



VicRoads

# Echuca-Moama Bridge Project - Impact Assessment Aquatic Flora and Fauna

June 2015





# Glossary of terms

Term	Definition
1 in 100 year flood	A flood which results from a storm which has a statistical probability of occurring once in every 100 years.
Access	The location by which vehicles and / or pedestrians enter and / or leave property adjacent to a road.
Afflux	A rise in upstream water level caused by introducing a constriction such as a bridge, into a stream, channel or floodplain.
Alignment Option	The location and geometric form of a carriageway in both the horizontal and vertical directions. For this Project the Alignment Option being assessed is the Mid-West Option.
Arterial Road	The nominated traffic routes (such as Murray Valley Highway or Cohuna-Echuca Road / Warren Street), for longer distance travel and larger vehicles.
At grade intersection	An intersection where all roads cross at the same level usually controlled by traffic signals or Stop or Give Way signs.
Attenuation	The reduction in the magnitude of sound pressure level during transmission over a distance or around a barrier.
Axel load limit	Restrictions on how much load can be carried on an axel, single or dual tyres, and on the vehicle or vehicle combinations.
Australian Height Datum (AHD)	The Australian standard height datum for calculating levels.
B-double	An articulated vehicle hauling two semi-trailers with the rear semi-trailer superimposed onto the front semi-trailer of the articulated vehicle. This is achieved by the use of a fifth wheel permanently located towards the rear of the front semi-trailer.
Back Swamp	A marshy area on a floodplain outside the main channel and behind a levee, where receding floodwater tends to deposit fine sediments.
Batter	In road construction, an artificial uniform slope created on the sides of fills or cuts. The proposed batters for the Project have a slope of 2:1 (vertical to horizontal).
Benefit Cost Ratio (BCR)	The ratio of the discounted benefits over the life of a project to the discounted capital costs, or the project's discounted total agency costs.
Bored pile	A steel or reinforced concrete post that is inserted vertically into the ground by drilling, or formed in the ground in a pre-bored hole, to support a load.
Bridge	A bridge is a structure built to cross an obstacle in the road network. The Project comprises bridges across the Campaspe River, the Murray River and some bridging components over the Campaspe/Murray River floodplains.
Carriageway	That portion of a road or bridge devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes, such as the two-lane, two-way carriageway in the initial alignment.
CaLP Act	Catchment and Land Protection Act (1994) (Vic)
Chainage	The distance of a point along a control line, measured from a datum point.
Clear Zones	An area within the recovery area which is ideally kept clear of hazards (or within which unmovable hazards are shielded). The width of the clear zone reflects the probability of an accident occurring at that location and the cost-effectiveness of removing hazards. The clear zone width is dependent on traffic speeds, road geometry and traffic volume.

Term	Definition
Concept Design	Initial high-level functional layout of a concept, such as a road or road system, to provide a level of understanding to later establish detailed design parameters.
Construction Environmental Management Framework (CEMP)	A site or project specific plan developed to ensure that appropriate environmental management practices are followed during the construction and/or operation of a Project.
Construction Area	The area defined for the Project that would be directly impacted by construction activities. It typically includes areas where vegetation would be removed and could include site compounds and laydown areas, which are outside the proposed Right-of-Way.
Corridor	An area of travel between two points. It may include more than one major route and more than one form of transport. Two corridors were investigated prior to the development of the EES. These corridors were identified as the Mid-West 2 Corridor (which included the Mid-West 2A and Mid-West 2B options) and the Mid-West Corridor, (which included the Mid-West Option).
Culvert	One or more subsurface adjacent pipes or enclosed channels for conveying surface water or a stream below formation level.
Cut	The depth from the natural surface of the ground to the construction level.
dB(A)	The human ear is not equally sensitive to all parts of the sound frequency range and the scale most commonly used is the A-weighted decibel or dB(A). This unit most accurately reflects human perception of the frequency range normally associated with road traffic noise.
Deceleration lane	An auxiliary traffic lane provided to allow vehicles to decrease speed on the approach to an intersection.
Design speed	A speed fixed for the design and correlation of those geometric features of a carriageway that influence vehicle operation. The alignment option has been designed to 90 kilometers per hour, for a posted speed limit of 80 kilometers per hour.
Earthworks	All operations involved in loosening, removing, depositing, shaping and compacting soil or rock.
EES Scoping Requirements	The Scoping Requirements under the Victorian Environment Effects Act 1978 (Vic) entitled "The Second Crossing of the Murray River at Echuca Moama dated June 2014
Environmental Management Framework (EMF)	Outlines the environmental measures recommended to be adopted as part of the EES.
Environment	For the purpose of the EES, environment incorporates physical, biological, heritage, cultural, economic and social aspects.
Environment Effects Statement (EES)	A statement prepared at the request of the Victorian Minister for Planning, pursuant to the Victorian <i>Environmental Effects Act 1978</i> , on the potential environment impact of a proposed development.
EPBC Act	Environment Protection Biodiversity and Conservation Act (1999) (Commonwealth)
FFG Act	Flora and Fauna Guarantee Act 1988 (Vic)
Fill	One or more of the following: 1. The depth from the subgrade level to the natural surface. 2. That portion of road where the formation is above the natural surface. 3. The material placed in an embankment.

Term	Definition
Flood runner	A small anabranch of a waterway which only flows during periods of high flow from the waterway that it branches from.
Floodway	Land that is identified as carrying active flood flows associated with waterways and open drainage systems.
Freehold land	Privately owned land.
Gradeline	The level and gradient of a road carriageway along the centreline.
Highway	A principal road in the road network with direct property access, such as the Murray Valley Highway.
Initial alignment	For the purpose of this EES, the initial alignment comprises the construction of a two lane, two-way carriageway road including a single bridge across each waterway.
Intersection	The place at which two or more roads meet or cross.
Land use	The type of development permitted in an area whether it be industrial, commercial, residential, recreational or a combination of some or all of these different uses.
Local access path	Minor path generally located in a local or residential area that links road and/or other path cycling routes, such as those paths within Victoria Park.
Major Road	A road to which is assigned a permanent priority for traffic movement over that of other roads.
Mid-West Option (Preferred Alignment)	The Mid-West Option extends from the Murray Valley Highway along Warren Street before diverting to the northwest where it crosses Campaspe Esplanade and the Campaspe River, then turns north-east to cross the Murray River north of the Victoria Park Boat Ramp. This option then extends north in New South Wales to cross Boundary Road in Moama and connect with the Cobb Highway at Meninya Street.
Mid-West 2A Option	The Mid-West 2A Option extends north/northwest on a new alignment from the intersection of the Murray Valley Highway and Warren Street, crosses the Campaspe River north of the Echuca Cemetery, before turning northeast towards Reflection Bend on the Murray River. This option then passes immediately south of Reflection Bend and crosses the Murray River north of the Victoria Park Boat Ramp, then extends north in New South Wales to cross Boundary Road in Moama and connect with the Cobb Highway at Meninya Street.
Mid-West 2B Option	The Mid-West 2B Option extends north/northwest on a new alignment from the intersection of the Murray River Highway and Warren Street, crosses the Campaspe River northeast of the Echuca Cemetery, before turning north towards the Echuca Sports and Recreation Reserve. This option crosses the Murray River north of the Victoria Park Boat Ramp, then extends north in New South Wales to cross Boundary Road in Moama and connect with the Cobb Highway at Meninya Street.
Mitigation Measures	Measures which are implemented to reduce an adverse impact caused by road construction and operation.
No Project Option	This assumes no additional bridge crossing of the Murray River and assumes existing road conditions and networks remain unchanged.
Preferred Alignment	The preferred alignment is the Mid-West Option.
Property	A property is land owned by a single landowner. It may include multiple contiguous titles owned by the same registered proprietor.
Recovery Area	The area beside the traffic lane required for a run-off-road vehicle to stop safely or be brought under control before rejoining the traffic lane.

Term	Definition
REF	Review of Environmental Factors pursuant to the Environmental Planning and Assessment Act 1979 (NSW)
Right-of-Way	The Right-of-Way is a strip of land the extent of which is reserved under a planning ordinance for the public purposes of a road and, in this case, encompasses sufficient land to construct the Project. The Right-of-Way comprises the sealed road surfaces (including shoulders / verges) and a 5-10 metre clear zone either side of the road formation of the ultimate alignment.
Right-turn lane	Right-turn lanes are used to provide space for the deceleration and storage of turning vehicles.
Risk Assessment	The processes of reaching a decision or recommendation on whether risks are tolerable and current risk control measures are adequate, and if not, whether alternative risk control measures are justified or would be implemented.
Roads and Maritime Services (Roads and Maritime)	Roads and Maritime Services are the co-proponent for the Echuca-Moama Bridge Project. Roads and Maritime Services are the NSW state government department responsible for the environmental assessment on the NSW component of the Project.
Roundabout	A channelised intersection at which all traffic moves clockwise around a central traffic island. The roundabouts proposed as part of the Project are located at the Murray Valley Highway and on Warren Street, which are both three-leg roundabouts.
Sedimentation Basins	Engineered basins designed to contain road drainage and spills on the new carriageway, preventing contaminants from entering the floodplain.
SEPP	State Environment Protection Policy
Service Road	A road designed or developed to be used, wholly or mainly, by traffic servicing adjacent land along Warren Street as part of the Mid-West Option only.
Shared Path	A paved area particularly designed (with appropriate dimensions, alignment and signing) for the movement of cyclists and pedestrians.
Staged Construction	A construction sequence in which the initial alignment comprising a single traffic lane in each direction is constructed and then, should traffic demand warrant an increase in road capacity, the road and bridge structures are duplicated, providing two traffic lanes in each direction.
Study Area	The area identified by individual specialists to determine potential impacts for the Project relating to a specific discipline.
Super "T"	A load-bearing structure (usually reinforced concrete) with a T-shaped cross-section.
Title	A title is an official record of who owns a parcel of land. Adjoining titles in the same ownership are considered and assessed as a 'property' in the impact assessment.
The Project	The Echuca-Moama Bridge EES (the Project) involves the construction and operation of a second road bridge crossing of the Murray and Campaspe Rivers at Echuca-Moama.
TSC Act	Threatened Species Conservation Act 1995 (NSW)
Turning lanes	An auxiliary lane reserved for turning traffic, providing deceleration length and storage for turning vehicles.
Two Way Carriageway	A carriageway with two traffic lanes allotted for use by traffic in opposing directions.
Ultimate alignment	For the EES, the ultimate alignment comprises the construction of a duplicated roadway and bridges. The ultimate duplication would be constructed when future traffic demand warrants an increase in road capacity. The EES considers the potential impacts of the ultimate alignment.

Term	Definition
VicRoads	VicRoads (Roads Corporation) is the co-proponent for the Project. VicRoads is responsible for project management of the planning and would manage the construction of the Project.
Work Hours	Work schedule during construction of the Project in which employees are required to work a certain number of hours but can schedule those hours as they wish. Typical work hours for the Project would be from 7.30 am (or sunrise – whichever is the earlier) to 5.30 pm or sunset (whichever is the later).





# Executive summary

*VicRoads, in partnership with New South Wales Roads and Maritime Services (Roads and Maritime), is undertaking planning activities for a second Murray River crossing at Echuca Moama. The second crossing, known as the 'Echuca-Moama Bridge Project' (the Project) would alleviate congestion on the existing bridge, provide an alternate access for traffic between the two towns and cater for road freight, including vehicles with Higher Mass Limits (HML) and High Productivity Freight Vehicles (HPFV).*

*On 14 June 2013, the Minister for Planning determined that an Environment Effects Statement (EES) would be required to assess the potential environmental effects of the Project within Victoria. As the Project extends into NSW, a Review of Environmental Factors (REF) would be required to assess impacts within New South Wales. This impact assessment has been prepared to inform the EES and REF.*

*As part of the EES options assessment, the Mid-West Option was determined to be the better performing option within Victoria, and was selected by the Victorian Government as the preferred alignment for detailed risk and impact assessment. The Mid-West Option utilises existing road reserves for part of its length, has the least impact on biodiversity and habitat values, cultural heritage values and satisfies the Project objectives. This report is focussed on impacts of the Mid-West Option and "No Project" Option only.*

*This Aquatic Flora and Fauna Impact Assessment Report has been prepared in response to the Scoping Requirements for the Project. The scope of this assessment includes the review of previous investigations, consideration of the existing conditions, an options assessment, environmental risk assessment and impact assessment.*

## **Impacts on target threatened species**

*The existing conditions in terms of aquatic flora and fauna biodiversity and catchment values within the Study Area were established using field surveys and by literature review. Of the fifteen threatened species (listed under the FM, FFG or EPBC Acts, or state advisory lists) identified in the desktop assessment the following eight were assessed as either being likely to occur or possibly occurring in the Study Area:*

- *Likely to occur:*
  - *Murray Cod*
  - *Silver Perch*
  - *Golden Perch*
  - *Murray Spiny Crayfish*
- *Possibly occur:*
  - *Trout Cod*
  - *Freshwater (Eel-tailed) Catfish*
  - *Flatheaded Galaxias*
  - *Murray River Turtle*

*The risk assessment identified eighteen risk pathways that may result due to the project's construction and operation. Of these, seventeen were considered low risk to aquatic flora and fauna values if standard VicRoads and NSW Roads and Maritime controls are implemented.*

One residual risk rating of medium remained, relating to a spill of toxic chemicals resulting from a vehicle incident under high rainfall conditions. Planned controls exist for reducing the likelihood of this event, and further controls are not expected to provide measurable additional reduction in the risk level. It is notable that the level of risk from this impact pathway is not considered any greater than the risk at the existing river crossings, and may in fact be lessened through the incorporation of improved traffic and environmental design controls (e.g. 1 in 100 year spill basins).

Therefore, if the mitigation measures proposed by VicRoads and Roads and Maritime are successfully implemented and recommendations outlined in this report are adopted, the impact of the construction and operations of the proposed bridge on aquatic flora and fauna values are generally considered to be low.

### Legislative requirements from impacts

In addition to requirements for planning permits under the planning legislation of each state, the project will trigger requirements under legislation in both Victoria and New South Wales. Approvals under various sections of legislation will need to demonstrate the ability to minimise impacts.

Legislation	Requirement
Fisheries Management Act 1994 (NSW)	The proposal would involve works that would affect fish or fish habitat. The proposal would potentially require the following approvals/permits:  Section 199 – give notice of dredging and reclamation work to the Minister and to consider any matters raised by the Minister.  Section 205 – impacts to aquatic vegetation (e.g. wetlands)  Section 219 – works which would block fish passage.
Threatened Species Conservation Act 1995 (NSW)	The Threatened Species Conservation Act 1995 (TSC Act) lists a number of threatened species, populations or ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If any of these could be impacted by the project, an assessment of significance that addresses the requirements of Section 5A of the Environmental Planning and Approvals Act 1979 must be completed to determine the significance of the impact.  Significance of impacts completed and provided in Appendix B.
Water Management Act 2000 (NSW)	Approval under section 91E of the Water Management Act 2000 would not be required as the works are being undertaken by Roads and Maritime Services.  A licence may be required under section 91F of the Water Management Act 2000 if the proposal is to intercept any aquifers (not covered in this assessment).
Water Act 1989 (Victoria)	Under Section 67 of the Water Act 1989, a Works on Waterways Permit is likely to be required for the project. The two major waterway crossings on the project are the Campaspe River and Murray River.  The Campaspe River is subject to the Victorian Water Act 1989. Some Authorities have exemptions from the requirement for a Works on Waterways permit under negotiated by-laws. In the absence of such a by-law, a permit would be required.  The permit would specify conditions that consider protection of bank integrity, fish passage, in-stream ecology, local drainage and any other parameters relevant to the site.  The Murray River is not subject to the Victorian Water Act 1989.
Flora and Fauna Guarantee Act 1988	If salvage of FFG Act listed threatened species is required, an FFG permit to collect would be required.

<i>Legislation</i>	<i>Requirement</i>
<i>Catchment and Land Protection Act 1994</i>	<i>The project should, specifically, avoid adding to the deterioration of river health which could decrease the likelihood of achieving the NCCMA Regional Catchment Management Strategy objectives.</i>
<i>Environment Protection Act 1970</i>	<i>Impacts to water quality in the Campaspe River must not exceed water quality objectives specified in SEPP (WoV) to protect beneficial uses, unless extensive modification or natural variation precludes this attainment. In such situations the background level becomes the objective.</i>
<i>Wildlife Act 1975 (Victoria)</i>	<i>A Management Authorisation under the Act may be required if native fauna (e.g. turtles) need to be captured and/or relocated during proposed works.</i>
<i>Fisheries Act 1995 (Victoria)</i>	<i>If management actions for mitigating impacts of fish populations require the salvaging and translocation of individuals, a permit (Management Authorisation) under the Fisheries Act 1995 would be required.</i>

*Environmental documentation (i.e. Project Environmental Management Plan, Site Environmental Plan, etc.) should be developed prior to application for environmental approvals. The documentation would be required to demonstrate to referral authorities that the project meets the requirements for environmental protection.*

*Once the required information is gathered, application can be made to the relevant authorities for approval to undertake the project, under the appropriate legislation.*

*This report is subject to, and must be read in conjunction with, the limitations set out in Section 8 and the assumptions and qualifications contained throughout the Report.*





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- Appendix B – Seven Part Test of Significance (NSW Threatened Species Assessment)
- Appendix C – Matters of National Significance Test (Department of Environment Significance  
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# 1. Introduction

## 1.1 Project overview

VicRoads, in partnership with New South Wales Roads and Maritime Services (Roads and Maritime), is undertaking planning activities for a second Murray River crossing at Echuca Moama. The Project, known as the Echuca-Moama Bridge Project would alleviate congestion on the existing bridge and provide an alternate access for residents and improved security of access for the local community, as well as catering for freight and agricultural machinery.

As part of the assessment and approvals processes, the Project was referred to the Victorian Minister for Planning for a decision whether an assessment under the Environment Effects Act 1978 is needed to determine the Project's potential for significant effects on the environment. On 14 June 2013, the Minister determined an Environment Effects Statement (EES) would be required. As the Project extends into New South Wales, a Review of Environmental Factors (REF) would be required to assess impacts within NSW.

This Aquatic Flora and Fauna Impact Assessment has been prepared to inform the EES and REF. The EES is required to consider the potential effects of the Project to the environment, inform the public and other stakeholders and enable a Ministerial Assessment of the Project to inform decision makers. The purpose of the REF is to document the likely impacts of the proposal on the environment and to detailed recommended protective measures to be implemented during construction.

The EES for the Project has considered three alignment options. As part of the options assessment for the EES, the alignment of the Mid-West Option was determined to be the better performing when considering a balance between environmental, social and economic considerations. This impact assessment has been prepared based on the Mid-West Option (the Preferred Alignment).

## 1.2 Purpose of this document

The purpose of this Aquatic Flora and Fauna Impact Assessment report is to document the potential impacts to aquatic flora and fauna values and to outline the methodology, risks and proposed mitigation measures for the Project within both Victoria and New South Wales.

## 2. Project description

### 2.1 Project background

Echuca and Moama are currently linked by a single road bridge across the Murray River with a single carriageway in either direction. The existing bridge was built in 1878 and originally operated as a combined road/rail bridge until 1989, whereby a separate rail bridge was constructed. The nearest alternative road crossings of the Murray River are at Barham, 86 km to the west, Barmah 36 km to the east, or Tocumwal 120 km to the east.

The existing road bridge and its approaches have inherent safety and operational limitations including its inability to carry over-width loads and higher mass-limited vehicles used by an increasing proportion of the freight transport industry. Rehabilitation works to upgrade the operational capacity of the bridge would require lengthy road closures and would be further complicated by the need for heritage considerations.

The existing bridge does not provide a suitable level of service for the increased volume of light vehicle traffic experienced during peak summer tourist events. Extensive delays are commonly experienced at these times which are easily exacerbated by any minor traffic incidents. This results in sizeable delays and in particular restricts the movement of emergency services vehicles from one town to the other.

Early investigations to provide for a second Murray River Crossing at Echuca-Moama commenced in 1965. Since then, VicRoads has undertaken extensive planning investigations including route options development and environmental impact assessments. Over the past 15 years, five corridors have been considered for an additional Murray River crossing. These investigations have included:

- An Environment Effects Statement (EES)/Environmental Impact Statement (EIS) study in 2000/2001 which determined a Western Corridor as the option approved by the Planning Panel;
- Preparation of an Environmental Report in 2010 for a Mid-West corridor (this process was superseded in late 2010 following a change in Government); and
- The current EES process which formally commenced in 2013.

As a result of the investigations completed and stakeholder consultation conducted, VicRoads has amassed significant knowledge of existing environmental, social and economic conditions and community values in the Echuca-Moama region.

