

Threatened flora species

A total of 152 flora species were recorded in the study area during field surveys, including 80 native species and 72 exotic species. Surveys were undertaken for six threatened flora species predicted to occur within the study area, however none were found. Further discussion of the suitability of habitat for threatened flora species is provided in Table 5 of **Appendix H** (Biodiversity development assessment report).

Weeds

During field surveys 15 high-threat weed species were recorded in the study area, with four listed as priority weeds for the Greater Sydney region shown in Table 7-49.

Table 7-49 High threat and priority weed species recorded in the study area

Scientific name	Common name	Priority weed species
<i>Ageratina adenophora</i>	Crofton Weed	No
<i>Asparagus asparagoides</i>	Bridal Creeper	Yes
<i>Bidens pilosa</i>	Cobblers Pegs	No
<i>Chlorophytum comosum</i>	Spider Plant	No
<i>Cyperus eragrostis</i>	Umbrella Sedge	No
<i>Ehrharta erecta</i>	Panic Veldt Grass	No
<i>Lantana camara</i>	Lantana	Yes
<i>Ligustrum lucidum</i>	Large-leaved Privet	No
<i>Ligustrum sinense</i>	Small-leaved Privet	No
<i>Lonicera japonica</i>	Japanese Honeysuckle	No
<i>Olea europaea</i>	African Olive	Yes
<i>Rumex sagittata</i>	Turkey Rhubarb	No
<i>Rumex acetosella</i>	Sorrel	No
<i>Senecio madagascarensis</i>	Fireweed	Yes
<i>Tradescantia fluminensis</i>	Wandering Jew	No

Threatened fauna species

A likelihood of occurrence assessment identified 28 threatened fauna species as having a moderate to high likelihood of occurring in the study area. Targeted threatened fauna surveys were undertaken for five species within areas of suitable roosting/breeding habitat within the study area, as shown on Figure 7-37 to Figure 7-41. No nocturnal surveys were conducted as part of the field survey, as the field survey timing was outside the recommended survey period for microbats. However, in accordance with Appendix F of the *Microbat Management Guidelines* (Transport, 2021), the survey period for the current assessment adheres to BAM requirements for the locally occurring threatened microbat species, the Southern Myotis and Bent-winged bats in structures such as bridges.

The findings of this survey concluded that the:

- Large Bent-winged Bat (*Miniopterus orianae oceanensis*) is considered highly unlikely to be present
- Little Bent-winged Bat (*Miniopterus australis*) is considered highly unlikely to be present
- Southern Myotis (*Myotis macropus*) is considered highly unlikely to be present in the majority of the bridges. All potential foraging habitat has been accounted for in the calculation of offset requirements, as outlined in **Section 7.6.6**.

- Cumberland Plain Land Snail (*Meridolum corneovirens*) was not present
- Dural Land Snail (*Pommerhelix duralensis*) was not present.

Migratory species

The desktop review identified 23 listed migratory species with the potential to occur within the study area, however none of these had a moderate or high likelihood of occurring. As such, no targeted surveys were undertaken for migratory species.

Aquatic biodiversity

Field surveys were undertaken at 13 sites along creeks and tributaries where waterway crossings intersected with the study area. These sites are depicted in Figure 7-55 to Figure 7-67).

Habitat-based assessments were undertaken. Given the degraded nature of the waterways present, a habitat-based survey was considered adequate for the assessment of the proposed modification. The aquatic habitat assessment values from the site surveys are detailed in **Appendix H** (Biodiversity development assessment report).

Riparian vegetation

The vegetation across all riparian assessment sites was noted as typically modified, dominated by exotic vegetation and providing little function for the waterway, with understoreys comprised of mostly exotic grasses and annuals. Vegetation alongside waterways contained the following endangered ecological communities (listed under the *Biodiversity Conservation Act 2016* (NSW)):

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

Aquatic species

The following aquatic species types were considered during the aquatic biodiversity assessment:

- Fish
- Threatened species
- Macroinvertebrates.

