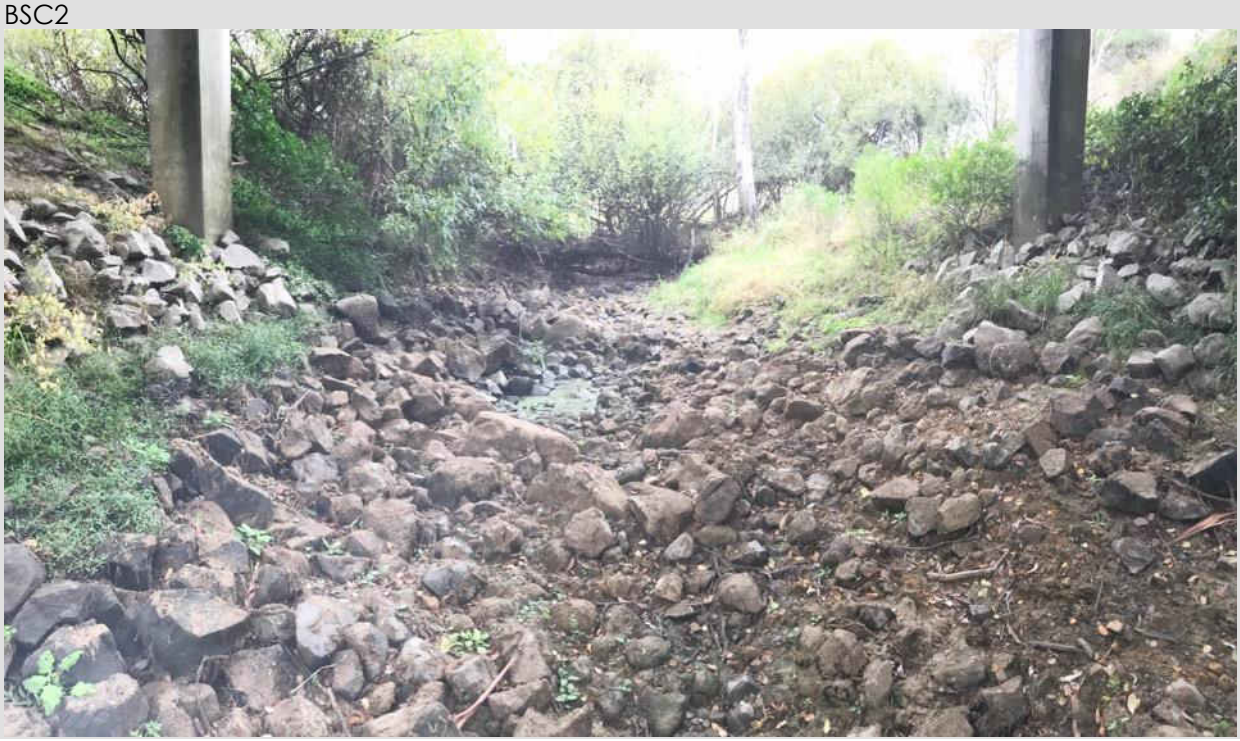
Appendix A In Situ Water Quality results

Parameter	Units	Site							
		TRWB1	TRWB2	TRWB3	TRWB4	TRWB5	TRWB6	TRWB7	TR1
Time Collected		14:00	13:20	13:40	15:00	11:00	12:45	7:30	9:45
Oxygen Saturation	%	73.7	83.2	85.5	80.1	82.3	79.4	76.0	79.2
Dissolved Oxygen	ppm	7.28	8.82	8.61	8.10	8.55	8.63	7.91	8.62
Electrical Conductivity	µS/cm	485	496	467	490	480	486	490	538
pH	pH Units	7.63	7.22	7.73	7.78	7.71	7.75	7.37	7.55
ORP	mV	143	341	176	140	207	183	347	263
Turbidity	NTU	24.8	26.8	35.6	28.8	22.0	23.4	31.9	17.8
Water Temperature	°C	14.6	12.8	14.5	14.9	11.4	12.1	13.0	11.5