### 2.2 The project

The Echuca-Moama Bridge Project (the Project) involves the construction and operation of a second road bridge crossing of the Murray and Campaspe Rivers at Echuca-Moama. The Project extends between Echuca (within Victoria) and Moama (in New South Wales) and is therefore subject to the provisions of the Victorian and New South Wales approvals processes. As part of the EES (within Victoria), the proposed alignment is assessed against a 'No Project' option, whereby it is assumed that the existing road conditions and networks remain unchanged and in NSW a Review of Environmental Factors (REF) is being prepared to consider the construction impacts of the Project.

The Project comprises a Right-of-Way (RoW) sufficient to build a four lane road and duplicated bridges across both Rivers. The Project includes an elevated roadway and extensive bridging across the Campaspe and Murray River floodplains, as well as changes to existing approach roads.



Construction of the Project would be staged to meet traffic demands and includes the initial alignment and an ultimate duplication. The initial alignment comprises two lanes (a single carriageway in either direction) and the ultimate duplication, which comprises the two lanes in both directions and duplicated bridges next to the bridges built during the initial alignment.

The project would involve bridge crossings of the Murray River and Campaspe River. Further bridging and culverts would be provided over low lying flood prone land, providing adequate clearance for movement of flood waters. The piers of the Campaspe and Murray River bridges would be constructed outside of the river channel (summer flow / low water mark extent).

The proposed bridge over the Campaspe River is designed to fully span the river, without support structures in the river channel. At the Campaspe River, bridge piers would be located clear of the river banks to the north and south of the river.

The proposed bridge over the Murray River is designed to span the summer water level river channel, and support structures would not be required within the river channel, but are placed on the river bank above typical baseflow river level. A cantilever structure is proposed over the Murray River, with piers in the river banks supporting a 90-95 m clear span over the river channel. The piers would be located above the normal summer flow (summer river water level).

Some construction works may be required on or near the banks of the Murray River. The construction process for Murray River Bridge piers would involve the installation of coffer dams in dry conditions if possible.

The Project design includes provision for spill basins to be constructed adjacent to the alignment to capture run-off from the new roadway. The spill basins have been incorporated into the design consistent with discussions with the EPA and allow for the capture and/or treatment of run-off from the road surface and enable removal or release into the flood plain as required. The spill basins would be located as close to the road carriageway as possible to minimise the construction footprint of the Project. On the elevated carriageway from Warren Street in Echuca to Cobb Highway in Moama, the spill basins would be constructed within the batter slope.

The height of the spill basins would be determined during detailed design. The EPA has instructed VicRoads to adopt a risk based approach to spill basin design. This would involve an assessment of construction and maintenance costs, access requirements and public safety, spill risk and effectiveness and reliability of required management measures.

## 2.3 Project objectives

The Project objectives are:

- Improve accessibility and connectivity for the community of Echuca-Moama and the wider region;
- Provide security of access with a second flood free crossing between Echuca and Moama;
- Enable cross border access for high productivity freight vehicles and oversized vehicles;
- Improve emergency services accessibility between Echuca and Moama during emergency situations and major tourist and flood events;
- Provide road infrastructure that supports:
  - The state (Vic and NSW) and national economies through improved connectivity of goods and services; and
  - The local and regional economy of Echuca-Moama.

## 2.4 Preferred alignment

VicRoads undertook an assessment of alignment options known as the Mid-West Option, the Mid-West 2A Option and the Mid-West 2B Option based upon the information from previous assessments and existing conditions in the area. This assessment is included in Chapter 5 of the main EES document. The result was the selection of a Preferred Alignment for consideration by specialists. The Preferred Alignment, known as the Mid-West Option was determined to be a better performing option when considering a balance between environmental, social and economic considerations. The alignment is approximately 4.3 km in length and utilises existing road infrastructure along part of Warren Street (Echuca-Cohuna Road), has the least amount of vegetation removal and least amount of raised road formation and bridging, impacting on the overall cost of the Project. Refer to the Echuca-Moama Project EES Main Report for more details on the assessment of alignment options to support the selection of the Preferred Alignment.

The Preferred Alignment extends from the Murray Valley Highway along Warren Street before diverting to the northwest where it extends to the west of Victoria Park Oval. The alignment then turns north-east to cross the Murray River before extending north to connect with the Cobb Highway (Refer Figure 1).

More specifically, the alignment of the “Mid-West” Option comprises:

- A new roundabout at the intersection of the Murray Valley Highway;
- Upgrade works along Warren Street, including widening of the road pavement, shoulder sealing, upgrading flood relief structures, line marking and intersection upgrades at Homan Street and Redman Street;
- Consolidation of service road access on the western side of Warren Street between Homan Street and Redman Street;
- Line marking for a dedicated right-turn lane for traffic turning into Homan Street;
- Construction of a new ‘three-leg’ roundabout approximately 120 m south of Campaspe Esplanade;
- Construction of a new road extending north-west from Warren Street and construction of a new bridge across the Campaspe River and Crofton Street;
- Construction of a new road extending north over part of the former Echuca College site and construction of a new road over a slab on the edge of an existing sand hill;
- A new road extending north-east over the western and northern tennis court in Victoria Park and to the north of the Echuca Caravan Park;
- Construction of a new bridge over the Murray River near the existing boat ramp;
- Construction of an elevated road east of the Murray River to connect with a realigned Meninya Street (the existing Cobb Highway) at a new signalised intersection; and
- Signalisation of the intersections at Cobb Highway and Perricoota Road and Cobb Highway and Francis Street.

The main construction activities associated with the Project would comprise:

- Civil and structural works associated with the construction of new elevated roadway and bridges across the Murray and the Campaspe River;
- Construction of earthworks and flood relief structures for the new Link Road across the Murray River and Campaspe River floodplains; and

- Improvements to existing roads and intersections on approaches in Victoria and New South Wales, including the construction of a large diameter roundabout at the Murray Valley Highway / Warren Street intersection and traffic signals with Meninya Street and Perricoota Road in Moama.

## 2.5 Study area

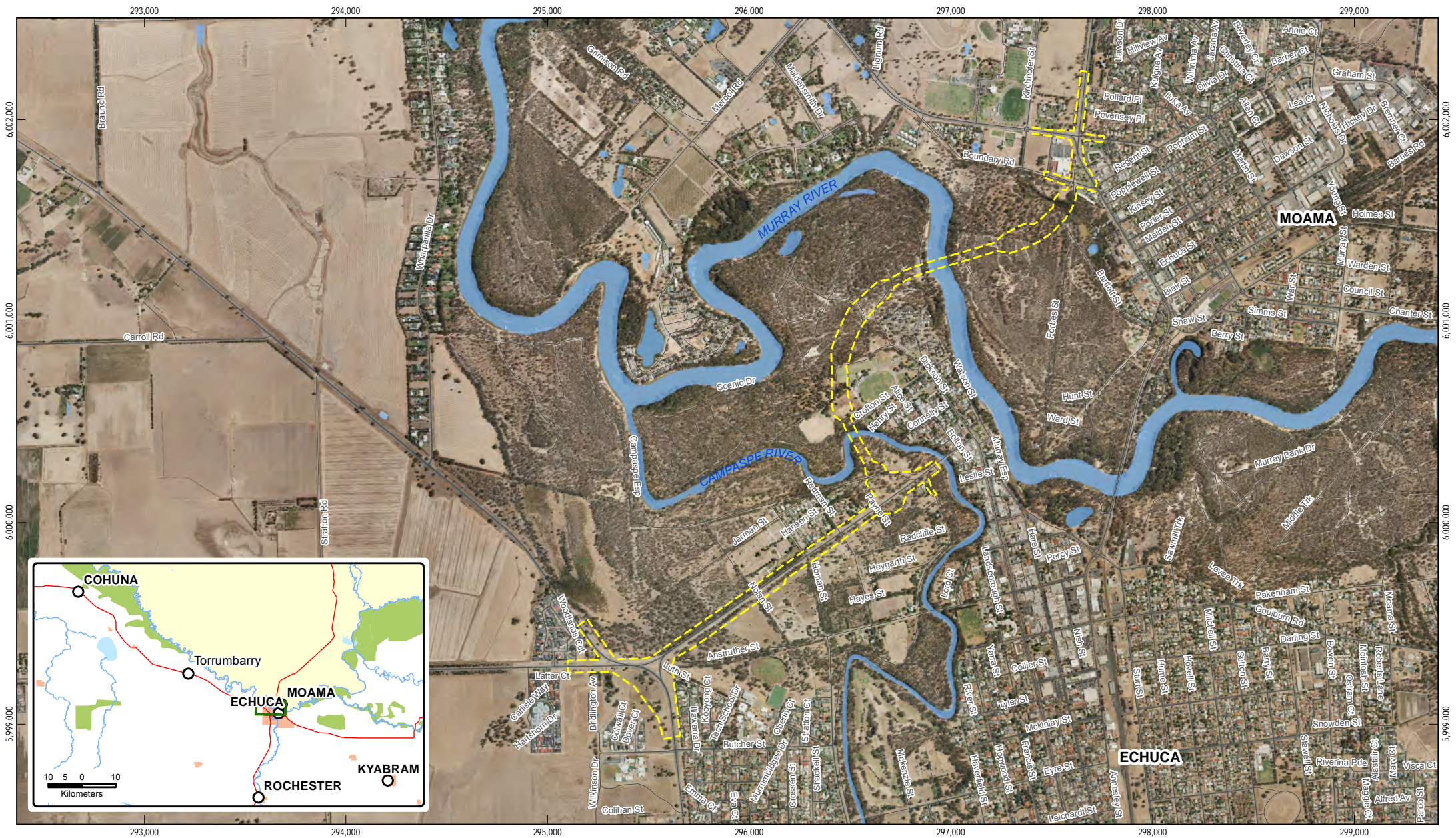
The Study Area for this Aquatic Flora and Fauna Impact Assessment is located on the Murray and Campaspe Rivers in the townships of Echuca, Victoria and Moama, NSW. It lies on the Victoria/NSW border approximately 200 km north of Melbourne, 400 km east of Canberra and 640 km south south-east of Sydney, within the jurisdiction of the Campaspe (Victoria) and Murray (NSW) Shires. A map of the Study Area is presented in Figure 2.

The Study Area includes the proposed RoW described above (Section 2.4) and waterways or aquatic habitat intersected by the alignment. Specifically, these include the rivers plus floodplain wetlands that may be permanent or ephemeral (e.g. unnamed wetlands located on private property adjacent to Boundary Road, Moama (Figure 4)).

The Study Area extends beyond the RoW due to the potential for aquatic ecosystem impacts from any water quality degradation, particularly increased sedimentation, that may extend downstream of the proposed river crossings. Therefore, for the purposes of characterising existing conditions and considering potential impacts to the aquatic flora and fauna, the Study Area extended downstream to Torrumbarry weir on the Murray River. Torrumbarry weir provides the first significant hydrological barrier on the Murray River downstream of Echuca-Moama, and thus is considered as a meaningful downstream boundary to the study area. In terms of upstream extent, the Study Area extends for approximately 5 km upstream from the proposed RoW on both the Murray and Campaspe rivers.

The Study Area lies within the Central Murray River, which is defined by the Murray-Darling Basin Authority as extending from Yarrawonga down to the confluence with the Darling River at Wentworth. The Lower Murray River continues from Wentworth further downstream to the Coorong and Lower Lakes near the Murray Mouth. Consideration of potential impacts beyond the Study Area are regarded at a regional scale, and are referred to in this report as affecting the Central and Lower Murray River.



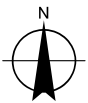


Scale 1:1,500,000 (At A4)

0 200 400 600 800

Metres

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



#### LEGEND

--- Ultimate Road Reserve



VicRoads  
Echuca Aquatic Flora and Fauna Study

Job Number	31-31891
Revision	B
Date	15 Dec 2014

#### Project Alignment

#### Figure 1

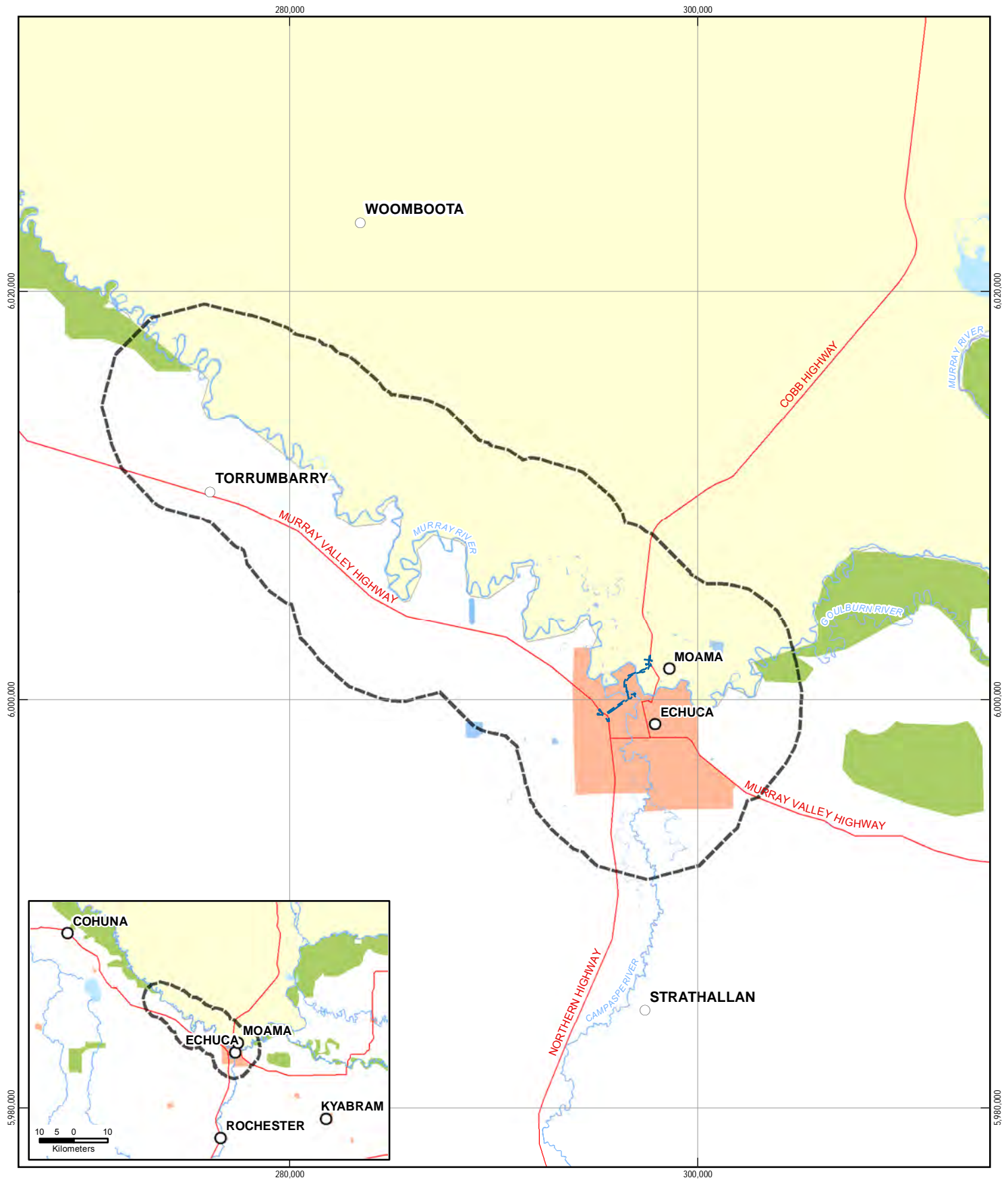
G:\31\31891\GIS\_OLD\Maps\Deliverables\2\3131891\_005\_Fig1\_ProjectAlignment\_A4L.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

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Data source: VicRoads Imagery, and VicMap, DEPI (2014).. Created by:irsmith





#### LEGEND

- Proposed Right-of-Way (ultimate duplication)
- Extent of Study Area
- Water Area
- Major road
- Park

Scale 1:250,000 (At A4)

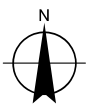
0 1 2 4 6 8

Kilometers

Map Projection: Transverse Mercator

Horizontal Datum: GDA 1994

Grid: GDA 1994 MGA Zone 55



VicRoads  
Echuca Aquatic Flora and Fauna Study

**Aquatic Impact Assessment  
Study Area**

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Revision	A
Date	19 Jan 2015

**Figure 2**





#### LEGEND

- Proposed Right-of-Way (ultimate duplication)
- Water Area
- Aquatic fauna sampling point

Scale 1:25,000 (At A4)

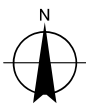
0 125 250 500 750 1,000

Meters

Map Projection: Transverse Mercator

Horizontal Datum: GDA 1994

Grid: GDA 1994 MGA Zone 55



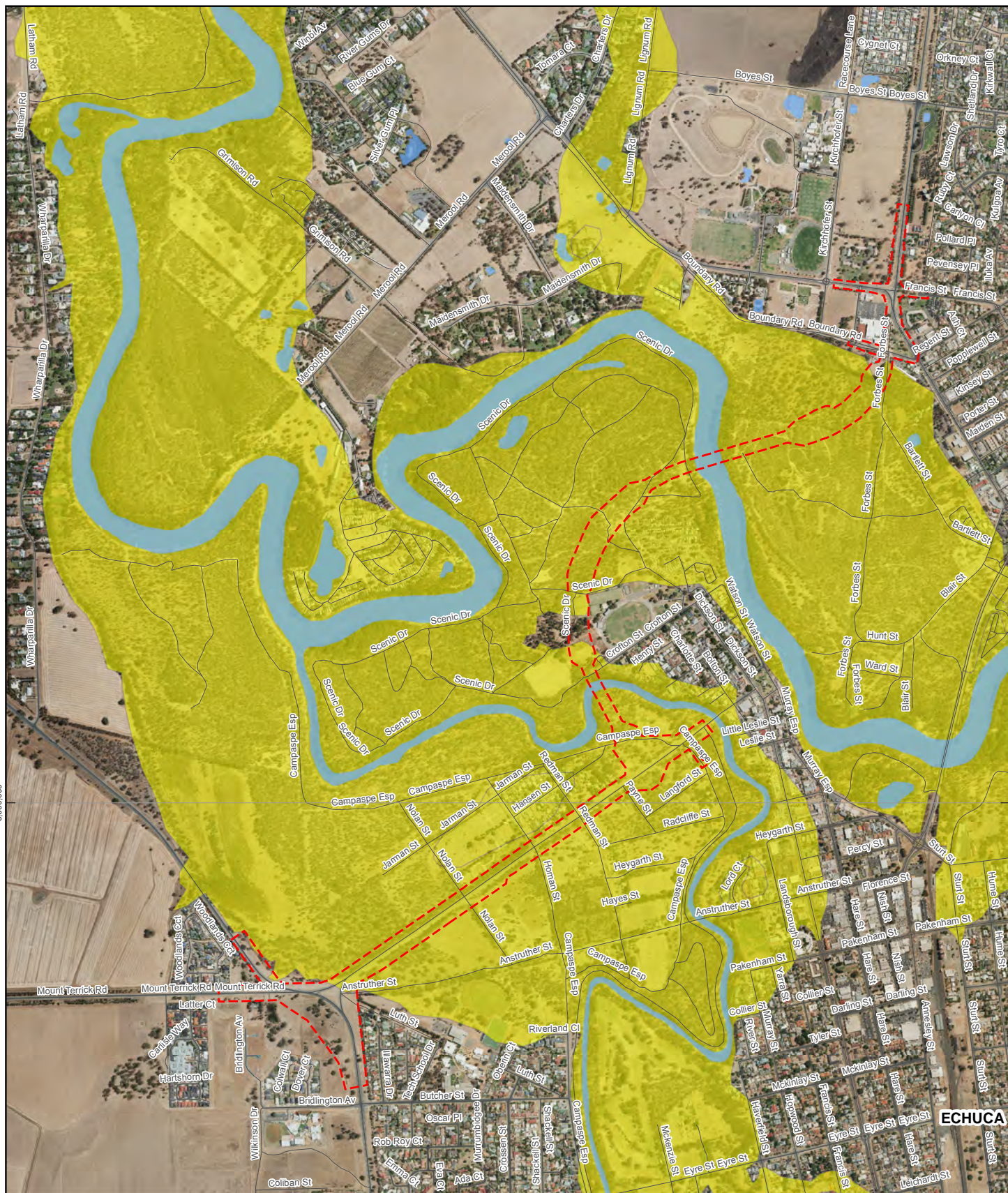
VicRoads  
Echuca Aquatic Flora and Fauna Study

Job Number 31-31891  
Revision A  
Date 16 Dec 2014

#### Aquatic Survey Sites

#### Figure 3

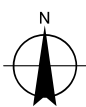




#### LEGEND

- Proposed Right-of-Way (ultimate duplication)
- Extent of Floodplain Habitat
- Water Area

Scale: (At A4)  
 0 100 200 400 600 800  
 Meters  
 Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 55



VicRoads  
 Echuca Aquatic Flora and Fauna Study

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 Date 16 Dec 2014

Extent of Floodplain Habitat

Figure 4



## 3. Existing conditions

### 3.1 Methodology

To gain an understanding of the existing aquatic environment associated with the Study Area two approaches were employed:

- A desktop review of historical literature and relevant databases;
- Two site visits, which included:
  - A habitat assessment and fish survey within the Murray and Campaspe Rivers (April 2012) in relation to previously proposed bridge alignments (GHD 2013); and
  - A habitat assessment of the 'Preferred Alignment' (Mid-West) and a fish survey of a wetland on private property in Moama (Boundary Road Wetland) (undertaken in August 2014).