The desktop-based analysis revealed the following records of fish species within proximity to the study area:

- Long-finned Eel (*Anguilla reinhardtii*)
- Short-finned Eel (*A. spp.*)
- Carp (*Cyprinus carpio*)
- Eastern Gambusia (*Gambusia holbrooki*).

The proposed modification is located within the Sydney Metropolitan and Hawkesbury-Nepean catchments, however waterways such as Cabramatta Creek and Hinchinbrook Creek are described as degraded, drained, extensively cleared and highly modified. Both catchments are impaired by numerous barriers to fish passages from culverts, bridges, and erosion control structures that impede diversity and abundance of fish, favouring common or exotic species tolerant to disturbed habitats (Nicholis and McGirr 2005; DPI 2006).

Threatened species searches of the DAWE's Protected Matters Search Tool (PMST) (10 kilometre buffer) (DAWE, 2021) and Fisheries NSW spatial data portal (DPI, 2021) identified three threatened fish species with potential to occur in the Georges River and Hawkesbury-Nepean catchments. No threatened invertebrates listed under the EPBC Act or FM Act were identified as having the potential to occur within the PMST search area. The potential for occurrence of all threatened species is unlikely in all waterways in the study area, either as there was no potential habitat identified during field surveys, no previous records and/or known or modelled distribution under threatened species distribution

mapping in proximity to the construction footprint (DPI, 2021). There were therefore no aquatic species with a moderate to high likelihood of occurrence within, or up and downstream of, the waterways that would be affected by construction or operation of the proposed modification.

Although the study area crosses over creeks which may contain macroinvertebrates, previous studies indicated that the quality of the water in the creeks are 'severely impacted' with few macroinvertebrate species present, most being pollution tolerant species (Georges Riverkeeper, 2020; Blacktown City Council, 2020).

Given the highly modified nature of the existing environment, and low likelihood of species occurring, impacts to aquatic species is not discussed further.

Aquatic habitat

Small coastal wetlands are present within the southern section of the study area, downstream of a few aquatic survey locations (see Figure 7-55 to Figure 7-67). These wetlands are part of the Georges River catchment and include key fish habitat (KFH) (Sydney Metropolitan and Hawkesbury-Nepean). Estuarine KFH protected under the *State Environmental Planning Policy (Resilience and Hazards) 2021*, notably the Nationally important RAMSAR wetland Towra Point Nature Reserve at Botany Bay, is located about 25 kilometres downstream of the southern end of the study area.