Appendix B Site Photographs

BSC1

BSC2



TRWB1

TRWB2

TRWB3

TRWB4

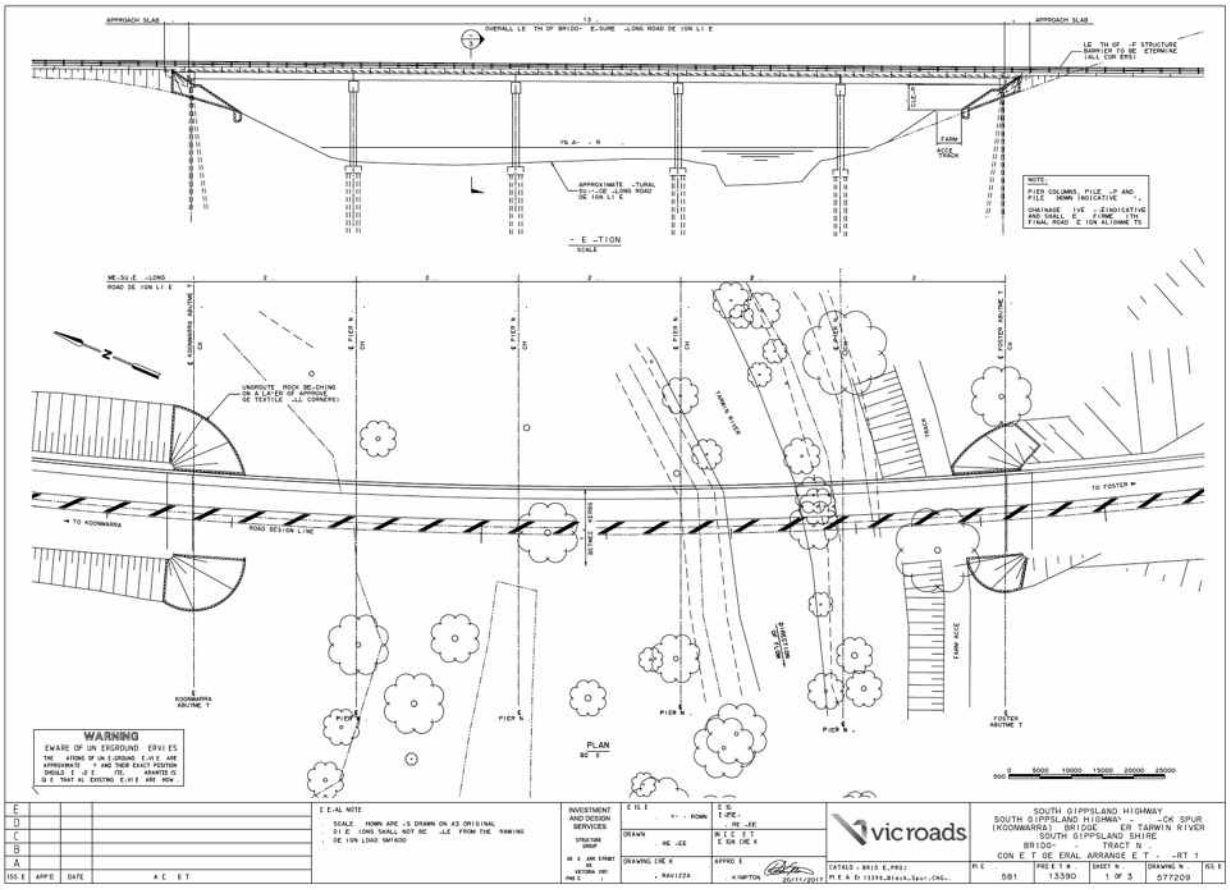
TRWB5

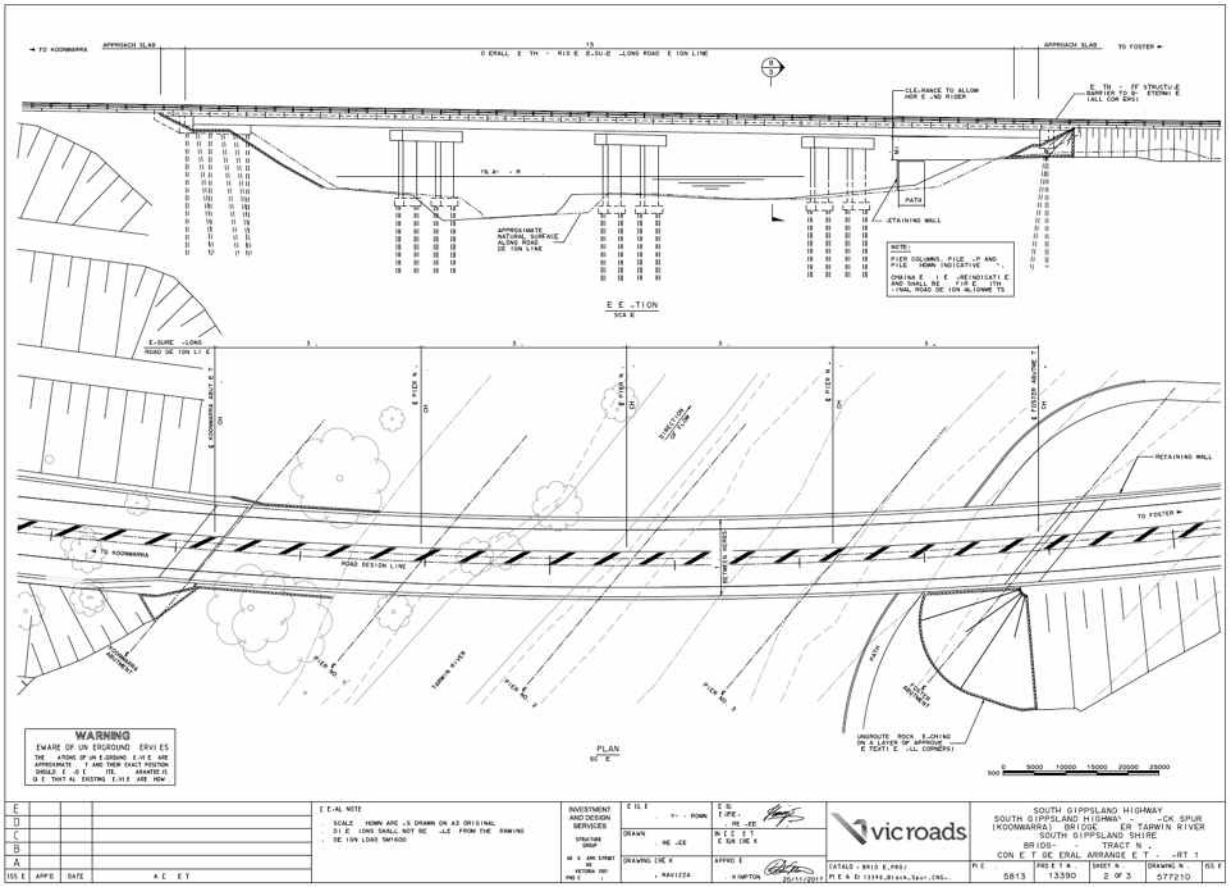
TRWB6

TRWB7

TR1

Appendix C Bridge Design Schematics





Appendix D Likelihood of significant impacts ratings and definitions

Likelihood of significant impact	Definition	Example of risk to MNES	Recommendation
Highly likely	A significant impact is expected to occur in most circumstances	Potential to result in permanent and irreversible decline of the ***species***.	High level of project redesign and/or relocation required to avoid/minimise impacts on species. Reassessment of potential for significant impacts required.
Likely	A significant impact will probably occur in most circumstances	Potential to result in long-term decline of a ***population*** or ***significant population***, and likely to have an impact on the ***species***.	Moderate level of project redesign required, combined with intensive threat management measures. EPBC referral required.
Possible	A significant impact could occur	Potential to result in short-term decline of a ***population, important*** or ***significant population***, may have an impact on the ***species***.	Minor redesign should be investigated. Moderate level of mitigation measures required. EPBC referral required, unless mitigation clearly demonstrates that there is no residual risk of significant impact.
Unlikely	A significant impact could occur but is not expected	Potential to result in decline of a ***local population***, unlikely to impact on the ***population*** or ***species***.	Low to moderate level of mitigation measures is recommended to minimise risk, where there is uncertainty around level of risk due to lack of quantitative data. EPBC referral not expected to be required, but pre-referral meeting recommended.
Highly unlikely	A significant impact may occur only in exceptional circumstances	Potential to affect individuals, but no expected decline of a ***local population***.	No mitigation measures required. No EPBC referral required.

Definition of terms used for significant impact assessment

Term	Definition
Species	The species, subspecies or geographic extent defined in the EPBC listing, which is documented in the status section for each species.
Population	Population located within the Gippsland region.
Significant population	As defined in relevant Action Statement or Listing Advice.
Local population	Population located broadly within the Morwell River Catchment on the Gippsland Plains.

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