#### 3.1.1 Desktop review

The database search and literature review examined information on the Study Area. When interrogating databases, the search area included a buffer of 5 km to ensure that mobile fauna were adequately captured in the desktop assessment. Figure 2 displays the area selected for each database search. Although the Campaspe River and Murray River are covered by NSW and Victorian legislation respectively, the habitats present are similar and the aquatic flora and fauna are not expected to discriminate between state borders. Species present in the Study Area are considered equally likely to occur in each state. Therefore, for the purposes of this review, both sets of state legislation are considered relevant to the entire Study Area.

#### *Databases*

The following databases were searched as part of the desktop review:

- Commonwealth Department of Environment Protected Matters Database (DoE, 2014a)
- Victorian Biodiversity Atlas (VBA) (DELWP 2014)
- Victorian Rare or Threatened Species Advisory lists (invertebrates and vertebrates) (DELWP, 2009; 2013)
- Atlas of NSW Wildlife (OEH, 2014)
- NSW Threatened and Protected Records Viewer (DPI, 2014)

#### *Literature review*

The following documents were reviewed for information on aquatic flora and fauna values, condition assessments of aquatic habitat relevant to the assessment area and Project:

- Environmental Watering Plan (NCCMA, 2010)
- DECCW State of the Catchments 2010 – Riverine Ecosystems Murray Region (DECCW 2010)
- Echuca-Moama Second Murray bridge crossing – aquatic fauna assessment (McGuckin, 2010)
- DELWP Index of Stream Condition Report (DELWP 2013)
- GHD Echuca Bridge Planning Study – Mid West 2 Option. Aquatic Flora and Fauna Assessment (GHD 2013)



- Mid West 2 Murray River Crossing at Echuca-Moama - Matters of National Environmental Significance (BL&A 2013)
- Fishes of the Murray-Darling Basin (Lintermans 2007) and Freshwater Fishes of Australia Allen *et al* (2003)

### 3.1.2 Field surveys

Within the Study Area, field survey sites were selected based on points of intersection between the proposed alignment design (available at the time of survey) and waterways or aquatic habitat (Figure 3). Sites were selected based on aerial imagery and the most up-to-date project design.

#### **Habitat assessment**

During April 2012 and August 2014 habitat assessments were undertaken considering the reaches within 150 m of the project alignment options being considered at the time of the survey. Therefore the assessments were based on reaches approximately 500 m downstream of the currently proposed Mid-West Option on the Murray River and approximately 500 m downstream from the currently proposed Mid-West Option on the Campaspe River. As the aquatic habitats in the Murray and Campaspe Rivers in the reaches of the Project are consistent and similar, the habitat assessment conducted at these locations is considered suitable for assessing the Project.

Included in the habitat assessment within the vicinity of each crossing point was:

- General landscape characteristics including land use and river water levels;
- Site specific parameters including:
  - Channel width
  - Vegetative cover
  - Composition of the streambed substrate
  - Relative abundance of streambed cover including large woody debris (logs, branches), organic debris (leaves, bark) and tree roots
  - Bank stability
  - Riparian condition
- Any other relevant observations

As part of the habitat assessment reference photographs were taken at each site.

#### **Fish survey**

Fish surveys were carried out in 2012 and 2014. In 2012 fish surveys were at two Murray River and Campaspe River sites in the Study Area (see Figure 3). Surveys were carried out on 12 April 2012. A fish survey of the Boundary Road wetland was carried out on 21 and 22 August 2014.

The 2012 survey involved the use of the following techniques for fish capture:

- **Bait Traps:** 12 bait traps (22 x 22 x 40 cm, 2 mm stretched mesh and 50 mm openings) were placed at each of the two survey sites. The traps were set in the afternoon submerged in water and left overnight, then inspected the next morning. In order to maximise the range of fish species captured, a different bait type was used in each set of four traps. The baiting regime included:
  - Four non baited
  - Four with dried cat food
  - Four with glow sticks

- **Fyke nets:** Three fyke nets were deployed at each of the two fish survey sites, left overnight and retrieved/inspected the following morning.

The 2014 survey involved the use of the following techniques for fish capture:

- **Bait Traps:** 10 bait traps (22 x 22 x 40 cm, 2 mm stretched mesh and 50 mm openings) were placed in the wetland south of Boundary Road. The traps were set in the afternoon submerged in water and left overnight, then inspected the next morning. In order to maximise the range of fish species captured, a different bait type was used in each set of four traps. All traps were baited with domestic cat food.
- **Fyke nets:** Four fyke nets were deployed at each of the two fish survey sites, left overnight and retrieved/inspected the following morning.
- **Electrofishing:** A Smith-Root LR20B Electrofisher was used to survey wadeable areas of the wetland.

Freshwater fish captured were identified with reference to Freshwater Fishes of Australia (Allen *et al*, 2003) and Lintermans (2007). Native species were returned to the water as near to the point of capture as possible. Noxious fish species collected were euthanised in a humane manner according to permit requirements.

Fish surveys were conducted in accordance with the following permits:

- Victorian Department of Primary Industries (DPI) Fisheries – Research **Permit No. RP891/1096**
- Victorian DELWP – Permit to take protected fish **Permit No. 10006248/10007230**
- NSW Industry and Investment – Scientific Collection **Permit No. PO7/0142-3.0/4.0**

## 3.2 Survey area characteristics

### 3.2.1 Murray River – aquatic habitat

#### Murray River

The field survey area extends along the Murray River approximately 300 m upstream and downstream of the boat ramp on the eastern side of Victoria Park Reserve (Figure 3). In this reach the Murray River is an unconfined, meandering river with fine grained sediments (Figure 5).

At the proposed crossing under the Preferred Alignment, the active channel of the Murray River is approximately 70-90 m wide. The channel has sloped banks and sand deposition has occurred on the Victorian side of the river (left bank). In the vicinity of the proposed bridge crossing under the Preferred Alignment, local erosion was observed and the banks on both sides were exposed throughout the riparian zone. There was no overhanging vegetation or large woody habitat observed on the banks at the proposed crossing point. The NSW (right) bank was less disturbed and some instream habitat was observed although large woody debris was still sparse. It is likely that large woody debris is present within the river channel, however the quantity or individual location of these aquatic habitat structures is not known.

Good longitudinal and lateral vegetation cover was observed in the canopy on both banks but the ground cover was predominately bare or composed of exotic grasses on the Victorian bank. Minimal shading of the river was observed. Erosion control in the form of rock beaching has been placed along the Victorian bank in the vicinity of the crossing point.

The area is widely used for recreational activities, with power-boats and paddle steamers observed. House boat moorings are located upstream within the vicinity of the proposed crossing. The Murray River in this region is also used extensively for recreational fishing.

In terms of aquatic fauna habitat, this reach of the Murray River has low levels of instream wood or tree roots, and there are no snags evident at the proposed crossing site. In-stream timber is preferred shelter, breeding and ambush sites for many fish species. The high level of recreational activity and boat traffic is also likely to result in this area being less preferred by many of the larger, disturbance sensitive fish species (i.e. Murray Cod).

### NSW Floodplain Wetlands

The site visit during August 2014 allowed for the inspection and survey of the Boundary Road Wetlands (Figure 3). The Boundary Road Wetlands are approximately 500 m from the Murray River and located on private property, with the Preferred Alignment passing to the east of the wetland basins. There is likely to be infrequent connectivity with the Murray River. During the site visit a maximum wetted area of approximately 100 x 20 m was observed. Depths ranged from approximately 15 cm to 3 m (according to the property owner). Substrate within the basins consisted of thick clay/silt. The Boundary Road Wetlands act as stormwater retention basins for this area of Moama; a number of entry drains were observed and urban litter was apparent throughout (Figure 6). The Boundary Road Wetlands are periodically de-silted by Murray Shire Council, which is likely to degrade the quality of aquatic habitat that may be present within the basins. Evidence of de-silting was obvious, with the excavated material piled on the southern bank (Figure 6). Near vertical banks were also observed in areas which had been dredged. One less disturbed area exists on the eastern margin of the basins contained habitat that may be suitable for aquatic fauna. Aquatic macrophytes (including scattered knotweed *Persicaria* sp., cumbungi *Typha* sp. and rushes *Juncus* sp.) were observed along with some woody debris.

Additional ephemeral aquatic habitat present within the Murray River floodplain was surveyed as part of the Flora and Fauna Impact Assessment completed as part of the EES (Brett Lane & Associates 2015). The flooded Red Gum woodland was located 500 m from the Murray River and consisted of a 50 metre by 60 metre area, up to 15 cm in depth with a clay substrate. Although not surveyed for aquatic fauna, this area could provide temporary aquatic habitat for fish species after large flooding events. However, its location suggests that only sporadic connection to the Murray River and Murray River fish populations would be made.



Figure 5 Murray River at proposed bridge crossing - Victorian bank; facing upstream (top) and downstream (bottom). Rock beaching placed along bank on either side of boat ramp





Figure 6 Stormwater wetland south of Boundary Road, Moama - dredged material visible in foreground (top), stormwater outlet to wetland (bottom)

### 3.2.2 Murray River – river health

The two indicators of aquatic biota used by the NSW Department of Environment, Climate Change and Water are:

- **macroinvertebrate assemblage**, which consist larval and adult insects, molluscs, worms and crustaceans and are an important component of river ecosystems
- **fish assemblage**, which consist of native and introduced species

These two forms of aquatic life are generally regarded as reliable indicators of river health and aquatic ecosystem condition. Macroinvertebrate assemblages are assessed using SIGNAL and AusRivAS indices, whereas fish assemblage assessment considers expectedness and nativeness (Davies *et al.* 2013).

According to the most recent State of the Catchments report (DECCW 2010) on riverine ecosystems in the Murray region (which includes Echuca-Moama), the condition of macroinvertebrate assemblages is considered very poor, and fish assemblages are considered poor.

### 3.2.3 Campaspe River – aquatic habitat

#### Campaspe River

The Campaspe River at the proposed crossing location under the Preferred Alignment has steep v-shaped banks that were exposed at the time of field assessment (August 2014) due to low water levels in the Campaspe River. Along this reach the Campaspe River is meandering with a bed of fine grained sediment. The section of the reach near the proposed crossing is located on a bend on the Campaspe River.

At the proposed Campaspe River crossing under the Preferred Alignment the channel is between 30-50 m wide. In the vicinity of the proposed bridge crossing under the Preferred Alignment, local erosion was observed, and the banks on both sides of the river had exposed riparian tree roots. There was overhanging vegetation (mainly eucalypts) and a moderate amount of large woody habitat (approximately one submerged log per 10-20 m) was observed instream on both banks of the Campaspe River.

Good longitudinal and lateral vegetation cover was observed in the canopy on both banks but the ground cover was predominately absent or composed of exotic grasses. Shading at mid-day covered less than 10% of the channel. The floodplain was well forested on both banks and contained flood runners, back swamps and good lateral and longitudinal canopy cover. The understory is less established and there are large patches of bare earth.

Local land use on north bank is the Crofton Street road reserve, whilst the southern bank is vegetated privately owned land. Boats and boat access were not observed near the proposed crossing location. The Campaspe River in this region is also valued for recreational fishing.

#### Victorian Floodplain Wetlands

Warren Street crosses the Campaspe River floodplain. Four existing culverts are located on this road (Figure 8). These culverts occasionally contain water after a rainfall event, and thus these culverts may occasionally contain aquatic habitats. The field inspection of these culverts undertaken in August 2014 indicated poor habitat quality that is not expected to provide important habitat for native aquatic fauna. The vegetation within the aquatic habitat is mainly comprised of grasses, rushes and sedges.

The floodplain is occasionally inundated from the Murray and Campaspe Rivers, and thus may include additional ephemeral aquatic habitat present within the Campaspe and Murray River floodplains. Surveys for floodplain aquatic habitat undertaken for Growling Grass Frogs (Brett Lane & Associates 2015) identified a Campaspe floodplain billabong, located outside the Preferred Alignment. Although not surveyed for aquatic fauna, this floodplain area could provide temporary aquatic habitat for aquatic flora and fauna after large flooding or local rainfall events. Based on aerial imagery, the presence of floodplain aquatic habitat within the Preferred Alignment is likely to be ephemeral, with limited connectivity to the rivers. As the significance of these habitats for threatened aquatic species varies dependent on inundation and connectivity with the main river channels, the presence or absence of significant species or ecological values is dependent on flooding events. The threatened aquatic species that might be expected in the study area are unlikely to reside in this ephemeral habitat except following major flooding events that connect the floodplain to the main river channel. The floodplain aquatic habitat in the RoW is most likely to be inundated following local rainfall events, which would not connect these pools to the main river channel. Therefore, it is unlikely that the floodplain habitat within the RoW provide significant habitat for threatened aquatic fauna and flora populations. There may be some loss of this ephemeral floodplain aquatic habitat within the RoW once the Project is complete due to changes to the drainage through culverts. However, as the inundation is mostly due to runoff from local rainfall events, the impact of the Project on aquatic habitat in the surrounding floodplain should not change.





Figure 7 Campaspe River at proposed bridge crossing (facing upstream (top) and downstream)





Figure 8 Warren Street Culvert

### 3.2.4 Campaspe River – river health

The most recent comprehensive river health assessments (Sustainable Rivers Audit (Davies *et al.*, 2013); and Index of Stream Condition (DELWP, 2013)) indicate that the lowlands of the Campaspe are modified from 'natural' condition, with their overall ratings describing the ecosystem health as moderate.

“Index of Stream Condition brings together data from a variety of sources to give a detailed overview picture of river and stream condition across the State. The ISC is made up of five subindices – hydrology, streamside zone, physical form, water quality and aquatic life.”

“This score is then categorised into one of five broad condition bands – excellent, good, moderate, poor or very poor. ”

Index of stream Condition: The Third Benchmark of Victorian River Condition (DEPI 2013)

The Index of Stream Condition Aquatic Life sub-index (based on the number and type of aquatic macroinvertebrates found within the river) classified the aquatic life in lower Campaspe River as being in moderate condition (DELWP 2013), with the majority of reaches in the Campaspe being classified as either poor or moderate condition. The generally lower scores in the Campaspe River basin could be attributed to the highly modified hydrology and environment (DELWP 2013), however it is notable that the hydrology of reaches in the lower Campaspe River has water available from Lake Eppalock for environmental water.

### 3.2.5 Aquatic weeds

Table 1 details the current known distribution and likelihood of occurrence of aquatic weeds within the vicinity of the Study Area. No listed aquatic weeds were observed in the RoW during the site surveys, however Willow trees (*Salix* spp.) and Arrowhead (*Sagittaria platyphylla* & *S. montevidensis*) are known from the broader Study Area.

Table 1 National and State-listed Aquatic Weed Species

Common Name	Scientific Name	Legislation			Distribution within Study Area	Description
		Weed of National Significance	NSW Noxious Weed	Vic Noxious Weed		
Alligator Weed	<i>Alternanthera philoxeroides</i>	X	X	X	Potential to occur	Alligator weed is a perennial herb that forms dense root systems close to the banks and then extends dense floating mats over the surface and chokes the waterway. It is harmful to water quality, native plants and animals, flow, aesthetics and can degrade pasture and crop yields.
Willow Species (except Weeping Willow, Pussy Willow, and Sterile Pussy Willow)	<i>Salix</i> spp. (Except <i>S.babylonica</i> , <i>S.x.calodendron</i> and <i>S.x.reichardtii</i> )	X		X	Known to occur	Willow species encroach on waterways increasing erosion and flooding, reducing water quality and flow, and available habitat for native plants and animals.
Cabomba	<i>Cabomba caroliniana</i>	X	X	X	Potential to occur	Fully submerged aquatic plant with prolific growth rates. Cabomba infestations reduce water quality and species diversity within waterways, impact on capacity and reduce recreation activities.
Sagittaria spp. Including Arrowhead	<i>Sagittaria platyphylla</i>  <i>Sagittaria montevidensis</i>	X	X		Known to occur	A highly invasive densely growing aquatic plant that forms large monocultures within waterways reducing flow, increasing sedimentation and reduced aquatic biodiversity.
Salvinia	<i>Salvinia molesta</i>	X	X		Potential to occur	Commonly grown free floating aquatic fern that reduces aquatic biodiversity by reducing light within the water column and consequently killing all submerged aquatic plants and eventually aquatic fauna.
Water Hyacinth	<i>Eichhornia crassipes</i>	X	X	X	Potential to occur	An ornamental freshwater plant that reduces aquatic biodiversity, impacts water storages, irrigation infrastructure recreation and amenity values.

Common Name	Scientific Name	Legislation			Distribution within Study Area	Description
		Weed of National Significance	NSW Noxious Weed	Vic Noxious Weed		
Hymenachne	<i>Hymenachne amplexicaulis</i>	X	X		Potential to occur	A semi aquatic perineal grass that displaces native plants, reduces biodiversity and threatens native fish populations and wetland habitats
East Indian Hygrophila or Indian Swamp Weed	<i>Hygrophila polysperma</i>		X		Potential to occur	A fast growing and fast spreading perineal freshwater herb that reduces aquatic plant diversity.
Heteranthera	<i>Heteranthera reniformis</i>		X		Potential to occur	A sprawling annual or perineal aquatic plant that threatens native vegetation and freshwater aquatic habitats.
Horsetails	<i>Equisetum</i> spp.		X		Potential to occur	Non flowering highly invasive perineal plant that is highly toxic to livestock and reduces species diversity.
Leafy elodea/Dense Waterweed	<i>Egeria densa</i>		X	X	Potential to occur	A submerged aquatic perineal plant that occurs in nutrient rich slow flowing waterways restricting flow, aquatic biodiversity and recreation as well as increasing siltation.
Senegal tea plant	<i>Gymnocoronis spilanthoides</i>		X		Potential to occur	A highly invasive and rapid growing aquatic weed that impedes flow, ecosystem function and recreation activities.

### 3.2.6 Aquatic pathogens

Pathogens may be defined as a bacterium, virus or other microorganism that may cause illness or death to (in this case) aquatic fauna. Based on data obtained from DPI (DPI NSW, 2015) Epizootic Haematopoietic Necrosis Virus (EHNV) has the potential to occur within the Study Area. Although primarily know to affect Redfin Perch and Rainbow Trout it also has the potential to negatively impact native fish species. EHNV has been documented in the [upper Murrumbidgee catchment in NSW](#), the Broken River catchment in Victoria and the lower Murray Darling catchment in South Australia. At present EHNV is thought to be absent from the middle, western, and northern portions of the Murray Darling Basin (DPI NSW, 2015), and thus considered absent from the Study Area at present.



### 3.3 Significant species

#### 3.3.1 Desktop review

##### ***Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Protected Matters Search Tool***

Aquatic Matters of National Environmental Significance (NES) listed under the EPBC Act previously identified within the Study Area were investigated using the Protected Matters Search Tool (PMST) (DoE, 2014a). This tool lists species, species habitat, populations and ecological communities that are likely to occur, or may occur within the Study Area.

The EPBC Act defines the following categories for describing the status of native threatened species of NES:

**Extinct in the wild** - known only to survive in cultivation, in captivity or as a naturalised population well outside its past range.

**Critically endangered** - facing an extremely high risk of extinction in the wild in the immediate future.

**Endangered** - facing a very high risk of extinction in the wild in the near future.

**Vulnerable** - facing a high risk of extinction in the wild in the medium term future.

Aquatic Matters of NES identified in the search include five fish and three aquatic plant species.

- Murray Hardyhead *Craterocephalus fluviatilis* – listed as Endangered with habitat that may occur within the Study Area
- Murray Cod *Maccullochella peelii peelii* – listed as Vulnerable with habitat that may occur within the Study Area
- Macquarie Perch *Macquaria australasica* – listed as Endangered with habitat that may occur within the Study Area
- Silver Perch *Bidyanus bidyanus* – Listed as Critically Endangered with habitat known to occur within the Study Area
- Trout Cod *Maccullochella macquariensis* – listed as Endangered with habitat known to occur within the Study Area
- River Swamp Wallaby Grass *Ampibromus fluitans* – listed as Vulnerable with habitat that may occur within the Study Area
- Western Water-Starwort *Callitriche cyclocarpa* – listed as Vulnerable with habitat likely to occur within the Study Area
- Ridged Water Milfoil *Myriophyllum porcatum* – listed as Vulnerable with habitat likely to occur within the Study Area

An assessment of the likelihood of these species occurring in the Study Area is provided in Section 3.3.3.