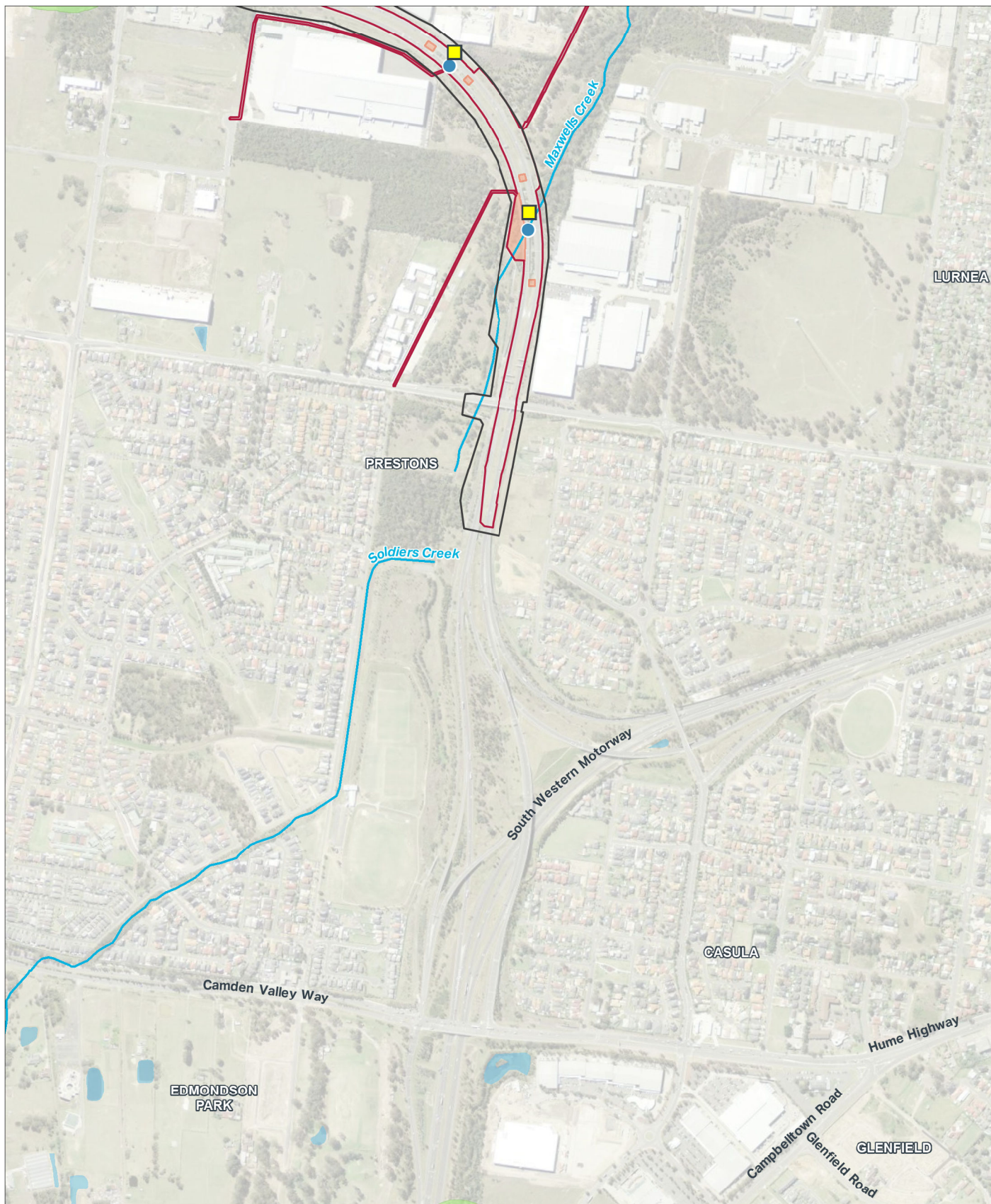


FIGURE 7-55: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (1 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse
- Aquatic survey effort
- Coastal wetland proximity area
- Proposed bridge widening**
- Northbound