### **Victorian DELWP Data Victorian Biodiversity Atlas (VBA 2014)**

The VBA contains historical records of native and exotic flora and fauna collected or observed within Victoria. The database is maintained by the Victorian DELWP, and threatened species listed under EPBC Act, Victorian FFG Act or the DELWP threatened species advisory lists are able to be identified.

The FFG Act lists flora or fauna species that are in a demonstrable state of decline which is likely to result in extinction or if it is significantly prone to future threats which are likely to result in extinction. There is no differentiation between the conservation status of FFG Act listed species.

The DEPI threatened species advisory lists are based on technical information and advice obtained from a range of experts. The information in these lists may be of use in setting priorities for actions to conserve biodiversity. These advisory lists are not the same as the Threatened List established under the Victorian FFG Act. There are no direct legal requirements or consequences that flow from inclusion of a species in advisory lists. Also, some of the species in these advisory lists are also listed as threatened under the FFG Act. The advisory list defines the following categories for describing the conservation status:

**Extinct** - no reasonable doubt that the last individual has died

**Regionally Extinct** - as for Extinct but within a defined region (in this case the state of Victoria) that does not encompass the entire geographic range of the taxon

**Extinct in the Wild** - known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range

**Critically Endangered** - facing an extremely high risk of extinction in the wild

**Endangered** - facing a very high risk of extinction in the wild

**Vulnerable** - facing a high risk of extinction in the wild

**Near Threatened** - does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for, or is likely to qualify for, a threatened category in the near future

**Data Deficient** - there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat.

The VBA was queried for accounts of aquatic flora and fauna species previously recorded as occurring in the Study Area. The taxon types included in the search are dicotyledons, monocotyledons, reptiles, fish, mussels, decapod crustacean, aquatic invertebrates.

The ten listed threatened species identified from the database searches included:

- Trout Cod *Maccullochella macquariensis* – EPBC Act Endangered, FFG Act listed and DELWP Advisory List as Critically Endangered
- Murray Cod – *Maccullochella peelii peelii* - EPBC Act Vulnerable, FFG Act listed and DELWP Advisory List as Vulnerable
- Macquarie Perch – *Macquaria australasica* - EPBC Act Endangered, FFG Act listed and DELWP Advisory List as Endangered
- Golden Perch *Macquaria ambigua* – DELWP Advisory List as Near Threatened

- Striped Gudgeon *Gobiomorphus australis* – DELWP Advisory List as Near Threatened
- Freshwater Catfish (Eel-tailed Catfish) *Tandanus tandanus* – FFG Act listed and DELWP Advisory List as Endangered
- Flat-headed Galaxias *Galaxias rostratus* – DELWP Advisory List as Vulnerable
- Southern Pygmy Perch (Murray Darling Lineage) *Nannoperca australis* – DELWP Advisory List as Vulnerable
- River Snail *Notopala sublineata* – FFG Act listed and DELWP Advisory List as Critically Endangered
- Murray Spiny Crayfish *Euastacus armatus* – FFG Act listed and DELWP Advisory List as Near Threatened
- Murray River Turtle *Emydura macquarii* – DELWP Advisory List as Vulnerable

In addition, although no records were retrieved from the VBA database search, Silver Perch (FFG Act listed and DELWP Advisory List as Vulnerable) are known to occur in the area. Likewise, habitat exists that is suitable for Murray Hardyhead (FFG Act listed and DELWP Advisory List as Critically Endangered) within the Study Area although no records have been observed.

An assessment of the likelihood of these listed species occurring in the Study Area is provided in Section 3.3.3.

#### **Atlas of NSW Wildlife**

The Atlas of NSW Wildlife (DECCW 2014) was queried for records occurring in the assessment area. One threatened aquatic flora species was returned in this search:

- River Swamp Wallaby Grass *Ampibromus fluitans* – listed as Vulnerable and protected under EPBC Act.

No aquatic fauna species were returned in the search.

#### **NSW Threatened Fish, Aquatic Invertebrates and Marine Vegetation**

The list of threatened fish, aquatic invertebrates and marine vegetation protected under the NSW *Fisheries Management Act 1994* (FM Act) (DPI, 2014) was cross checked against the other database search records of aquatic species recorded in the Study Area.

The FM Act defines the following categories for describing the status of threatened species:

**Presumed Extinct** – not recorded in its known or expected habitat in NSW

**Critically Endangered** – facing an extremely high risk of extinction in NSW in the immediate future

**Endangered** – facing a very high risk of extinction in NSW in the near future

**Vulnerable** – facing a high risk of extinction in NSW in the medium-term future

**Endangered Population** – a group of a single species occupying a particular area facing a very high risk of extinction in NSW in the near future

**Endangered Ecological Community** – an assemblage of flora and fauna occupying a particular area facing a very high risk of extinction in NSW in the near future

Eight FM Act listed species were identified, including:

- Macquarie Perch *Macquaria australasica* – listed as Endangered
- Murray Hardyhead *Craterocephalus fluviatilis* – listed as Critically Endangered
- Silver Perch *Bidyanus bidyanus* – listed as Vulnerable
- Trout Cod *Maccullochella macquariensis* – listed as Endangered
- Flatheaded Galaxias *Galaxias rostratus* – listed as Critically Endangered
- Murray Crayfish *Euastacus armatus* – listed as Vulnerable
- River snail *Notopala sublineata* – listed as Endangered
- Southern Pygmy Perch *Nannoperca australis* – listed as Endangered.

Other matters identified by this search included:

- Endangered Population: Murray-Darling Basin population of Eel-tailed Catfish (Freshwater Catfish) *Tandanus tandanus*. This species has been recorded in the Study Area; and
- Endangered Ecological Community (EEC): Lowland Murray Aquatic EEC. All native fish and aquatic invertebrates within all natural creeks, rivers and associated lagoons, billabongs and lakes of the regulated portions of the Murray, Murrumbidgee and Tumut rivers, as well as all their tributaries and branches are included within this community.

An assessment of the likelihood of these listed species occurring in the Study Area is provided in Section 3.3.3.

### **Literature review**

The aquatic fauna of the Murray and Campaspe River in the vicinity of the Study Area was assessed in 2010 (McGuckin, 2010). In the report McGuckin compiled data from previous studies conducted over the preceding ten years and a survey undertaken between the 25 and 27 August 2010. This document indicates 16 species of fish are present within these adjacent river systems including 12 native and four exotic. The McGuckin report identifies five listed threatened fish species that could potentially occur in the vicinity of the Study Area:

- Silver Perch – *Bidyanus bidyanus*
- Murray Cod – *Maccullochella peelii peelii*
- Trout Cod - *Maccullochella macquariensis*
- Southern Pygmy Perch - *Nannoperca australis*
- Golden Perch - *Macquaria ambigua* (DELWP Advisory List only)

The full species list is included in Appendix A.

An Environmental Watering Plan for the Campaspe River was developed by North Central Catchment Management Authority (NCCMA) in 2010. The Interim Plan identified 10 native species including three migratory species, as being present in the Campaspe River (NCCMA 2010).

The study into Matters of National Environmental Significance (MNES) (Brett Lane & Associates 2013) identified the potential for three EBPC listed aquatic flora species to be present in the Campaspe River. Initial and targeted flora surveys undertaken in 2011 as part of the MNES study (Brett Lane & Associates 2013), did not reveal the presence of such species, and concluded that the Project would not significantly affect listed flora species.

An assessment of the likelihood of these listed species occurring in the Study Area is provided in Section 3.3.3.



### 3.3.2 Field surveys

Fish surveys undertaken by GHD in the Boundary Road Wetlands as part of this existing conditions assessment collected no EPBC or NSW FM Act listed species.

Only a single native fish species was recorded – Carp Gudgeon *Hypseleotris* sp.

One exotic fish species were collected in the wetlands – Oriental Weather Loach *Misgurnus anguillicaudatus*.

The Boundary Road Wetlands is not considered likely to provide significant habitat suitable for listed threatened fish species. The low connectedness with the main Murray channel, high disturbance and water quality impacts of stormwater inputs reduce the quality of this aquatic habitat.

### 3.3.3 Likelihood of threatened species occurrence assessment

For the identified Commonwealth and State listed threatened species, a “likelihood of occurrence assessment” was undertaken to determine those species likely to occur in the Study Area (Likelihood Assessment). The aim of the Likelihood Assessment is to determine whether identified Commonwealth and State listed threatened species have been previously recorded in the vicinity of the Study Area and to make an assessment of how likely they are to occur and therefore be impacted upon by the Project. This likelihood assessment is based on the opinion of experienced and qualified aquatic ecologists, using recent historical records of the presence of species within the Study Area, and/or the presence of suitable species habitat within the study area together with suitable populations in waterways within the region if not recorded from within the Study Area.

The Likelihood Assessment is provided in Table 2. Where a species was assessed as being unlikely to occur, it was given no further consideration. Of the 16 listed threatened species identified in the Likelihood Assessment the following eight were assessed as either being likely to occur or possibly occurring in the Study Area:

- Likely to occur:
  - Murray Cod
  - Silver Perch
  - Golden Perch
  - Murray Spiny Crayfish
- Possibly occur:
  - Trout Cod
  - Freshwater (Eel-tailed) Catfish
  - Flatheaded Galaxias
  - Murray River Turtle

Table 2 Likelihood of threatened species occurrence assessment

Common Name	Scientific Name	EPBC Act	Vic FFG Act	Vic DELWP Advisory List	NSW FM Act	NSW TSC Act	Comments
Murray Hardyhead	<i>Craterocephalus fluvialtilis</i>	En	L	CE	CE		Unlikely Previously known to occur in the Murray River. Only one record in NSW in last 30 years, from Darling River near Wentworth. In Victoria, only known from few lakes near Mildura and near Swan Hill and Kerang (DoE 2014b).
Murray Cod	<i>Maccullochella peelii peelii</i>	Vu	L	Vu			Likely Species is known to occur throughout the Murray Darling Basin (Allen <i>et al</i> 2003) and in the Study Area where it is a regular recreational fishing target species.
Macquarie Perch	<i>Macquaria australasica</i>	En	L	En	En		Unlikely Species was known to occur in the middle reaches of the Murray River (Lintermans 2007, Allen <i>et al</i> 2003) before 1980, but now is known to exist in the upper reaches of the Murray Basin.
Silver Perch	<i>Bidyanus bidyanus</i>	CE	L	Vu	Vu		Likely Species has been found in recent fish surveys in both the Murray and Campaspe Rivers (Lintermans 2007) and in the Study Area (McGuckin 2010) where it is a regular recreational fishing target species.
Trout Cod	<i>Maccullochella macquariensis</i>	En	L	CE	En		Possible Formerly widespread in southern Murray Darling Basin, there are no records of Trout Cod near Echuca-Moama since 1970. Restocking has been undertaken in the Murray and tributaries upstream. Suitable habitat present in both Murray and Campaspe River, and so Trout Cod could occasionally be found in the Study Area.
River Swamp Wallaby Grass	<i>Ampibromus fluitans</i>	Vu				Vu	Unlikely Confined to permanent swamps principally along the Murray River between Wodonga and Echuca-Moama (Walsh 1994). Suitable habitat in Forested Wetland habitat in New South Wales. Not recorded during targeted flora survey (BL&A 2013). (Common Swamp Wallaby-grass, <i>Amphibromus nervosus</i> recorded commonly in NSW)

Common Name	Scientific Name	EPBC Act	Vic FFG Act	Vic DELWP Advisory List	NSW FM Act	NSW TSC Act	Comments
Western Water-starwort	<i>Callitriche cyclocarpa</i>	Vu	L	Vu		Vu	Unlikely NSW and Victoria in thick patches in floodwaters (DEC 2005). Mostly aquatic, in damp, swampy places (Jeanes, 1999). Suitable habitat in Forested Wetland habitat in New South Wales. Not recorded during targeted survey in known flowering period (BL&A 2013), nor detected in aquatic field survey.
Ridged Water Milfoil	<i>Myriophyllum porcatum</i>	Vu	L	Vu			Unlikely Rare and restricted to northern and north western Victoria where it has been recorded growing in temporary waterholes, lagoons, farm dams, and rock holes and on clay pans (Jeanes 1996a). Endemic to Victoria. Does not occur in NSW. Ground layer of River Redgum dominated woodland on the Victorian side of the Study Area is highly degraded and disturbed.
Flatheaded Galaxias	<i>Galaxias rostratus</i>			Vu	CE		Possible Known from the southern Murray Darling basin. Considered a difficult fish to survey (Lintermans 2007), with very few records in the past 15 years. In NSW, now only known from the upper Murray River near Tintaldra (DPI NSW 2012). In Victoria, the species is known from Murray catchment, including Goulburn, Loddon and Campaspe catchments.
Freshwater (Eel-tailed) Catfish	<i>Tandanus tandanus</i>		L	En	E <sup>1</sup>		Possible Species is widespread throughout the Murray Darling Basin (Lintermans 2007), but generally prefers lower, slow flowing rivers. No records from the Murray or Campaspe Rivers near the Study Area since 1950, but habitat present should be suitable for this species.
Golden Perch	<i>Macquaria ambigua</i>			NT			Likely Species is known to occur throughout the Murray Darling Basin (Allen <i>et al</i> 2003) and in the area where it is a regular recreational fishing target species.

<sup>1</sup> Murray-Darling Basin population



Common Name	Scientific Name	EPBC Act	Vic FFG Act	Vic DELWP Advisory List	NSW FM Act	NSW TSC Act	Comments
River Snail	<i>Notopala sublineata</i>		L	CE	E		Unlikely Endemic to the Murray/Darling Basin, but considered extinct within its natural habitat. Now restricted to a few populations in irrigation pipes near Mildura (DPI NSW 2012).
Murray Spiny Crayfish	<i>Euastacus armatus</i>		L	NT	Vu		Likely Found along the entire length of the Murray River, including numerous records from surveys near Echuca-Moama.
Southern Pygmy Perch	<i>Nannoperca australis</i> (Murray Darling lineage)			Vu	E		Unlikely Species is known to occur in the Murray River catchment, including the Campaspe basin. However the species has disappeared from most locations in NSW (Lintermans 2007) There are no records near Echuca-Moama, and the preferred habit (heavily vegetated waterways (Allen <i>et al</i> 2003)) was not observed within the Study Area.
Striped Gudgeon	<i>Gobiomorphus australis</i>			NT			Unlikely Species is known from coastal catchments only (Allen <i>et al.</i> 2003). Historical record in Campaspe River doubtful.
Murray River Turtle	<i>Emydura macquarii</i>			Vu			Possible Occur across much of the Murray system, and suitable habitat is present in the Study Area.

**EPBC Act**

CE – Critically Endangered

E – Endangered

Vu – Vulnerable

**FFG Act**

L – Listed as Threatened

**Vic DELWP Advisory List**

CE – Critically Endangered

En – Endangered

Vu – Vulnerable

NT – Near Threatened

**NSW FM Act**

CE – Critically Endangered

En – Endangered

Vu – Vulnerable

**NSW TSC Act**

Vu - Vulnerable

## 4. EES scoping requirements

### 4.1 EES evaluation objectives

For the aquatic ecological aspects of the Echuca-Moama Bridge, the relevant draft evaluation objectives, as outlined in the EES Scoping Requirements are:

- **Biodiversity and Habitat**

*To avoid or minimise adverse effects on native vegetation and listed flora and fauna species and ecological communities, and address opportunities for offsetting potential losses consistent with relevant policy*

- **Catchment Values**

*To maintain floodplain functions, hydrology, values of surface water, groundwater and geomorphic stability of proximate sections of the lower Campaspe and Murray Rivers.*

### 4.2 EES scoping requirements

The EES Scoping requirements specific to the scope of this Aquatic Flora and Fauna Impact Assessment are as follows:

- **Biodiversity and Habitat**

**Key issues for objective**

*Degradation to local and downstream aquatic habitat from increase in sedimentation.*

**Priorities for characterising the existing environment**

*Characterise the distribution and quality of biodiversity values that could be affected by the project, including native vegetation, terrestrial and aquatic habitat and patterns of wildlife movement.*

*Identify the existence or likely existence of any listed species or communities and any declared weeds or pathogens.*

*Identify any potentially threatening processes that could result from the project under the FFG Act.*

*This characterisation is to be informed by relevant databases, literature and appropriate targeted and/or seasonal surveys and modelling where appropriate. In the absence of positive identification of the presence of listed species and communities, but where suitable habitat is identified, a precautionary approach to the further investigation and assessment of its occurrence should be applied.*

**Design and mitigation measures**

*Identify and describe the potential and proposed design and mitigation measures, which could avoid or minimise significant effects on native vegetation, and/or any listed flora, fauna and ecological communities and potentially threatening processes.*

**Assessment of likely effects**

*Identify and assess likely direct and indirect effects on native vegetation, ecological communities and the habitat of any listed species of flora and fauna along the alignments.*

**Approach to manage performance**

*Identify proposed measures to further mitigate and manage residual effects of the project, including addressing the offset requirements of Victoria's native vegetation permitted clearing regulations and relevant provisions of planning schemes.*

*Identify in the EES any further methods proposed to manage risks of effects on other biodiversity values and native vegetation, including as part of the EMF and resulting residual effects.*

- **Catchment Values**

**Key issues for objective**

*Potential for the project to have significant effects on the functions, values and beneficial uses of surface water and geomorphic stability of proximate sections of the lower Campaspe and Murray Rivers.*

*Potential for the contamination of soils and groundwater from construction and operation activities, including the exposure and disposal of any waste or contaminated soils.*

**Priorities for characterising the existing environment**

*Identify and characterise relevant surface water and floodplain environments, including in terms of the existing drainage functions, geomorphology and behaviour.*

**Design and mitigation measures**

*Identify proposed measures to mitigate any potential effects, including any relevant features or preventative techniques to be employed during construction.*

**Assessment of likely effects**

*Identify potential effects on the functions, values and beneficial uses of surface water and geomorphic stability of proximate sections of the lower Campaspe and Murray rivers.*

**Approach to manage performance**

*Identify any additional measures to manage and monitor effects on catchment values and identify likely residual effects.*



## 5. Legislation, policies and guidelines

As part of this Aquatic Flora and Fauna Impact Assessment for the Project, it has been necessary to review and consider any relevant legislation, policies or guidelines that apply. As the project crosses NSW – Victoria border, the aquatic flora and fauna, aquatic ecosystems and aquatic habitats considered in the Study Area are unlikely to be specific to only one or the other state. Therefore management of aquatic flora and fauna should consider all legislation as relevant to the entire Study Area. For example, the presence of Victorian listed threatened species in the Murray River (NSW) should be managed as though the species are located in Victoria. And correspondingly, NSW listed threatened species should be afforded equal protection in the Campaspe River (Victoria).

### 5.1 Commonwealth

#### ***Environment Protection Biodiversity Conservation Act 1999***

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to promote the conservation of biodiversity by providing protection for threatened species, threatened ecological communities, migratory and marine species and other protected matters. The Matters of National Environmental Significance listed under the EPBC Act 1999 relevant to this assessment are:

- Wetlands of International Significance (Ramsar Sites)
- Threatened Species and Ecological Communities
- Migratory Species

Based on the desktop assessment and survey referred to in earlier chapters of this report, there are several listed threatened fish species that may occur in the vicinity of the Study Area (Table 2). Of particular importance to the proposed Project is the likely presence of the EPBC Act listed species:

- Silver Perch (Critically Endangered)
- Trout Cod (Endangered)
- Murray Cod (Vulnerable)

No Wetlands of international Importance (Ramsar sites) are located within the Study Area. Five Ramsar sites are located downstream of the Study Area. These are:

- Gunbower Forest
- NSW Central Murray state forests
- Banrock Station Wetland complex
- Riverland
- Coorong and Lakes Alexandrina and Albert

There are no aquatic EPBC listed Migratory Species.

## 5.2 State

### 5.2.1 New South Wales

The following legislation is relevant to the Murray River, and the associated floodplain habitat and wetlands on the NSW side of the Murray River.

#### ***Threatened Species Conservation Act 1995 (TSC Act NSW)***

The *Threatened Species Conservation Act 1995* (TSC Act (NSW)) lists threatened species, populations or ecological communities in NSW. Proponents should identify if their project is likely to have a significant impact on threatened biota, or their habitats. If any species or habitats could be impacted by the proposal, an Assessment of Significance that addresses the requirements of section 5A of the *Environmental Planning and Assessment Act 1979* must be completed.

#### ***Fisheries Management Act 1994 (FM Act (NSW))***

The *Fisheries Management Act 1994* (FM Act (NSW)) aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations including conserving fish stocks and fish habitat and promoting ecologically sustainable development.

The FM Act requires an assessment of whether threatened species of fish and marine vegetation, populations or ecological communities are likely to be affected by the activity. If a significant effect on the threatened species is likely, a Species Impact Statement must be completed and consultation with NSW Fisheries would be required.

The Project potentially triggers a number of key threatening process listed under the FM Act (NSW) including:

- The removal of large woody debris from NSW rivers and streams;
- The degradation of native riparian vegetation along New South Wales water courses; and
- Instream structures and other mechanisms that alter natural flow.

#### ***State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)***

*State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) aims to facilitate the effective delivery of infrastructure across the State of NSW. Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. As the Project is for a road and is to be carried out by Roads and Maritime in conjunction with VicRoads, development consent from council is not required. The proposal is therefore to be assessed under Part 5 of the New South Wales *Environmental Planning and Assessment Act* (1979) (EP&A Act). The effect on threatened species, populations or ecological communities, or their habitats needs to be determined under section 5A of the EP&A Act. This involves the application of the Assessment of significance detailed in section 5A of the Act, and as required by the TSC Act in accordance with relevant assessment guidelines.

The Project is not located on land reserved under the New South Wales National Parks and Wildlife Act (1974) (NPW Act) and does not affect land or development regulated by *State Environmental Planning Policy No. 14 - Coastal Wetlands*, *State Environmental Planning Policy No. 26 - Littoral Rainforests* or *State Environmental Planning Policy (Major Projects) 2005*. Part 2 of ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), would be discussed in the Review of Environmental Factors (REF).

### ***Murray Regional Environmental Plan No 2—Riverine Land (MREP2)***

Murray Regional Environmental Plan No 2 – Riverine Land (MREP 2) has been deemed a State Environmental Planning Policy from 1 July 2009. The aims of MREP 2 are to conserve and enhance the riverine environment of the River Murray for the benefit of all users. It covers the riverine land of the River Murray. The Murray Shire is one of 11 Local Government Areas (LGA) to which MREP 2 applies.

Clause 8(c) states that the planning principles set out in Part 2 (clauses 9 and 10) must be applied when a public authority or person proposes to carry out a development which does not require development consent but which has the potential to adversely affect the riverine environment of the River Murray. As the Project has the potential to adversely affect the riverine environment through clearing of native vegetation and construction on the Murray River floodplain, consultation with Murray Shire Council should be undertaken in accordance with MREP 2.

#### **5.2.2 Victoria**

The following Victorian legislation is applicable to the Campaspe River, and the associated floodplain and wetland habitats. This legislation is also relevant to the Murray floodplain and wetland habitats on the Victorian side of the Murray River.

### ***Planning and Environment Act 1987 (Victoria)***

The Planning and Environment Act establishes a framework for planning the use, development and protection of land in Victoria in the present and long-term interests of all Victorians.

The Act provides for a single instrument of planning control, the planning scheme, which sets out the way in which land may be used or developed. The planning scheme is a legal document, prepared and approved under the Act.

### ***Campaspe Planning Scheme***

A planning scheme sets out objectives, policies and provisions relating to the use, development, protection and conservation of land in the area to which it applies. The applicable planning scheme within the Victorian proportion of the Study Area is the Campaspe Planning Scheme. A set of standard provisions called the Victoria Planning Provisions (VPP) forms a template for all planning schemes. Included in the VPP is the State Planning Policy Framework (SPPF), which covers strategic issues of State importance. Also included in planning schemes are the Local Planning Policy Framework (LPPF) which sets a local and regional strategic policy context for a municipality and consists of the Municipal Strategic Statement (MSS) and specific local planning policies.

The following provides a brief summary of the clauses of the SPPF and LPPF, including planning zones and overlays that apply to the Project and are of relevance to the Aquatic Flora and Fauna Impact Assessment. The objectives of the following planning scheme zones and overlays for the Shire of Campaspe are consistent with the environmental requirements of this project.



Table 3 Campaspe state and local planning policies

Clause	Relevant objectives	Relevant strategies
<b>SPPF 11.11-4 Environmental assets</b>	To manage the region's environmental and cultural heritage assets and minimise exposure to natural hazards.	Protect the region's environmental assets and values, particularly those associated with significant wetlands and the Murray River.
<b>SPPF 12.01-1 Protection of biodiversity</b>	To assist the protection and conservation of Victoria's biodiversity, including important habitat for Victoria's flora and fauna and other strategically valuable biodiversity sites.	<p>Use statewide biodiversity information to identify high value biodiversity and consider the impact of land use and development on these values.</p> <p>Ensure strategic planning:</p> <ul style="list-style-type: none"> <li>• Avoids and minimises significant impacts, including cumulative impacts, of land use and development on Victoria's biodiversity.</li> <li>• Assists in the protection and management of sites containing high value biodiversity.</li> <li>• Assists in the re-establishment of links between isolated habitat remnants that contain high value biodiversity.</li> </ul> <p>Ensure that decision making takes into account the impacts of land use and development on Victoria's high value biodiversity.</p> <p>Considers impacts of any change in land-use or development that may affect the biodiversity value of adjoining national parks and conservation reserves or nationally and internationally significant sites including wetlands and wetland wildlife habitat designated under the Convention on Wetlands of International Importance (the Ramsar Convention), and sites utilised by species designated under the Japan-Australia Migratory Birds Agreement (JAMBA) or the China-Australia Migratory Birds Agreement (CAMBA).</p>
<b>SPPF 13.02-1 Floodplain management</b>	To assist the protection of floodplain areas of environmental significance or of importance to river health.	Locate developments and uses which involve the storage or disposal of environmentally hazardous industrial and agricultural chemicals or wastes and other dangerous goods (including intensive animal industries and sewage treatment plants) away from floodplains unless site design and management is such that potential contact between such substances and floodwaters is prevented, without affecting the flood carrying and flood storage functions of the floodplain.

Clause	Relevant objectives	Relevant strategies
<b>SPPF 14.02-1 Catchment planning and management</b>	To assist the protection and, where possible, restoration of catchments, waterways, water bodies, groundwater, and the marine environment.	<p>Protect water catchments and water supply facilities to ensure the continued availability of clean, high-quality drinking water.</p> <p>Consider the impacts of catchment management on downstream water quality and freshwater, coastal and marine environments.</p> <p>Undertake measures to minimise the quantity and retard the flow of stormwater runoff from developed areas.</p> <p>Encourage measures to filter sediment and wastes from stormwater prior to its discharge into waterways, including the preservation of floodplain or other land for wetlands and retention basins.</p> <p>Ensure that works at or near waterways provide for the protection and enhancement of the environmental qualities of waterways and their in-stream uses.</p> <p>Require the use of appropriate measures to restrict sediment discharges from construction sites.</p>
<b>SPPF 14.02-2 Water quality</b>	To protect water quality.	<p>Protect reservoirs, water mains and local storage facilities from potential contamination.</p> <p>Ensure that land use activities potentially discharging contaminated runoff or wastes to waterways are sited and managed to minimise such discharges and to protect the quality of surface water and groundwater resources, rivers, streams, wetlands, estuaries and marine environments.</p>
<b>LPPF 21.04-2 Environment</b>	<p><b>Water</b></p> <p>To ensure that the quality, quantity and availability of water is maintained.</p> <p>To ensure any new use or development does not cause water pollution or land degradation.</p> <p>To protect the health of waterways, wetlands and floodplain areas of environmental significance.</p> <p>To protect the environmental importance of the Murray River.</p> <p>To protect the surface waters and ground waters in the Loddon, Campaspe and Goulburn Basin catchments from stormwater pollutants and the impacts of peak stormwater flows.</p>	<p><b>Water</b></p> <p>Ensure that development proposals do not impact detrimentally on the quantity and quality of surface water, groundwater or infrastructure such as dams, irrigation channels and drainage systems.</p> <p>Protect waterways, wetlands and floodplain areas of environmental significance.</p> <p>Ensure effective design and construction of wetlands and stormwater pollutant traps.</p> <p>Encourage developments on land abutting Waranga Basin or any watercourses or waterways to make provision for vegetated riparian buffer zones along foreshores and stream banks to improve water quality, local amenity and biodiversity values.</p> <p>Provide greater flexibility in engineering standards and allow for water sensitive urban design techniques.</p> <p>Implement the best practice performance objectives set out in the Urban Stormwater Best Practice Environment Management Guidelines.</p> <p>Minimise stormwater pollutants and peak stormwater flows at the source in accordance with the best practice performance objectives.</p> <p>Promote the use of water sensitive urban design, including stormwater reuse.</p>

Clause	Relevant objectives	Relevant strategies
	<b>Biodiversity</b> To protect, manage and restore native vegetation, including grasslands and wetland vegetation.	Encourage the retention of existing riparian vegetation.
	<b>Murray River corridor</b> To protect the environs of the Murray River recognising its importance for nature conservation, flooding, economic development, recreation and tourism.	Protect and enhance the biodiversity, ecological, and cultural values of the waterway.  Prevent the loss of riparian flora and fauna, biodiversity, habitat and wetland environments

Table 4 Zones and overlays

Zone/Overlay	Purpose
<b>36.03 Public Conservation and Resource Zone</b>	To implement the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.  To protect and conserve the natural environment and natural processes for their historic, scientific, landscape, habitat or cultural values.
<b>42.01 Schedule 1 - Environmental Significance Overlay 1</b>	<b>MURRAY RIVER CORRIDOR</b> Environmental objectives to be achieved: <ul style="list-style-type: none"> <li>To promote consistent planning and management along the Murray River corridor.</li> <li>To protect the environs of the Murray River recognising its importance for nature conservation, flooding, economic development, recreation and tourism.</li> <li>To protect and enhance the biodiversity, ecological, and cultural values of waterways.</li> <li>To prevent the loss of riparian flora and fauna, biodiversity, habitat and wetland environments.</li> <li>To protect the values and role of the Murray River reserves and other public land as floodplains and as buffer areas for nutrients and other pollutants.</li> <li>To specifically address land degradation processes including erosion, native vegetation decline, pollution of ground or surface water, groundwater accession, salinisation and soil acidity, and adverse effects on the quality of land and water habitats.</li> </ul>
<b>44.03 Flood Overlay</b>	To implement the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.  To identify waterways, major floodpaths, drainage depressions and high hazard areas which have the greatest risk and frequency of being affected by flooding.  To ensure that development maintains or improves river and wetland health, waterway protection and flood plain health.



### **Flora and Fauna Guarantee Act 1988 (Victoria)**

The Flora and Fauna Guarantee (FFG) Act provides for the protection of species, the management of threats, the promotion of community conservation initiatives and a regulatory structure for flora and fauna conservation in Victoria. The Act covers both vertebrates and invertebrates in terrestrial and aquatic habitats.

FFG-listed species which have been collected in the vicinity of the Study Area or are likely to occur are:

- Freshwater Catfish (Eel-tailed Catfish) – *Tandanus tandanus*
- Murray Cod – *Maccullochella peelii peelii*
- Silver Perch – *Bidyanus bidyanus*
- Trout Cod – *Maccullochella macquariensis*

Table 5 lists the FFG Act Threatening Processes which may result due to the Echuca Bridge Project. The Project must provide details on how it will address the impact by proposing mitigation measures which will avoid, minimise or reduce the impact of the threatening process.

**Table 5 Summary of threatening processes (as listed under the FFG Act (1988)) applicable to the Echuca-Moama Bridge Project**

Process
Alteration to the natural flow regimes of rivers and streams
Input of toxic substances into Victorian rivers and streams
Degradation of native riparian vegetation along Victorian rivers and streams
Increase in sediment input into Victorian rivers and streams due to human activities
Removal of wood debris from Victorian streams

### **Environment Protection Act 1970 and State Environmental Protection Policy (Waters of Victoria) 2003 (Victoria)**

The *Environmental Protection Act (1970)* allowed for the creation of the *State Environmental Protection Policy (Waters of Victoria) 2003 (SEPP WoV)* (Victorian Government 2003), which applies to all surface waters of Victoria. SEPP (WoV) aims to provide a coordinated approach for the protection and, where necessary, rehabilitation of the health of Victoria's water environments.

The SEPP (WoV) identifies 'beneficial uses' of waterways and establishes environmental quality objectives at levels that will ensure the protection of these uses. SEPPs are legally enforceable statutory instruments. When undertaking works on or adjacent to surface water systems, management measures need to be implemented to minimise environmental risks to aquatic ecosystems and to protect other beneficial uses. When undertaking works on or adjacent to surface water systems, the SEPP will require management measures to be implemented to minimise environmental risks to the aquatic ecosystem and to protect beneficial uses.

Impacts to water quality must not exceed water quality objectives specified to protect beneficial uses, unless extensive modification or natural variation precludes this attainment. In such situations the background level becomes the objective. Relevant clauses of this policy must be adhered to. The following clauses (with a brief description of relevant aspects) are applicable to the Project:

#### Clause 43 – Surface water management and works

- Minimise unnatural erosion, sediment re-suspension and other risks to aquatic habitat.
- Ensure that existing and new *in situ* structures do not pose a barrier to fish movement.

#### Clause 53 – Aquatic and riparian vegetation protection and rehabilitation

- Minimise the removal of, and rehabilitate native vegetation within or adjacent to surface waters.

#### Clause 56 - Construction activities

- Minimise soil erosion, land disturbance and discharge of sediment and other pollutants to surface waters.
- Where construction activities impinge on surface waters, construction managers need to monitor affected surface waters to assess whether beneficial uses are being protected.

#### Clause 57 – Roads

- Manage roads and infrastructure to minimise erosion and sediment and pollutant transport.
- Maintain roads that adjoin surface waters to minimise sediment runoff.

#### ***Catchment and Land Protection Act 1994 (CaLP Act)***

The *Catchment and Land Protection Act 1994* (CaLP Act) has the objective of establishing a framework for the integrated and coordinated management of catchments that will:

- Maintain and enhance long-term land productivity while also conserving the environment; and
- Aim to ensure that the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced.

The CaLP Act establishes Catchment Management Authorities (CMAs) and provides for the development of Regional Catchment Strategies that must assess the nature, causes, extent and severity of land degradation of the catchments in the region and identify areas for priority attention. The Project is located in the North Central CMA region and therefore falls under the NCCMA Regional Catchment Management Strategy (NCCMA 2013). This Strategy lists objectives that are aimed at improving the condition of waterways within the region. In relation to the lower Campaspe River the objective is to:

- Improve the condition of the lower Campaspe River from 'moderate' to 'good' (based on Index of stream Condition by 2050).

The Project should take the above strategy into account. Specifically, it should avoid adding to the deterioration of river health which could decrease the likelihood of achieving the NCCMA Regional Catchment Management Strategy objectives.

#### ***Water Act 1989 (Vic)***

The *Water Act 1989* (Water Act) is intended to ensure that water resources are conserved and properly managed for sustainable use for the benefit of present and future Victorians. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses and to provide for the protection of catchment conditions.

Part 10 of the *Water Act* outlines the Waterway Management responsibilities and requirements for regional drainage and floodplain management, as relevant to the Authorities responsible for waterway management districts. Any works undertaken in and around waterways and their floodplains will need to be undertaken in accordance with the *Water Act (1989)*. North Central Catchment Management Authority (NCCMA), as caretakers for river health under the *Water Act (1989)* are responsible for issuing licences for works on waterways and therefore VicRoads will require a licence (Works on Waterways) from NCCMA prior to undertaking the works.

#### ***Fisheries Act 1995 (Vic)***

One of the objectives of the *Fisheries Act 1995* (Fisheries Act) is to protect and conserve fisheries resources, habitats and ecosystems including the maintenance of aquatic ecological processes and genetic diversity. One of the provisions of the Fisheries Act is that fish passageway must not be blocked.

FFG-listed fish are also protected under the *Fisheries Act 1995* and may not be taken without authorisation under both Acts. Recreational angling is a popular activity downstream from the Study Area, and in accordance with the Fisheries Act 1995, the bridge development should not impede this activity and the ecologically sustainable management and development of the fishery in the future.

#### ***Wildlife Act 1975 (Vic)***

The *Wildlife Act 1975* (Wildlife Act) forms the procedural, administrative and operational basis for the protection and conservation of native wildlife within Victoria. The Wildlife Act often sits as the default reference for other associated legislation, and is the basis for the majority of Wildlife permit/licensing requirements within the state.

In accordance with the Wildlife Act, a permit is required to take (including salvage and translocation during the construction activities) or destroy wildlife.

## 6. Impact assessment

The detailed Aquatic Flora and Fauna Impact Assessment documented in this report addresses the potential aquatic flora and fauna impacts of the construction and operation of the Project.

The impacts of the Project, together with proposed mitigation measures, are considered in detail through the environmental risk assessment process. The details of the risk assessment process undertaken for the Project are outlined in the EES.

Relevant sections of the environmental risk register are provided in this report and the identified impacts of the Mid-West Option is considered in detail in the following sections.

### 6.1 Benefits and opportunities

No potential benefits to aquatic flora and fauna values were identified.

### 6.2 Impacts

#### 6.2.1 Impacts to Lower Murray Endangered Ecological Community

The degradation of Murray River aquatic ecosystems may occur through bridge construction activities negatively impacting water quality, habitat quality or directly impacting flora and fauna species. Based on standard river health indicators, the condition of macroinvertebrate assemblages is considered very poor, and fish assemblages are considered poor in the Murray River at Echuca-Moama (DECCW 2010). Given that the existing site conditions are poor, the risk from the proposed bridge to the Study Area is considered to be low, should all standard VicRoads and Roads and Maritime controls be implemented, and therefore the overall impact is considered to be minor.

Appendix B provides full details of the seven part test of significance (in accordance with the NSW EP&A Act, DECC Threatened Species Assessment Guidelines, (DECC 2007)) which was applied to the Lower Murray River EEC.

#### 6.2.2 Impacts to threatened species

There are a number of risk pathways that may lead to threatened aquatic species (listed under the EPBC, FFG or NSW FM Acts) being impacted. However direct impacts are only likely to occur should construction activities require access to waterways. Any construction activities that involve entering the Murray River (e.g. with the use of coffer dams) has the potential to encounter and possibly injure or kill aquatic flora and fauna species, possibly by stranding aquatic species within the coffer dams when they are installed in aquatic habitat. Although coffer dam installation would ideally occur outside the river channel, it is understood that a rise in water level outside the river channel may not prevent construction from proceeding. This could possibly allow aquatic species to move into the area of the coffer dam, and then be caught within the coffer dam walls.

The project description outlines that bridge piers are planned outside the average wetted summer flow, and construction activities will avoid working in the Murray River channel. Therefore, construction of the bridge is unlikely to encounter aquatic organisms. In the event that works are required in the wetted channel, the implementation of standard VicRoads and Roads and Maritime controls, including the preparation and implementation of an EMP that includes salvage and translocation measures that should be followed. With these controls in place, the any threatened species encountered should be able to be protected and translocated, and the overall impact on threatened species is considered minor.



Appendix B provides full details of the seven part test of significance (DECC 2007) which was applied for three listed fish species which are considered 'likely' or 'possibly' to occur. An *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act) significance assessment was also undertaken for the three EPBC Act listed fish species assessed as 'likely' or 'possibly' to occur in the Study Area (Appendix C).

#### 6.2.3 Impacts to threatened species habitat

Construction activities have the potential to impact aquatic habitat. This may occur if habitat has to be moved to allow for construction. An example of this impact may be the removal of large woody debris or logs from the river. These structures provide habitat for a number of threatened aquatic species likely to be present in both the Campaspe and Murray Rivers. However, the project does not plan to construct bridge piers in the wetted channel, and therefore any habitat structures present in the wetted channel should not be affected by construction. If construction requires coffer dams to be built in the Murray River channel where aquatic habitat is present, standard VicRoads and Roads and Maritime controls require measures to allow for the relocation of habitat considered important to aquatic species. Therefore the impact of the bridge construction and operation on aquatic habitat for threatened species in the Murray River is considered minor.

As the Campaspe River bridge crossing would fully span the river channel (and does not include in-channel structures), the impact of the bridge construction and operation on aquatic habitat for threatened species is considered insignificant.

#### 6.2.4 Impacts to downstream wetlands

Activities that may have a detrimental impact on the river also have the potential to impact on downstream wetlands. The databases indicate the downstream presence of Ramsar wetlands associated with the Murray Valley, including the Gunbower Forest, Kerang Wetlands and Hattah-Kulkyne Lakes.

These wetlands, typical of Murray River wetlands, are dependent on numerous factors for inundation and are disconnected from the river for a significant portion of the year. Some wetland complexes, like the Hattah-Kulkyne Lakes have become dependent on flow manipulation, levees and other management intervention to allow flows into the wetlands.

Activities that have the potential to impact on water quality in the Murray River may possibly impact on downstream wetlands – for example, sedimentation, spills, run-off including litter or contaminants from heavy rainfall during construction, when there may be areas of exposed soil.