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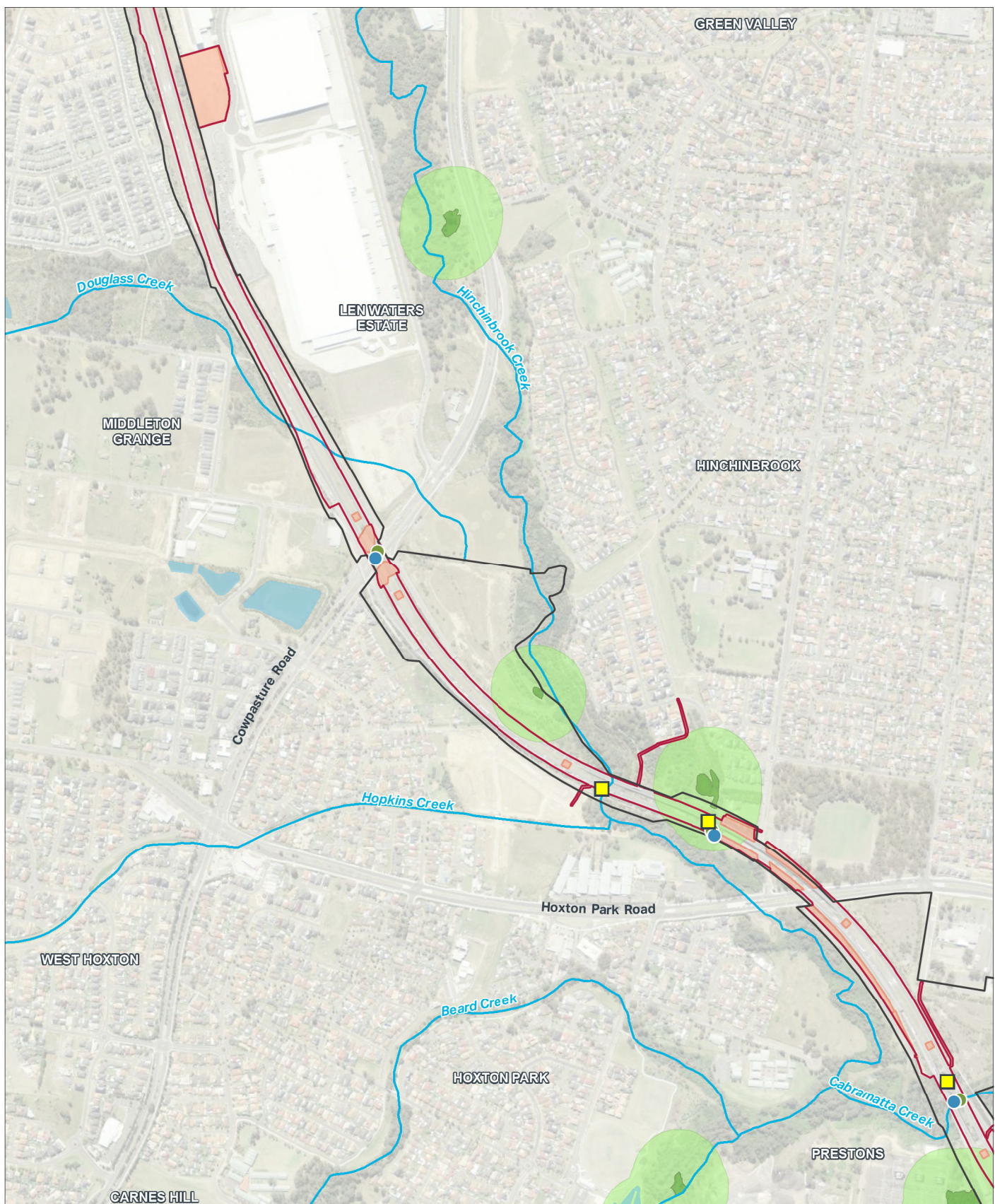


FIGURE 7-57: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (3 OF 13)

Legend

- | | |
|---|--|
| Construction footprint | Aquatic survey effort |
| Operational footprint (maintenance boundary) | Coastal wetland |
| Construction ancillary facility | Coastal wetland proximity area |
| Waterbody | Proposed bridge widening |
| — Watercourse | ● Northbound |
| | ● Southbound |