However, for these wetlands to be impacted so far downstream from the construction site, the spill would need to coincide with a time of water levels in the river that are elevated enough for the river to overflow into the channels leading to the wetlands. Additionally, at these times of high flow, the impact would need to be of a size that is not dissipated by the level of flow in the river or the distance downstream to the wetlands. The risk of water quality impacts from these events is considered to be low, should all standard VicRoads and Roads and Maritime controls be implemented, and therefore the overall impact at downstream wetlands is considered to be minor.

Equally, during operation of the bridge following construction, any spill or other impact into the river would need to be an event significant enough to overwhelm the stormwater runoff basins at a time of significant rainfall and significant flows in the river for it to reach these downstream wetlands, let alone have a detrimental impact on them.

Whilst an impact is possible, given the intermittent connection between these wetland complexes and the river and the combination of factors required for an impact to occur, it is considered unlikely and minor.

#### 6.2.5 Sedimentation

Any earthworks and/or removal of native vegetation in the vicinity of the Campaspe and Murray Rivers may lead to soil disturbance which could increase the level of sediment entering these waterways. Increased sedimentation may impact aquatic ecosystems in a number of ways, including blocking light, smothering aquatic habitat and directly impacting fish gills. The standard VicRoads and Roads and Maritime controls include measures for preventing sediment runoff from the construction site, and monitoring of erosion and water quality to ensure that adverse impacts on aquatic habitat quality can be identified and stopped. With these controls in place, the overall impact of sedimentation on aquatic flora and fauna is considered minor.

#### 6.2.6 Impact on downstream water quality

##### Construction

There are a number of scenarios during construction of the proposed second bridge that may lead to a degradation of downstream water quality. These include spills from plant equipment, run-off during rain events, dust and litter. The risk of water quality impacts from these events is considered to be low, should all standard VicRoads and Roads and Maritime controls be implemented, and therefore the overall impact is considered to be minor.

##### Operation

During the operation of the new bridge there remains the possibility that a traffic incident may occur that leads to a major spill of hazardous material into either the Campaspe or Murray Rivers during a heavy rainfall event. This may lead to the proposed spill basins being overwhelmed with stormwater and the contaminant entering the waterway. Any pollutant that enters the Campaspe or Murray Rivers is expected to cause ecological impacts downstream beyond the source site.

As there are two Wetlands of International Importance (Gunbower Forest and NSW Central Murray state forest Ramsar Sites) located approximately 60 km by river downstream from the proposed Mid-West Option, severe impacts on water quality may have major consequences on these high values ecosystems.

The Project Design includes spill basins to capture all runoff from the bridge. The capacity of these spill basins will need to be designed to hold a major rainfall event. The capacity of the spill basins is yet to be finalised in the detailed design, however the risk based approach to spill basin design will need to consider the potentially major consequences of this unpredictably rare event.

As the consequence of this event is largely dependent on the environmental hazard level of the pollutant, preventing acutely toxic materials (e.g. pesticides, herbicides) from being transported on the bridge during times when an overflow to waterways may occur is considered suitable for reducing the consequence of operational water quality impacts.

It is proposed that a road safety audit will be completed during the detailed design phase and that standard VicRoads and Roads and Maritime controls will be implemented. It is suggested that management of vehicles transporting high risk loads are implemented.

Despite the various measures in the project design and environmental management during bridge operation, the impact of such worst case scenario spill is considered major. However, when compared to the impact of a spill of hazardous material at the existing river crossings, the impact is comparable and perhaps lessened by the inclusion of the various environmental protection design measures (e.g. drainage and spill basin design).

#### 6.2.7 Noise and vibration

Fish use sound in a number of ways, including communication, hunting and predator avoidance. Human-induced noise may impact fish by generating high intensity (e.g. acute) or low intensity (e.g. chronic) noise (Popper and Hastings 2009). High intensity noise may kill or damage hearing of fish or lead to a startle response, whereas low intensity noise may pervade the environment and lead to behaviour changes over a long-term period.

Vibrations, including sound waves, travel faster and more effectively through liquids than through air, and even more effectively through solids. Thus the vibration generated through construction activities in waterways and in the ground near waterways is expected to cause noise impacts on aquatic ecosystems.

Vibration generated during construction activities would include pile-driving (high intensity noise) and general low-level noise due to plant movement and other activities. The impacts of pile-driving on fish are largely unknown (Popper and Hastings 2009). However, fish are more likely to elicit an avoidance response before physical damage occurs if they are not constrained (McCauley *et al* 2000). The majority of research has focussed on the marine environment but physical damage and behavioural responses may be extrapolated to the freshwater environment. In the context of the Project, generation of noise due to pile-driving would most likely lead to short-term behavioural impacts in fish and that any impact would be only during periods of pile-driving. It is expected that excessive noise could potentially cause aquatic fauna to evacuate or deter fauna from moving through the Study Area.

It is noted that night works are unlikely (and therefore no significant noise would be expected to be generated) during any 24 hour period thus providing reprieve to fauna. Low-level noise generated by plant movement is not likely to significantly impact aquatic fauna; the Murray River already experiences a moderate level of disturbance due to commercial and recreational activities and no access to the Campaspe River channel has been proposed. A number of control measures have been proposed by VicRoads and Roads and Maritime as part of their standard control measures. Although these measures are proposed to minimise impacts to humans, they do provide some measures which will also allow for the impacts of noise on aquatic fauna to be minimised. Therefore, given the likely short-term, localised, nature of noise generation, aquatic fauna may evacuate or avoid the Study Area for a limited time period. Therefore the impact on aquatic fauna is considered to be minor.

#### 6.2.8 Impacts to riparian vegetation

Riparian vegetation provides bank stability and shading for the aquatic ecosystem and contributes woody habitat (i.e. when old trees fall into the river) and plant litter (organic material at the base of the food chain). Removal of riparian vegetation and subsequent bank instability can also lead to erosion, which has been discussed previously. The Project proposes to remove native vegetation, including large old trees but all removal is proposed outside of the main channels. Additionally, any riparian vegetation that requires removal would be cut off at ground level to minimise the risk of compromising soil stability. Relative to the amount of riparian vegetation within the river floodplains, the reduction of shading, plant litter or woody habitat resulting from the removal of riparian vegetation is considered insignificant, and therefore the impact on aquatic fauna is considered to also be insignificant.

#### 6.2.9 Aquatic weed infestation

The presence of noxious weeds in aquatic environments can cause a number of negative impacts, which are not confined to the immediate weed-infested area. Weeds can displace native species, have impacts on water quality and can degrade the aquatic habitat. Aquatic pathogens can result in illness or death for aquatic fauna.

Weed invasion and pathogen spread could occur as a result of the Project, either due to the transportation of weeds and pathogens into the area, or by transmitting them to different locations within the construction area. Plant machinery, personnel, vehicles boats and barges used during construction could contribute to increased weed infestation, as well as to the spread of pathogens.

A weed management program and monitoring controls would be implemented to manage noxious aquatic weeds and to minimise the risk of weed infestation. These management measures would also minimise the spread of pathogens. With these management measures in place, the impact on the aquatic ecosystem is expected to be minor.

#### 6.2.10 Impedance to passage of aquatic fauna

##### **Construction**

Fish passage is important to provide access to habitat, food and shelter, to allow for the avoidance of predators and to allow for seasonal movement associated with breeding cycles (Fairfull and Witheridge 2003). The construction of bridge pylons in the Murray River channel has the potential to impact fish passage only if construction requires the use of coffer dams (or other in-channel structures) within the wetted channel. However, given the channel width of the Murray River, any intrusion to the waterway is likely to be minimal in terms of width of channel impeded and also likely to occur over a relatively short time period. The Campaspe River bridge crossing will fully span the river channel and does not include in-channel structures. There is unlikely to be any significant impacts to fish passage in the Campaspe River. Therefore, the impact of the bridge construction on the passage of aquatic fauna is considered minor.



## Operation

During operation the new bridges would provide additional shading over the Murray and Campaspe Rivers and noise due to vehicle usage. Both of these impacts can result in 'behavioural' impedance to fish passage (Thorncraft and Harris, 2000). For example some fish species will not enter an intensely shaded section of river during daylight (Fairfull and Witheridge, 2003). However, the bridges are designed to be sufficiently high above the water level to allow reflected and scattered light during the day, and not result in excessive shading that could impact upon fish passage. It is also not expected that the level of light, shading, noise or vibration under the bridges would be sufficient to form a barrier to fish passage. Therefore the impact of the bridge on aquatic fauna passage is considered minor.

During a flood event, aquatic fauna move out of the river channel and onto the floodplain. Floods can be critical times for dispersal, allowing aquatic fauna access to intermittently connected populations or to colonise other suitable aquatic habitats hydrologically connected during flood (Boulton & Brock 2014). Construction of a barrier across the floodplain could impact the movement of aquatic fauna across the floodplain. The Project design includes bridging to allow for floodwaters and wildlife passage underneath the roadway. Existing culverts under roadways on the floodplain will also be upgraded to improve hydrological connectivity across the floodplain. The elevated roadways constructed on battered slopes may interrupt the previous flowpath of floodwater across the floodplain, however these impacts are expected to be isolated, and not expected to cause impacts at the scale of the Study Area. Therefore, the impact of the Project on movement of aquatic fauna onto and across the floodplain is considered minor.

### 6.2.11 Impacts to aquatic species habitat and ecological function within the floodplain

The physical process of flooding and sedimentation in lowland river floodplains is essential to replenishing topsoil and nutrients, distributing propagules of plants and animals and temporarily inundating the floodplain vegetation (Boulton & Brock 2014). Any significant changes to flow regimes may therefore have ecological implications.

Floodplain ecological function is particularly important for maintaining native riparian vegetation, and the natural flow regimes of rivers (which includes the magnitude and frequency of overbank flooding) are important for maintaining ecological function of the floodplain. Degradation of riparian vegetation or alteration to flow regime are both listed as a threatening process under FFG Act (1988).

## Construction

The construction of bridge pylons in the Murray River channel and Campaspe floodplain has the potential to directly remove floodplain habitat under the RoW. These impacts will ultimately lead to a reduction in floodplain habitat at these locations. However, given the extent of the floodplain (Figure 4) and its already modified state it is unlikely that installation of the bridge pylons will lead to a significant loss of aquatic species habitat or ecological function. Therefore, the impact of the bridge construction on floodplain habitat for aquatic species and/or ecological function is considered minor.

## Operation

Impacts during operation of the bridge will likely be similar to those that may occur during the construction phase. There will be a direct loss of habitat under the RoW. However, given the extent of the floodplain, any overbank flows would likely still allow for all ecological functions to take place. Therefore the impact of bridge operation on floodplain habitat for aquatic species and/or ecological function is considered minor.

## 6.3 Risk assessment

### 6.3.1 Methodology

The risk assessment for the Project included identification and management of Project risks and Environmental risks. Project risks were identified by VicRoads before an environmental risk assessment was undertaken with key specialists. A summary of the Project risk assessment is outlined in Chapter 4 of the EES.

The environmental risk assessment developed for the EES included the development of impact pathways and mitigation measures that could reduce the impact of the Preferred Alignment.

A qualitative risk assessment was undertaken with key specialists. VicRoads and key members of the Project team developed a risk register based upon a detailed understanding of the Project and the Preferred Alignment. The risk register was sent to key specialists for review and consideration prior to attendance at a workshop held on 18 September 2014 to:

- Review the consequence criteria developed;
- Review the risks identified;
- Identify any additional risks that need to be addressed; and
- Develop detailed mitigation measures.

### 6.3.2 Risk significance

The significance of risks was identified having regard to the Consequence Criteria (Table 6) and Likelihood Guide (Table 7).

Consequence criteria was developed by VicRoads and reviewed by Project specialists to define a scale of magnitude from “insignificant” to “catastrophic” consequence. The scale of magnitude was based on the spatial area affected and expected recovery time of the value impacted. Accordingly, insignificant consequences were generally situated within a localised area with a recovery time potential within the range of normal variability. Conversely, catastrophic consequence criteria describe scenarios involving a very high magnitude event, affecting a State-wide area, or requiring over a decade to reach functional recovery. The Consequence criteria for Aquatic Fauna and Flora associated with the Project are outlined in Table 6.

Table 6 Consequence Criteria

Aspect	Insignificant	Minor	Moderate	Major	Catastrophic
Listed Threatened aquatic fauna species	No change detected for any aquatic fauna species listed under the EPBC Act, FFG Act, FM Act or DELWP Advisory List	Removal of < 1% of the Study Area population for an EPBC listed species OR Removal of <1% of the regional area population for an FFG, FMA or DELWP advisory listed species	Removal of >1% of the Study Area population but <1% of the regional area population for an EPBC listed species, OR Removal of >1% of the regional population but <2% of the State population for an FFG, FMA or DELWP Advisory listed species.	Removal of >1% of the regional population but <1% of the State population for an EPBC listed species, OR, Removal of >2% of the State population for an FFG, FMA or DELWP Advisory listed species	Removal of >1% of the State Population for an EPBC listed species.
Listed Threatened aquatic flora species	No change detected for any aquatic flora species listed under the EPBC Act, FFG Act, TSC Act or DELWP Advisory List	Removal of < 1% of the Study Area population for an EPBC listed species OR Removal of <1% of the regional area population for an FFG, TSC or DELWP advisory listed species	Removal of >1% of the Study Area population but <1% of the regional area population for an EPBC listed species, OR Removal of >1% of the regional population but <2% of the State population for an FFG, TSC or DELWP Advisory listed species.	Removal of >1% of the regional population but <1% of the State population for an EPBC listed species, or Removal of >2% of the State population for an FFG, TSC or DELWP Advisory listed species	Removal of >1% of the State Population for an EPBC listed species.
Listed endangered ecological community (EEC)	No measureable impact on the extent of a community listed under the TSC Act	Loss of <5% community member species from Study Area	Loss of <10% community member species from Study Area, or loss of <5% community member species from >20% defined EEC area	Loss of <50% community member species from Study Area, or loss of <10% community member species from >20% defined EEC area	Loss of >50% community member species from Study Area, or Loss of >10% community member species from >20% defined EEC area
Impedance to passage of aquatic fauna	Fish passage not affected	Fish passage restricted during construction period	Fish passage obstructed during construction period	Fish passage restricted permanently	Permanent obstruction to fish passage

Aspect	Insignificant	Minor	Moderate	Major	Catastrophic
Impacts to aquatic habitat	No detectable change in aquatic habitats	Short-term isolated detectable changes in aquatic habitats within the Study Area	Short-term localised detectable changes in aquatic habitats within Study Area	Long-term detectable changes in aquatic habitats which are significant within the Study Area, or Short-term detectable changes in aquatic habitats within the Central and Lower Murray River	Long-term detectable changes in aquatic habitats which are significant within the Central and Lower Murray catchment
Impacts to floodplain habitat for aquatic species	No detectable change in floodplain habitat for aquatic species or ecological function	Short-term isolated changes to floodplain habitat for aquatic species within the Study Area.	Short-term localised changes to floodplain habitat for aquatic species within the Study Area or detectable impacts to ecological function of floodplain within Study Area.	Long-term changes to floodplain habitat for aquatic species within the Study Area or detectable impacts to ecological function of floodplain within the Central and Lower Murray River.	Long-term changes to floodplain habitat for aquatic species beyond the Study Area and detectable impacts to ecological function of floodplain within the Central and Lower Murray River.



The significance of the risks were determined having regard to the Likelihood Guide (Table 7) and the Consequence Level (Table 6) as outlined in Table 8.

Table 7 Likelihood Guide

Descriptor	Explanation
Almost Certain	The event is expected to occur in most circumstances
Likely	The event will probably occur in most circumstances
Possible	The event could occur
Unlikely	The event could occur but is not expected
Rare	The event may occur only in exceptional circumstances

Table 8 Risk Significance Matrix

Likelihood	Consequence Level				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Negligible	Low	Medium	High	High
Unlikely	Negligible	Low	Medium	Medium	High
Rare	Negligible	Negligible	Low	Medium	Medium

### 6.3.3 Risk workshop

The Environmental Risk Assessment Workshop was held on 18 September 2014 to consider the risks and mitigation measures that would apply to the preferred alignment (Mid-West Option). The risk workshop was attended by the flora and fauna, cultural heritage, hydrology, noise, aquatic, traffic and geology specialists. The workshop also included representatives of VicRoads and the NSW Department of Roads and Maritime Services.

Initial discussions at the workshop were held regarding the suggested consequence criteria developed for each of the relevant specialist's disciplines for the Project and were followed by review of environmental risks.

The workshop included review of the Extreme, High and Medium initial risks. As part of the workshop, it was agreed that the consequence criteria or likelihood of some of the initial Medium, High and Extreme risks could be revised. The risk ratings were revised within the workshop and specialists were asked to review the updated risk register as part of their impact assessment to confirm or recommend if any further changes would be required. Table 9 outlines the aquatic flora and fauna risks identified for the preferred alignment. Table 9 outlines the aquatic flora and fauna risks identified for the preferred alignment.

Table 9 Risk Register

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ1	Construction has an adverse effect on the Lower Murray Endangered Ecological Community	Degradation of aquatic ecosystem of the Murray River through impacts on water quality, habitat quality, flora or fauna.		VicRoads Section 177 A3, A4, A5, A6, B1, D1, F1, G1, H, I1, I2, K1, K2, L1.  Roads & Maritime Standard Safeguards G, E, W, N, B.  Roads & Maritime Biodiversity Guidelines: Guides 1, 2, 3, 6, 7, 9, 10.	The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to habitat for threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals. All work shall avoid impacts and protect native aquatic flora and fauna, aquatic ecosystems and aquatic habitat. Pre-clearing of aquatic habitats shall be undertaken, and any snags encountered will be translocated under guidance of a qualified aquatic ecologist. Any impacts to the waterways resulting from erosion and sedimentation, water quality degradation and pollution, weeds and pests, construction noise and waterway and riparian zone disturbance will be avoided wherever possible. Aquatic habitat monitoring shall be undertaken for the duration of the construction, and environmental incidents will be reported.	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ2	Construction encounters unexpected listed aquatic flora or fauna species	Injury or death to listed aquatic flora or fauna species during construction		<p>VicRoads Section 177 A3, A4, A5, A6, I1, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 1, 2, 9, 10.</p>	The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals. All work shall avoid impacts and protect native flora and fauna and habitat. Pre-clearing of aquatic habitats shall be undertaken, and any threatened species encountered will be translocated by a qualified aquatic ecologist. Aquatic habitat monitoring shall be undertaken.	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ3	Construction encounters habitat for EPBC Listed species	Removal or degradation of aquatic fauna habitat during construction		VicRoads Section 177 A3, A4, A5, A6, B1, D1, F1, G1, H, I1, I2, K1, K2, L1.  Roads & Maritime Standard Safeguards G, B.  Roads & Maritime Biodiversity Guidelines: Guides 1, 2, 10.	The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to habitat for threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals. All work shall avoid impacts and protect native aquatic flora and fauna and aquatic habitat. Pre-clearing of aquatic habitats shall be undertaken, and any snags encountered will be translocated under guidance of a qualified aquatic ecologist. Any impacts to the waterways resulting from erosion and sedimentation, water quality degradation and pollution, weeds and pests, construction noise and waterway and riparian zone disturbance will be avoided wherever possible. Aquatic habitat monitoring shall be undertaken for the duration of the construction, and environmental incidents will be reported.	Minor	Possible	Low		Minor	Possible	Low



Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ4	Construction encounters EPBC Listed species	Injury or death to listed aquatic fauna species during construction		<p>VicRoads Section 177 A3, A4, A5, A6, I1, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 1, 2, 9, 10.</p>	The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals. All work shall avoid impacts and protect native flora and fauna and habitat. Pre-clearing of aquatic habitats shall be undertaken, and any threatened species encountered will be translocated by a qualified aquatic ecologist. Aquatic habitat monitoring shall be undertaken.	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ5	Construction encounters habitat for Vic FFG listed species	Removal or degradation of aquatic fauna habitat during construction		VicRoads Section 177 A3, A4, A5, A6, B1, D1, F1, G1, H, I1, I2, K1, K2, L1. Roads & Maritime Standard Safeguards G, B. Roads & Maritime Biodiversity Guidelines: Guides 1, 2, 10.	The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to habitat for threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals. All work shall avoid impacts and protect native aquatic flora and fauna and aquatic habitat. Pre-clearing of aquatic habitats shall be undertaken, and any snags encountered will be translocated under guidance of a qualified aquatic ecologist. Any impacts to the waterways resulting from erosion and sedimentation, water quality degradation and pollution, weeds and pests, construction noise and waterway and riparian zone disturbance will be avoided wherever possible. Aquatic habitat monitoring shall be undertaken for the duration of the construction, and environmental incidents will be reported.	Minor	Possible	Low		Minor	Possible	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ6	Construction encounters Vic FFG listed species	Injury or death to listed aquatic fauna species during construction		<p>VicRoads Section 177 A3, A4, A5, A6, I1, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 1, 2, 9, 10.</p>	<p>The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to threatened aquatic fauna and flora species.</p> <p>The Contractor shall be responsible for obtaining all necessary permits and approvals.</p> <p>All work shall avoid impacts and protect native flora and fauna and habitat. Pre-clearing of aquatic habitats shall be undertaken, and any threatened species encountered will be translocated by a qualified aquatic ecologist.</p> <p>Aquatic habitat monitoring shall be undertaken.</p>	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ7	Construction encounters habitat for NSW Fisheries Management Act listed species	Removal or degradation of fauna habitat during construction		<p>VicRoads Section 177 A3, A4, A5, A6, B1, D1, F1, G1, H, I1, I2, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 1, 2, 10.</p>	<p>The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to habitat for threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals.</p> <p>All work shall avoid impacts and protect native flora and fauna and habitat. Pre-clearing of aquatic habitats shall be undertaken, and any snags encountered will be translocated under guidance of a qualified aquatic ecologist. Impacts of sedimentation, water quality, construction noise and waterway and riparian zone disturbance will be avoided wherever possible. Aquatic habitat monitoring shall be undertaken for the duration of the construction.</p>	Minor	Possible	Low		Minor	Possible	Low



Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ8	Construction encounters NSW Fisheries Management Act listed species	Injury or death to listed fauna species during construction		<p>VicRoads Section 177 A3, A4, A5, A6, I1, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 1, 2, 9, 10.</p>	<p>The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to threatened aquatic fauna and flora species.</p> <p>The Contractor shall be responsible for obtaining all necessary permits and approvals.</p> <p>All work shall avoid impacts and protect native flora and fauna and habitat. Pre-clearing of aquatic habitats shall be undertaken, and any threatened species encountered will be translocated by a qualified aquatic ecologist.</p> <p>Aquatic habitat monitoring shall be undertaken.</p>	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ9	Construction encounters habitat for DELWP Advisory listed species	Removal or degradation of aquatic fauna habitat during construction		<p>VicRoads Section 177 A3, A4, A5, A6, B1, D1, F1, G1, H, I1, I2, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 1, 2, 10.</p>	<p>The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to habitat for threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals. All work shall avoid impacts and protect native flora and fauna and habitat. Pre-clearing of aquatic habitats shall be undertaken, and any snags encountered will be translocated under guidance of a qualified aquatic ecologist. Impacts of sedimentation, water quality, construction noise and waterway and riparian zone disturbance will be avoided wherever possible. Aquatic habitat monitoring shall be undertaken for the duration of the construction.</p>	Minor	Possible	Low		Minor	Possible	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ10	Construction encounters DELWP Advisory listed species	Injury or death to listed aquatic fauna species during construction		<p>VicRoads Section 177 A3, A4, A5, A6, I1, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 1, 2, 9, 10.</p>	<p>The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals. All work shall avoid impacts and protect native flora and fauna and habitat. Pre-clearing of aquatic habitats shall be undertaken, and any threatened fauna species encountered will be translocated by a qualified aquatic ecologist. Aquatic habitat monitoring shall be undertaken.</p>	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ11	Construction works impact on downstream aquatic habitat water quality	Degraded river health, reduced aquatic habitat		<p>VicRoads Section 177 A3, A4, A5, A6, B1, D1, G1, I1, K1, K2, L1.</p> <p>Standard Specification Sections 3030.</p> <p>Roads &amp; Maritime Standard Safeguards G, W, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guide 10.</p>	<p>The contractor shall develop and implement an EMP that specifically includes the prevention of water quality impacts in the receiving waterways. The quality of water in waterways shall not be detrimentally impacted by runoff from the site. Water quality in the receiving waterways shall be monitored during all stages of construction. Works shall avoid work in waters wherever possible. Any leakage or spillage of fuels or chemicals shall not have a detrimental environmental impact. Drainage design shall be sufficient capacity to prevent flow of pollutants in stormwater to waterway.</p>	Minor	Possible	Low		Minor	Possible	Low



Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ12	Construction works result in sediment smothering aquatic habitat	Degraded aquatic habitat quality, reduced river health condition and suitability for aquatic fauna.		<p>VicRoads Section 177 A3, A4, A5, A6, D1, I1, K1, K2, L1.</p> <p>Standard Specification Sections 3030.</p> <p>Roads &amp; Maritime Standard Safeguards G, E, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 2,3,10.</p>	<p>The contractor shall develop and implement an EMP that specifically includes the prevention of erosion and minimisation of sediment runoff. All exposed surfaces shall be managed to minimise erosion and sediment generation. Works shall avoid work in waters wherever possible. Suitably scaled sedimentation basin shall be used to control sediment. Stockpiles shall be located and managed to avoid sediment from entering waterways. The contractor shall regularly inspect for and rectify soil erosion and scour. Establishment of no-go zones to limit soil disturbance. Drainage design shall be sufficient to prevent scour and capacity to prevent flow of sediment in stormwater to waterway.</p>	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ13	Construction noise (e.g. pile driving) degrades aquatic habitat quality.	Aquatic fauna behaviours affected, leave Study Area or are deterred from moving through the Study Area by extreme construction noise.	noise	VicRoads Section 177 A3, A4, A5, A6, H, I1, K1, K2, L1.  Roads & Maritime Standard Safeguards G, N.  Roads & Maritime Biodiversity Guidelines: Guide 10.	The contractor shall develop and implement an EMP that specifically includes the minimisation of construction noise impacts on aquatic ecosystem receptors. Works to be carried out to minimise noise impacts. Avoid activities in waterway as much as possible. Noisy construction activities shall be limited to standard working hours.	Minor	Possible	Low		Minor	Possible	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ14	Operational impacts to water quality from spills and runoff	Water quality impacts results in degraded aquatic habitat quality or death or injury to aquatic flora and fauna	hydrology, traffic	Standard Specification Sections 3010, 3030, 3080, 3090.	Runoff from all pavement areas will be collected and treated to quality suitable for discharge to the environment. Drainage design shall be modelled and sized to manage rainfall intensities and soil characteristics specific to the region. Road and bridge designed to safely achieve specified traffic volumes travelling at the minimum operating / design speeds. Roads safety audit to be completed on detailed design. Traffic incident device and signage to manage safety of hazardous load transport. Traffic barrier systems shall provide sufficient protection for hazardous load transport.	Major	Rare	Medium		Major	Rare	Medium

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ15	Construction and operation results in listed aquatic weeds and / or pathogens being spread in aquatic habitats	Invasion of aquatic habitat and increased spread of weeds or disease, affecting aquatic habitat quality	Soils & geology, biodiversity	<p>VicRoads Section 177 A3, A4, A6, F1, I1, I2, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, E, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 2, 3, 6, 7, 10.</p>	<p>The contractor shall develop and implement an EMP that specifically includes the prevention of the pests, weeds and pathogens. Riparian habitat to be marked and protected as no-go zones. Revegetation required for soil control and limit weed establishment. Declared weeds, pests and diseases shall not be introduced through the site, spread through or removed from the site.</p>	Minor	Unlikely	Low		Minor	Unlikely	Low



Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ16	Impedance to passage of aquatic fauna	Construction works and bridge design may provide a barrier or deterrent to aquatic fauna movement	Noise, Hydrology	<p>VicRoads Section 177 A3, A4, A6, B1, H, I1, K1, K2, L1.</p> <p>Standard Specification Sections 3030, 3060.</p> <p>Roads &amp; Maritime Standard Safeguards G, W, N, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 2, 10.</p>	<p>Bridge design does not include piles or other structures within the river channel. Structures to be built outside of the permanent waterway and water flow maintained.</p> <p>Drainage design shall be sufficient to prevent water quality impacts that may affect fauna movement. Waterway treatments shall minimise impact to waterways, and provide free passage for fish.</p> <p>Severe construction noise (e.g. pile driving) impacts on aquatic ecosystem limited to standard hours.</p> <p>Water quality impacts minimised to avoid deterrent to fish passage.</p>	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ17	Loss of riparian vegetation	Impacts aquatic fauna and flora dependant on riparian vegetation inputs for food/nutrient source or habitat quality (shading, structure)	Biodiversity, Soils & geology	<p>VicRoads Section177 A3, A4, A5, A6, D1, I2, K1, K2, L1.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 2, 7, 10.</p>	The contractor shall develop and implement an EMP that specifically includes the protection and monitoring of riparian vegetation. All work shall avoid impacts to native flora. Riparian habitat to be marked and protected as no-go zones. Clearing of riparian vegetation undertaken to minimise impacts to aquatic habitats.	<i>Insignificant</i>	<i>Almost Certain</i>	<i>Low</i>		<i>Insignificant</i>	<i>Almost Certain</i>	<i>Low</i>

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ18	Construction has an adverse effect on Wetlands of International Importance (Ramsar)	Degradation of aquatic ecosystem of the Murray River through impacts on water quality, habitat quality, flora or fauna.		VicRoads Section 177 A3, A4, A5, A6, B1, D1, F1, G1, H, I1, I2, K1, K2, L1.  Roads & Maritime Standard Safeguards G, E, W, N, B.  Roads & Maritime Biodiversity Guidelines: Guides 1, 2, 3, 6, 7, 9, 10.	The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to aquatic ecosystems habitat for threatened aquatic fauna and flora species. The Contractor shall be responsible for obtaining all necessary permits and approvals. All work shall avoid impacts and protect native aquatic flora and fauna, aquatic ecosystems and aquatic habitat. Any impacts to the waterways resulting from erosion and sedimentation, water quality degradation and pollution, weeds and pests, construction noise and waterway and riparian zone disturbance will be avoided wherever possible. Aquatic habitat monitoring shall be undertaken for the duration of the construction, and environmental incidents will be reported.	Minor	Unlikely	Low		Minor	Unlikely	Low

Risk No.	Impact pathway	Description of consequences	Linkages	VicRoads Contract Specification Section 177, Roads & Maritime Standard Safeguards or Roads & Maritime Biodiversity Guide Reference	Planned Controls to Manage Risk (as per VicRoads Section 177, Roads & Maritime standard safeguards and Project Description)	Initial Risk			Controls Recommended to Reduce Risk	Residual Risk		
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
AQ19	Construction and operation impacts aquatic ecological function of floodplain	Loss of lateral and longitudinal connectivity of river with floodplain, loss of aquatic habitat on floodplain, interruption to nutrient cycling and flood event aquatic species movement.	hydrology	<p>VicRoads Section 177 A3, A4, A5, A6, B1, D1, G1, I1, I2, K1, K2.</p> <p>Standard Specification Sections 3030, 3060.</p> <p>Roads &amp; Maritime Standard Safeguards G, B.</p> <p>Roads &amp; Maritime Biodiversity Guidelines: Guides 2, 3, 10.</p>	The contractor shall develop and implement an EMP that specifically includes the prevention of impacts to aquatic ecosystems habitat. Project design includes sufficient clearance, allowing floodwater onto floodplain. Existing flood relief structures under the carriageway to be upgraded, and bridges and culverts incorporated in the design to allow movement of floodwaters across floodplain. The contractor shall develop and implement an EMP that specifically includes the protection and monitoring of riparian and aquatic habitat. All work shall avoid impacts to native flora. Riparian habitat to be marked and protected as no-go zones. Clearing of riparian vegetation undertaken to minimise impacts to aquatic habitats.	Minor	Unlikely	Low		Minor	Unlikely	Low

## 6.4 Design and mitigation measures

In order to mitigate the risks for the Project, standard VicRoads and Roads and Maritime environmental protection measures and some additional Project specific measures have been identified for incorporation into the Environmental Management Framework (EMF). VicRoads, as the responsible proponent for the construction of the Project, would require the construction contractor to incorporate all of these measures from the Environmental Management Framework into the Construction Environmental Management Plan (CEMP).

Standard protection measures for the aquatic flora and fauna impacts, which would be adopted for this Project, include the following VicRoads and Roads and Maritime standard requirements.

### *VicRoads Section 177 Environmental Management (Major)*

Various aspects of the VicRoads standard environmental management protection measures for construction works (Section 177) are relevant to the aquatic flora and fauna impacts identified in the risk assessment. As a summary, these include:

**A3 Environmental Management Plans.** The Contractor shall be responsible for the preparation, implementation and other arrangements associated with the Environmental Management Plan (EMP).

**A4 Training.** The Contractor shall ensure all personnel are informed of the environmental issues and specific risks associated with the project and the required management and mitigation measures to address these risks.

**A5 Permits.** The Contractor shall be responsible for obtaining all necessary permits and approvals from the relevant authorities.

**A6 Development, Implementation and Monitoring of EMPs.** The Contractor shall engage a suitably experienced and skilled environmental management professional to prepare the Environmental Management Plan and manage and monitor all environmental issues and environmental treatments implemented during construction.

**B1 Water.** The quality of water in waterways shall not be detrimentally impacted by runoff from the site. Water quality in the receiving waterways and rainfall shall be monitored during all stages of construction.

**D1 Erosion and Sediment Control.** All exposed surfaces shall be managed to minimise erosion and sediment generation. Works shall avoid work in waters wherever possible, and where unavoidable, the EMP shall be prepared to protect beneficial uses. Suitably scaled sedimentation basins shall be used to control sediment. Stockpiles shall be located and managed to prevent sediment from entering waterways. The contractor shall regularly inspect for and rectify soil erosion and scour.

**F1 Waste and Resource Use.** Disposal of noxious or environmental weeds to prevent regeneration.

**G1 Fuels and Chemicals.** Any leakage or spillage of fuels or chemicals shall not have a detrimental environmental impact.

**H Noise.** All work to be undertaken under restrictions to minimise noisy work practices.



**I1 Flora and Fauna.** All work shall avoid impacts and protect native flora, fauna and habitat. Work to comply with any permits or approvals obtained by VicRoads. Significant habitat to be marked and protected as no-go zones. All personnel on site to be trained to identify significant habitat, flora and fauna. Translocation of fauna and habitat shall be undertaken by qualified ecologist with permit/licence. The contractor shall undertake monitoring of habitat sites and protective measures at the sites.

**I2 Weeds, Pests and Diseases.** Declared weeds, pests and diseases shall not be introduced through the site, spread through the site or removed from the site.

**K1 Reporting.** All environmental monitoring results shall be reported to Superintendent.

**K2 Environmental Incidents.** The contractor shall take immediate action to stop an environmental incident, and notify the Superintendent.

**L1 Environmental Audits and Surveillance.** The EMP shall be independently audited prior to commencement of works, and surveillance and audits are to be undertaken during construction.

### ***VicRoads Construction Contract Specification***

Various aspects of the VicRoads standard engineering design and traffic management measures from the VicRoads standard Design and Construction Contract (DC1), equivalent measures to VicRoads Standard Section 177, - Environmental Management (refer to EES Appendix 0) are relevant to the aquatic flora and fauna impacts identified in the risk assessment. As a summary, these include:

**3010 Road Geometry.** This section relates to the requirements for the geometric design of roads and bridges, to safely achieve specified traffic volumes travelling at the minimum operating/design speeds.

**3030 Drainage.** The waterway at bridge and culvert structures shall be sufficient to prevent scour and to limit afflux. Existing drainage catchments and flow patterns shall be maintained where practicable. Drainage systems shall be design with sufficient capacity. Ground surfaces are to be protected from scour. Stormwater shall discharge at the base of batters. Runoff from all pavement areas will be collected and treated to quality suitable for discharge to the environment.

**3060 Landscape and Architectural Elements.** Waterway treatments shall minimise impact to waterways, and provide free passage for fish.

**3080 Traffic Control and Management Devices.** Traffic incident device and signage to manage safety of hazardous load transport.

**3090 Traffic Barriers.** Traffic barrier systems shall provide sufficient protection for hazardous load transport.

### ***NSW Roads & Maritime Services (Transport) Environmental Assessment Procedure for routine and minor works. Standard Safeguards List***

Various aspects of the Roads & Maritime Services standard environmental protection measures for construction works are relevant to the aquatic flora and fauna impacts identified in the risk assessment. As a summary, these include:

**G General.** An EMP is prepared and implemented prior to works. Access to waterways is to be via existing boat ramp with no disturbance to the bank or surrounding vegetation.

**E Erosion and sedimentation.** Erosion and sediment control measures are to be implemented and maintained.

**W Water quality.** No release of dirty water in waterways. Monitoring to be undertaken. Measures to prevent pollution from entering stormwater incorporated in drainage system.

**N Noise and vibration.** Works to be carried out to minimise noise impacts.

**B Biodiversity.** There is to be no disturbance or damage to threatened species or critical habitat. Pathogens, weeds and pests are to be managed. Fauna handling must be carried out according to guidelines. Works are not to create an ongoing barrier to the movement of wildlife.

### ***NSW RTA (Roads and Maritime) Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects***

These Biodiversity Guidelines should be used or referred to whenever Roads & Maritime projects or maintenance works have the potential to impact on biodiversity, including aquatic flora and fauna.

**Guide 1: Pre-clearing process.** Procedure for unexpected threatened species finds.

**Guide 2 Exclusion zones.** Management requirements for establishing no-go zones relevant to aquatic habitats.

**Guide 3 Re-establishment of native vegetation.** Revegetation requirements for erosion and soil control.

**Guide 6 Weed management.** Prevent or minimise the spread of noxious aquatic weed species on all RMS project sites and during maintenance works.

**Guide 7 Pathogen management.** Prevent the introduction and/or spread of disease causing agents such as bacteria or fungi.

**Guide 9 Fauna handling.** Use of experienced aquatic ecologists for salvage and translocation of aquatic fauna to minimise impacts fauna and prevent injury to people handling fauna.

**Guide 10 Aquatic habitats and riparian zones.** Establish exclusion zones within aquatic habitats and riparian zones. Access to waterway undertaken to minimise impacts and risk of pollution or erosion. Clearing of riparian vegetation undertaken to minimise impacts to aquatic habitats. Snags relocated to maintain aquatic habitat. Site rehabilitation to protect banks and aquatic habitats. Ensure movement of fish up and downstream is maintained at all times during works in a waterway.

### ***Project Design Controls***

The Echuca-Moama Bridge Project Description (Vers. 8, 15 December 2014) incorporates the following design features which provide protection to aquatic ecosystems from potential impacts from the construction and operation of the proposed river crossings.

**Bridges across the Rivers.** The project would include new bridge crossings of the Murray River and Campaspe River. Flood relief structures including bridging and/or culverts would be provided over low lying flood prone land, providing adequate clearance for movement of flood waters and aquatic fauna. The piers of the Campaspe and Murray River bridges would be constructed outside of the river channel (summer flow/low water mark extent). At the Campaspe River, bridge piers would be located clear of the river banks to the north and south of the river. A cantilever structure is proposed over the Murray River, with piers in the river banks supporting a 90-95 m clear span over the river channel. The piers would be located above the normal summer flow (summer river water level).

The new carriageway in the floodplain would be up to 15 metres above the natural surface level.

**Water Management.** In order to sustainably manage surface water runoff and protect water quality, VicRoads advised that the Project would be constructed and operated in accordance with the VicRoads Integrated Water Management Guidelines. Specifically VicRoads proposes to:

- Use flood relief structures and other best-practice environmental management techniques to prevent sediment laden run-off from leaving construction sites; and
- Utilise non-potable (non-drinking water quality) water for construction activities wherever practicable.

**Drainage.** Kerb and channel would be constructed along the full length of the ultimate duplication to direct road run-off to spill/retention basins prior to discharging the water to the floodplain.

**Spill containment.** The Project design includes provision for spill basins to be constructed adjacent to the alignment to capture run-off from the new roadway. The spill basins have been incorporated into the design consistent with discussions with the EPA and allow for the capture and/or treatment of run-off from the road surface and enable removal or release into the flood plain as required.

Spill basins would be incorporated in the initial construction to capture all runoff from the road surface of the new carriageway from Warren Street in Echuca to Cobb Highway in Moama.

The spill basins would be located as close to the road carriageway as possible to minimise the construction footprint of the Project.

The height of the spill basins would be determined during detailed design. The EPA has instructed VicRoads to adopt a risk based approach to spill basin design. This would involve an assessment of construction and maintenance costs, access requirements and public safety, spill risk and effectiveness and reliability of required management measures.

**Noise Attenuation.** Noise attenuation measures for the Project would be implemented in accordance with the requirements of the VicRoads Traffic Noise Reduction Policy (2005). For the Project VicRoads Noise Policy would be applied in both Victoria and New South Wales.

**Vegetation protection.** The native vegetation within construction footprint that does not constitute a hazard (e.g. grassland) and is not impacted by the construction activity would be retained. These measures could lead to reduced native vegetation loss and assist minimise sediment impacts to aquatic ecosystems.

Significant vegetation would be fenced and protected during the construction of the Project.