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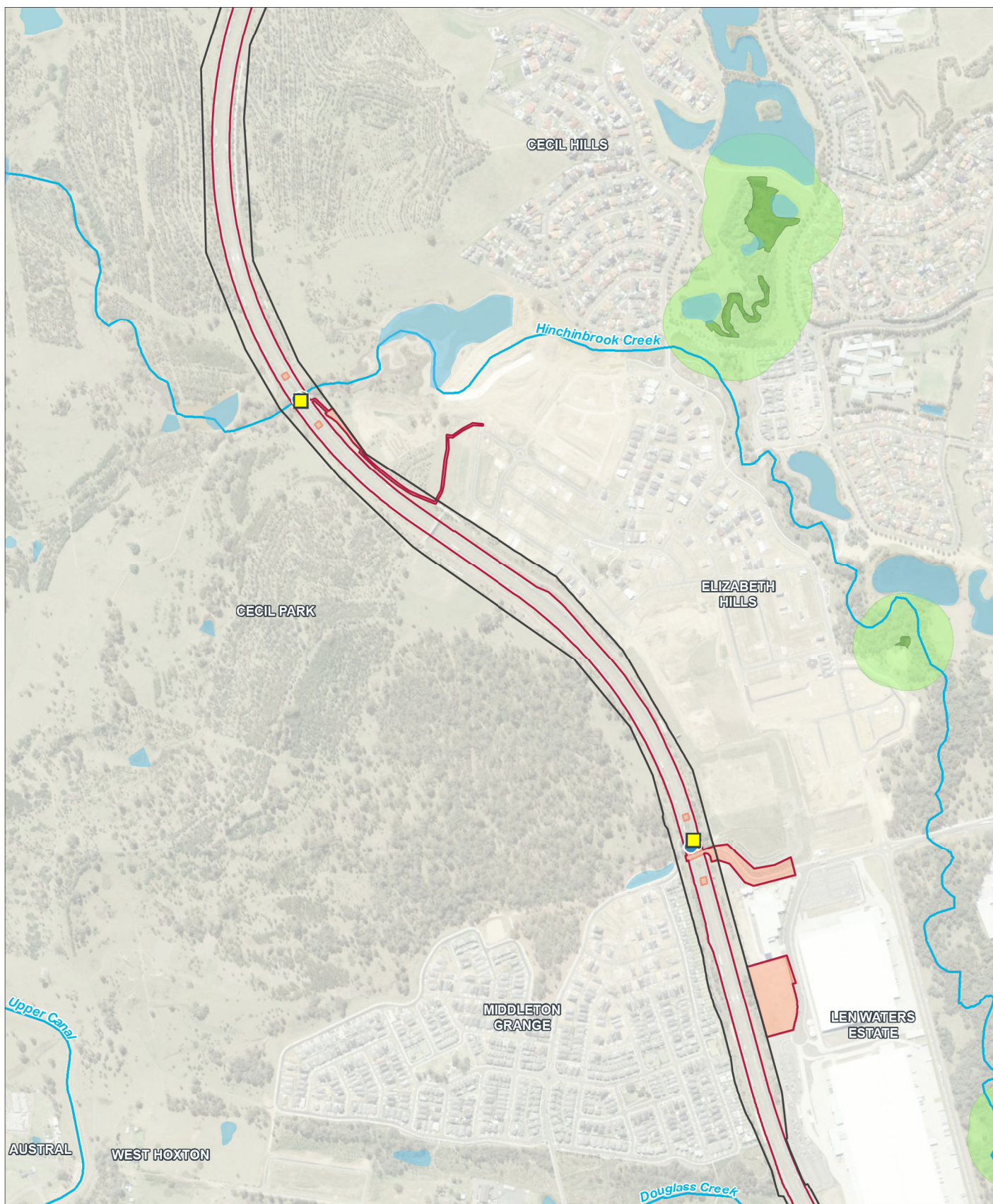


FIGURE 7-58: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (4 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse
- Aquatic survey effort
- Coastal wetland
- Coastal wetland proximity area
- Proposed bridge widening**
 - Northbound
 - Southbound



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FIGURE 7-59: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (5 OF 13)



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Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse

- Aquatic survey effort
- Coastal wetland
- Coastal wetland proximity area
- Key Fish Habitat

Proposed bridge widening

- Northbound
- Southbound

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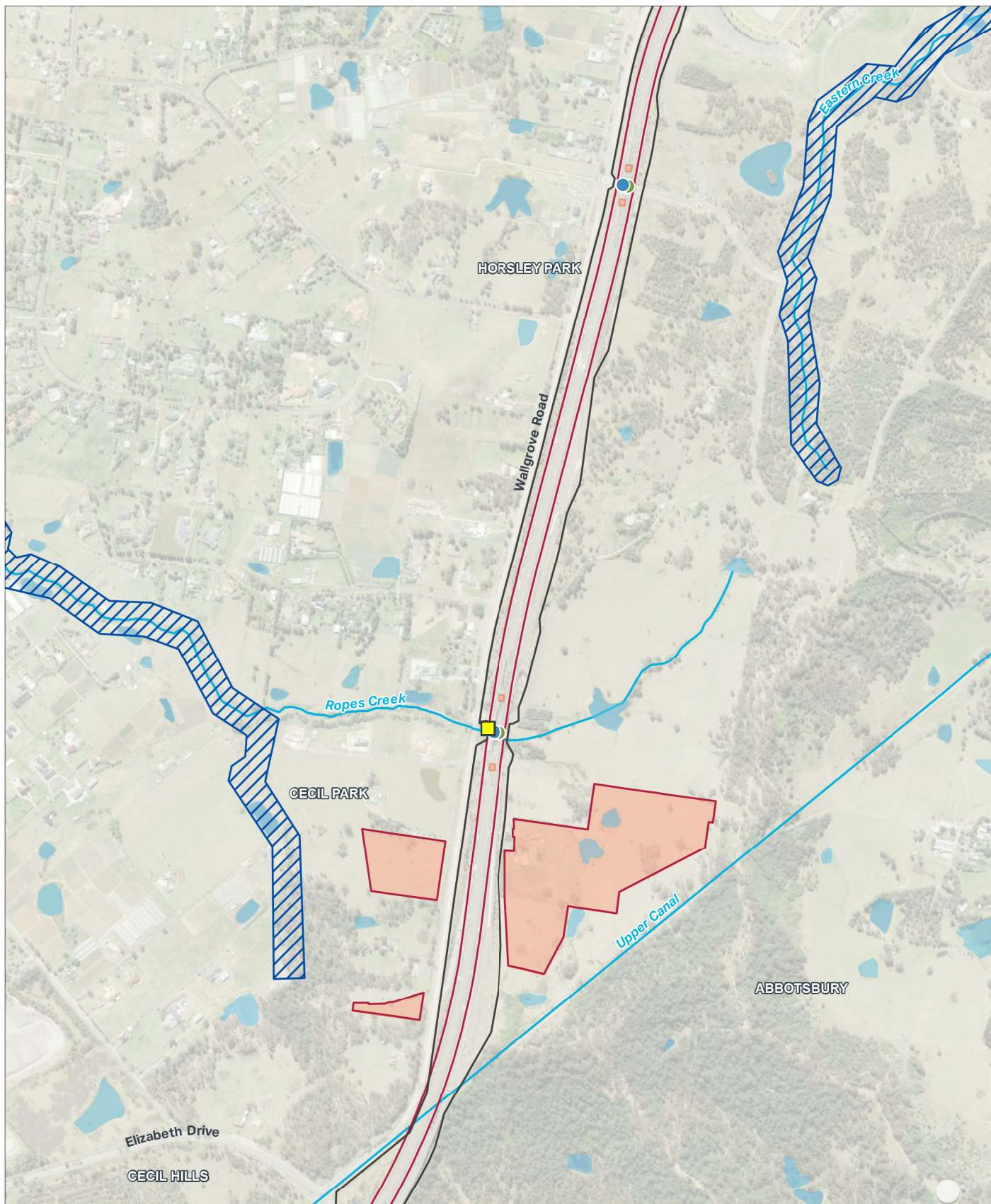


FIGURE 7-60: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (6 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse

- Aquatic survey effort
- Key Fish Habitat
- Proposed bridge widening**
- Northbound
- Southbound