**Site Preparation, Pavement and Road Construction.** The following would be undertaken for preparation of the site and construction of the pavement and road:

- Project boundaries would be delineated with suitable fencing and signage. Traffic management measures would be installed as required;
- Contractor's site office and compound would be established, along with stockpile sites as required;
- Erosion and sedimentation controls would progressively be installed for all activities. Other additional environmental management measures would be installed as required. This would include fencing off and signage for the protection of sensitive areas;
- Vegetation and tree stumps in the construction area outside specified fenced protected areas would be removed and topsoil stripped. Topsoil would be stored on site, for later reuse, as well as protected with silt fencing around each stockpile and seeded to minimise erosion;

- Stormwater drainage works would be completed, including the construction of water sensitive road design measures (spill basins). These may be consolidated with temporary sediment basins;
- Surface stabilisation may be required in certain locations, within the floodplain and Right-of-Way this would be determined following detailed design and selection of a final alignment;
- Cut material would be excavated to the necessary level and would be insignificant in volume across the project. Suitable excavated material would be recycled and incorporated in earthworks wherever possible. Unsuitable cut material would be transported and disposed of (on-site where possible);
- Verges would be constructed, batters completed, and roadside drainage elements constructed, as required. Kerbs and channels would be constructed where required to manage road run-off. Granular pavement materials would be imported, placed and compacted;
- Lighting, line markings, signs, and other road furniture (e.g. safety barriers and guide posts) would be installed where required; and
- Once the alignment has been constructed, the construction site would be landscaped and re-vegetated, including reinstating and topping up of topsoil, seeding, planting trees and shrubs, installing weed mats and mulch. Project opportunities for design elements would be considered at detailed design.

**Bridge Structural Works.** At the Murray River, coffer dams would be installed at pier locations in the river banks in dry conditions if possible. The dams will protect pier construction works from inundation in the event of high river flow, and minimise impacts on the river environment.

**Earthworks.** The Project is expected to result in minimal excavation as extensive lengths of the new carriageways would be subject to bridging.

There is very minimal cut expected for construction of this Project. Any spoil would be used during construction for batter flattening or land forming where this is possible. Spoil considered unsuitable for this purpose would be disposed of onsite where possible. Disposal of spoil onsite would be within the identified construction area or outside of environmentally sensitive 'no go' areas. Spoil may be disposed of offsite on adjacent properties (in non- environmentally sensitive areas) as agreed with landowners and subject to necessary statutory approvals.

**Source and Quantity of Materials.** Quantities of water required during construction are unknown at this stage and would depend on material sources and methodologies applied by the contractor(s). Water would be required for earthworks and pavement construction as well as part of dust suppression measures. As the majority of water is likely to be required for earthworks construction and dust suppression, this could be sourced locally through re-use of water captured on site or other non-potable supplies. In accordance with VicRoads Water Use Policy, in this area, recycling of waste water would also be considered where possible.

**Construction Site Drainage.** During construction, provision of sedimentation basins and other similar treatments and measures may be required to capture and treat any runoff from the site to prevent the discharge of sediment laden water into nearby waterways. In accordance with VicRoads requirements the sedimentation basins would be required to have a capacity to capture/store water generated up to a two year Average Recurrence Interval (ARI) storm event. The sizing of sedimentation basins would also need to be determined in accordance with the VicRoads Temporary Sedimentation Basin Design Tool.

The quality of water in receiving waterways would be monitored to ensure there was no detrimental impact from site runoff.

**Site Compounds.** Site compounds would be used to stockpile materials, store plant and equipment and to provide site offices, parking and amenities for construction staff. Chemicals and fuels for construction would be stored in appropriate storage areas within the compound site.

Site compounds and construction laydown areas are likely to be located in close proximity to carriageways and bridges under construction, but the exact number, area and locations cannot be identified at this time.

The construction area for the Project does not include location of site compounds.

VicRoads would require that the contractor(s) identify suitable locations, preferably within both the Project Area and Activity Area, and obtain approval for these. If the contractor identified a suitable location outside the Project and Activity Areas, it would need to ensure it met performance standards that resulted in no impacts to the environmental and social values and undertake appropriate consultation.

The contractor(s) CEMP would be required to contain provisions excluding the locations of site compounds and laydown areas from sites that contains known habitats for endangered species or remnant native vegetation.

**Rehabilitation.** Upon completion of the works, the construction site would be landscaped and re-vegetated, including reinstating topsoil, seeding, planting trees and shrubs, installing weed mats and mulch, and installing any design elements, as required.

### ***Project Specific Controls***

No additional project specific controls are recommended for protection of aquatic flora and fauna.



## 7. Summary of Impacts and Requirements

### 7.1 Impacts on target threatened species

The existing conditions in terms of aquatic flora and fauna biodiversity and catchment values within the Study Area were established using field surveys and by literature review. Of the fifteen threatened species (listed under the FM, FFG or EPBC Acts, or state advisory lists) identified in the desktop assessment the following eight were assessed as either being likely to occur or possibly occurring in the Study Area:

- Likely to occur:
  - Murray Cod
  - Silver Perch
  - Golden Perch
  - Murray Spiny Crayfish
- Possibly occur:
  - Trout Cod
  - Freshwater (Eel-tailed) Catfish
  - Flatheaded Galaxias
  - Murray River Turtle

The risk assessment identified eighteen risk pathways that may result due to the project's construction and operation. Of these, seventeen were considered low risk to aquatic flora and fauna values if standard VicRoads and NSW Roads and Maritime controls are implemented.

One residual risk rating of medium remained, relating to a spill of toxic chemicals resulting from a vehicle incident under high rainfall conditions. Planned controls exist for reducing the likelihood of this event, and further controls are not expected to provide measurable additional reduction in the risk level. It is notable that the level of risk from this impact pathway is not considered any greater than the risk at the existing river crossings, and may in fact be lessened through the incorporation of improved traffic and environmental design controls (e.g. 1 in 100 year spill basins).

Therefore, if the mitigation measures proposed by VicRoads and NSW Roads and Maritime are successfully implemented and recommendations outlined in this report are adopted, the impact of the construction and operations of the proposed bridge on aquatic flora and fauna values are generally considered to be low.

### 7.2 Legislative requirements from impacts

There are requirements for planning permissions under the planning legislation of each state. In Victoria, a Planning Scheme Amendment would be required to the Campaspe Planning Scheme, to provide for site specific planning permit exemptions and to introduce an Incorporated Document that details Project-specific conditions. In addition the Project will trigger requirements under legislation in both Victoria and New South Wales. Approvals under various sections of legislation will need to demonstrate the ability to minimise impacts, as identified for the risk assessment in Table 10.

Environmental documentation (i.e. Project Environmental Management Plan etc.) should be developed prior to application for environmental approvals. The documentation would be required to demonstrate to referral authorities that the project meets the requirements for environmental protection. Once the required information is gathered, application can be made to the relevant authorities for approval to undertake the project, under the appropriate legislation.

Table 10 Potential project requirements under state legislation

Legislation	Requirement
<i>Fisheries Management Act</i> 1994 (NSW)	<p>The Project would involve works that would affect fish or fish habitat. The Project would potentially require the following approvals/permits:</p> <p>Section 199 – give notice of dredging and reclamation work to the Minister and to consider any matters raised by the Minister.</p> <p>Section 205 – impacts to aquatic vegetation (e.g. wetlands)</p> <p>Section 219 – works which would block fish passage.</p>
<i>Threatened Species Conservation Act</i> 1995 (NSW)	<p>The <i>Threatened Species Conservation Act</i> 1995 (TSC Act) lists a number of threatened species, populations or ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If any of these could be impacted by the project, an assessment of significance that addresses the requirements of Section 5A of the <i>Environmental Planning and Approvals Act</i> 1979 must be completed to determine the significance of the impact.</p> <p>Significance of impacts completed and provided in Appendix B.</p>
<i>Water Management Act</i> 2000 (NSW)	<p>Approval under section 91E of the <i>Water Management Act</i> 2000 would not be required as the works are being undertaken by Roads and Maritime Services.</p> <p>A licence may also be required under section 91F of the <i>Water Management Act</i> 2000 if the proposal is to intercept any aquifers (not covered in this assessment).</p>
<i>Water Act</i> 1989 (Victoria)	<p>Under Section 67 of the <i>Water Act</i> 1989, a Works on Waterways Permit is likely to be required for the project. The two major waterway crossings on the project are the Campaspe River and Murray River.</p> <p>The Campaspe is subject to the Victorian <i>Water Act</i> 1989. Some Authorities have exemptions from the requirement for a Works on Waterways permit under negotiated by-laws. In the absence of such a by-law, a permit will be required.</p> <p>The permit will specify conditions that consider protection of bank integrity, fish passage, in-stream ecology, local drainage and any other parameters relevant to the site.</p> <p>The Murray River is not subject to the Victorian <i>Water Act</i> 1989.</p>
<i>Flora and Fauna Guarantee Act</i> 1988	<p>FFG-listed species which have been collected in the vicinity of the project site or are likely to occur are:</p> <p>Freshwater Catfish (Eel-tailed Catfish) - <i>Tandanus tandanus</i></p> <p>Murray Cod – <i>Maccullochella peelii peelii</i></p> <p>Silver Perch - <i>Bidyanus bidyanus</i></p> <p>Trout Cod - <i>Maccullochella macquariensis</i></p> <p>If salvage of threatened species is required, an FFG permit to collect will be required.</p>
<i>Catchment and Land Protection Act</i> 1994	<p>The project should, specifically, avoid adding to the deterioration of river health which could decrease the likelihood of achieving the NCCMA Regional Catchment Management Strategy objectives.</p>

Legislation	Requirement
<i>Environment Protection Act 1970</i>	Impacts to water quality in the Campaspe River must not exceed water quality objectives specified in SEPP (WoV) to protect beneficial uses, unless extensive modification or natural variation precludes this attainment. In such situations the background level becomes the objective.
<i>Wildlife Act 1975</i> (Victoria)	<p>In Victoria, the legislation for protecting and managing wildlife is the <i>Wildlife Act 1975</i>. Under this Act, 'wildlife' is defined as including indigenous vertebrate species (except declared pest species), invertebrate species listed under the <i>FFG Act 1988</i>, and some introduced game species. This Act does not apply to fish or listed aquatic invertebrates as defined under the <i>Fisheries Act 1995</i>. All other native fauna (listed as threatened or not) are protected under the <i>Wildlife Act 1975</i>.</p> <p>A Management Authorisation under the Act may be required if native fauna (e.g. turtles) need to be captured and/or relocated during proposed works.</p>
<i>Fisheries Act 1995</i> (Victoria)	If management actions for mitigating impacts of fish populations require the salvaging and translocation of individuals, a permit (Management Authorisation) under the <i>Fisheries Act 1995</i> will be required.

## 8. Assumptions and limitations

This report has been prepared by GHD for VicRoads and may only be used and relied on by VicRoads for the purpose agreed between GHD and the VicRoads as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than VicRoads arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and Preferred Alignment at the time of site inspections, and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by VicRoads and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The authors of this report have not been involved in the preparation of the Echuca-Moama Bridge Project Environment Effects Statement document and have had no contribution to, or review of the Echuca-Moama Bridge Project Environment Effects Statement document other than in the Echuca-Moama Bridge Project Aquatic Flora and Fauna Impact Assessment document. GHD shall not be liable to any person for any error in, omission from, or false or misleading statement in, any other part of the Echuca-Moama Bridge Project Environment Effects Statement document.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as location of vegetation, presence / absence of ephemeral wetlands. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions, including the presence of ephemeral wetlands on the floodplain, may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

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# Appendices



## Appendix A – Fish species list (McGuckin 2010)





Fish species identified by McGuckin (2010) known to occur (or presumed to occur) within the Study Area

Binomial name	Common name
<i>Bidyanus bidyanus</i>	<b>Silver Perch</b>
<i>Gadopsis marmoratus</i> *	River Blackfish
<i>Hypseleotris</i> sp.	<b>Carp Gudgeon</b>
<i>Maccullochella peelii peelii</i>	Murray Cod
<i>Maccullochella macquariensis</i>	Trout Cod -
<i>Macquaria ambigua</i>	<b>Golden Perch</b>
<i>Mordacia mordax</i> *	Short-headed Lamprey
<i>Nannoperca australis</i>	Southern Pygmy Perch
<i>Nematalosa erebi</i>	Bony Bream
<i>Philypnodon grandiceps</i>	<b>Flat-headed Gudgeon</b>
<i>Philypnodon macrostomus</i>	Dwarf Flat-headed Gudgeon
<i>Retropinna semoni</i>	<b>Australian Smelt</b>
<i>Cyprinus carpio</i>	<b>Carp</b>
<i>Carassius auratus</i>	<b>Goldfish</b>
<i>Misgurnus anguillicaudatus</i>	<b>Oriental Weather Loach</b>
<i>Perca fluviatilis</i>	<b>Redfin</b>

\* denotes McGuckin (2010) considered species not likely to be a resident of Murray River at Echuca-Moama

\*\* bold text indicates that species was captured during 2010 surveys



## Appendix B – Seven Part Test of Significance (NSW Threatened Species Assessment)



## B.1 The Lower Murray River Endangered Ecological Community (EEC)

***In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable as this is an endangered 'community'.

***In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable as this is an endangered 'community'.

***In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

- ***Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***

It is unlikely that the proposed development would have an adverse effect on the aquatic fauna community. The minor disturbances expected during construction would be of a short-term nature and still allow fish passage. The sedimentation risk associated with the project construction is not expected to lead to an adverse effect with the implementation of the proposed mitigation measures.

In conclusion, the Project is unlikely to have an adverse effect on the extent of the EEC such that its local occurrence is likely to be placed at risk of extinction.

- ***Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;***

It is unlikely that the Project would have a significant impact on the aquatic fauna community. The minor disturbances expected during construction would be of a short-term nature and still allow fish passage. The sedimentation risk associated with the project construction is not expected to lead to an adverse effect with the implementation of the proposed mitigation measures.

In conclusion, it is considered that the proposed development is unlikely to substantially and adversely modify the composition of the EEC such that its local occurrence is likely to be placed at risk of extinction.

***In relation to the habitat of a threatened species, population or ecological community:***

- i) ***the extent to which habitat is likely to be removed or modified as a result of the action proposed; and***
- (ii) ***whether the area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- (iii) ***the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

It is considered that the proposed development would not isolate or fragment aquatic habitat, with fish still being able to move freely through the reach of concern.

***Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)***

Not Applicable.



***Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan***

Not Applicable.

***Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process***

The activity is not part of a key threatening process.

**Conclusion:** It is considered highly unlikely that the Project and bridge development would have a significant adverse impact on the Lower Murray River EEC.

**B.2 Murray-Darling population of Eel-tailed Catfish (Freshwater Catfish) *Tandanus tandanus***

***In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.***

It is highly unlikely that the Project would have a significant impact on the life cycle of this species because disturbances during construction are expected to be minor and would still allow fish passage. The sedimentation risk associated with the project's construction is not expected to lead to an adverse effect if the proposed mitigation measures are adhered to.

***In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable.

***In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

- ***Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***  
Not applicable.
- ***Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;***  
Not applicable.

*In relation to the habitat of a threatened species, population or ecological community:*

***i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and***

Minimal, if any, habitat is expected to be impacted within the waterway and the footprint of the Project within aquatic habitat would be negligible in comparison to available surrounding habitat.

***(ii) Whether the area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action and,***

It is considered that the Project would not isolate or fragment any habitat, with fish able to move freely through the reach of concern.

***(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Not applicable.

***Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

There would be no adverse effect on critical habitat as there is not likely to be critical habitat present. The Project should have little to no effect on the aquatic fauna community, and the sedimentation risk associated with the project is not expected to lead to a long-term adverse effect.

***Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.***

Not Applicable

***Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.***

The activity is not part of a key threatening process.

**Conclusion:** A significant adverse impact of the bridge construction on the Eel-tailed (Freshwater Catfish) is highly unlikely.

### **B.3 Flat-Headed Galaxid *Galaxias rostratus***

***In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.***

It is highly unlikely that the development would have an impact on the life cycle of this species because the disturbances during construction are expected to be minor and would still allow fish passage. The sedimentation risk associated with the Project construction is not expected to lead to an adverse effect if suggested mitigations are adhered to.

***In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not Applicable

***In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

- ***Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***  
Not applicable
- ***Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;***  
Not applicable.

***In relation to the habitat of a threatened species, population or ecological community:***

- i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and***

Minimal, if any, habitat is expected to be impacted within the waterway and the footprint of the Project would be insignificant in comparison to available surrounding habitat.

***(ii) Whether the area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***

It is considered that the Project would not isolate or fragment any habitat, with fish able to move freely through the reach of concern.

***(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Not applicable.

***Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

There would be no adverse effect on critical habitat as there is no critical habitat present. The nature of the design of the proposed bridge should have little to no effect on the aquatic fauna community, and the small sedimentation risk associated with the Project is not expected to lead to a long-term adverse effect.

***Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan***

Not Applicable

***Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.***

The activity is not part of a key threatening process.

**Conclusion:** A significant adverse impact of the bridge construction on the Flatheaded Galaxid is highly unlikely.

## Appendix C – Matters of National Significance Test (Department of Environment Significance Assessment Guidelines)



Criteria	Trout Cod	Silver Perch	Murray Cod
Is it an important population?	Yes	Yes	Yes
<b>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:</b>			
Lead to a long-term decrease in the size of an important population of a species	No The project is expected to have a minimal footprint and implementation of mitigation controls proposed will minimise impacts to population size.	No The project is expected to have a minimal footprint and implementation of mitigation controls proposed will minimise impacts to population size.	No The project is expected to have a minimal footprint and implementation of mitigation controls proposed will minimise impacts to population size.
Reduce the area of occupancy of an important population of the species	No The small footprint and minimal (if any) instream works is unlikely to reduce the area of occupancy of the species.	No The small footprint and minimal (if any) instream works is unlikely to reduce the area of occupancy of the species.	No The small footprint and minimal (if any) instream works is unlikely to reduce the area of occupancy of the species.
Fragment an existing important population into two or more populations	No The small footprint and minimal (if any) instream works is unlikely to fragment the local population.	No The small footprint and minimal (if any) instream works is unlikely to fragment the local population.	No The small footprint and minimal (if any) instream works is unlikely to fragment the local population.
Adversely affect habitat critical to the survival of a species	No Minimal (if any) instream works are proposed; however, any requirement for the removal of instream habitat (such as snags) should be reinstated once the works have been completed or suitably re-located.	No Minimal (if any) instream works are proposed; however, any requirement for the removal of instream habitat (such as snags) should be reinstated once the works have been completed or suitably re-located.	No Minimal (if any) instream works are proposed; however, any requirement for the removal of instream habitat (such as snags) should be reinstated once the works have been completed or suitably re-located.
Disrupt the breeding cycle of an important population	No The small footprint and minimal (if any) instream works is unlikely to disrupt the breeding cycle of the species.	No The small footprint and minimal (if any) instream works is unlikely to disrupt the breeding cycle of the species.	No The small footprint and minimal (if any) instream works is unlikely to disrupt the breeding cycle of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No Minimal (if any) instream works are proposed; however, any requirement for the removal of instream habitat (such as snags) should be reinstated once the works have been completed or suitably re-located.	No Minimal (if any) instream works are proposed; however, any requirement for the removal of instream habitat (such as snags) should be reinstated once the works have been completed or suitably re-located.	No Minimal (if any) instream works are proposed; however, any requirement for the removal of instream habitat (such as snags) should be reinstated once the works have been completed or suitably re-located.



Criteria	Trout Cod	Silver Perch	Murray Cod
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	<p>No</p> <p>It is unlikely that additional invasive aquatic species would be introduced during the construction process if proposed controls are implemented. The Study Area already supports a number of invasive fish species.</p>	<p>No</p> <p>It is unlikely that additional invasive aquatic species would be introduced during the construction process if proposed controls are implemented. The Study Area already supports a number of invasive fish species.</p>	<p>No</p> <p>It is unlikely that additional invasive aquatic species would be introduced during the construction process if proposed controls are implemented. The Study Area already supports a number of invasive fish species.</p>
Interfere substantially with the recovery of the species.	<p>No</p> <p>The Project is expected to have a minimal footprint and implementation of mitigation controls proposed will minimise impacts to population size.</p>	<p>No</p> <p>The Project is expected to have a minimal footprint and implementation of mitigation controls proposed will minimise impacts to population size.</p>	<p>No</p> <p>The Project is expected to have a minimal footprint and implementation of mitigation controls proposed will minimise impacts to population size.</p>
Introduce disease that may cause the species to decline	<p>No</p> <p>The likelihood of the introduction of disease from the construction project is minimal, the area of concern is an urbanised environment and equipment used would be cleaned prior to working on site, as per standard controls proposed.</p>	<p>No</p> <p>The likelihood of the introduction of disease from the construction project is minimal, the area of concern is an urbanised environment and equipment used would be cleaned prior to working on site, as per standard controls proposed.</p>	<p>No</p> <p>The likelihood of the introduction of disease from the construction project is minimal, the area of concern is an urbanised environment and equipment used would be cleaned prior to working on site, as per standard controls proposed.</p>

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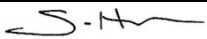
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