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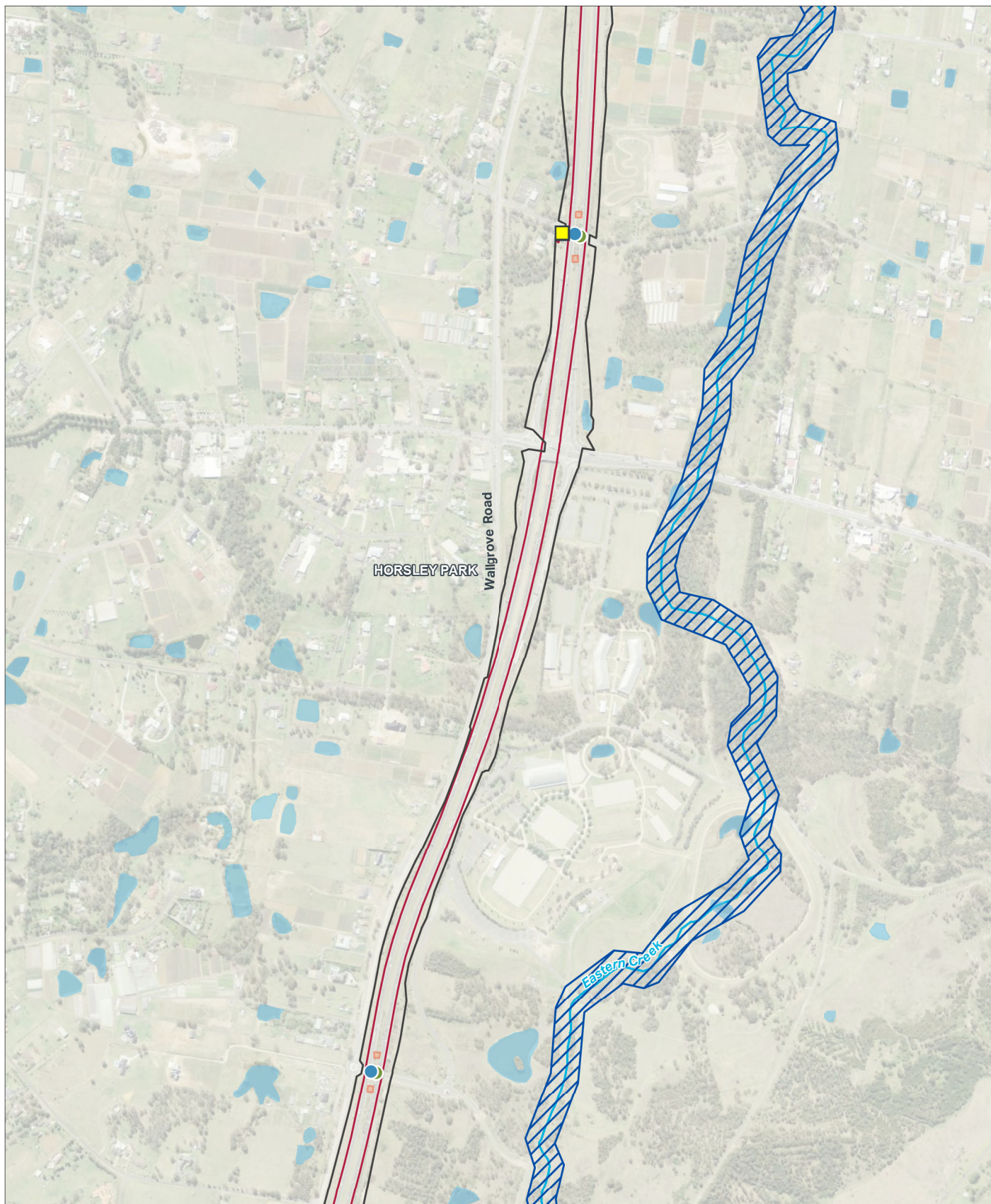


FIGURE 7-61: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (7 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse

- Aquatic survey effort
- Key Fish Habitat
- Proposed bridge widening**
- Northbound
- Southbound



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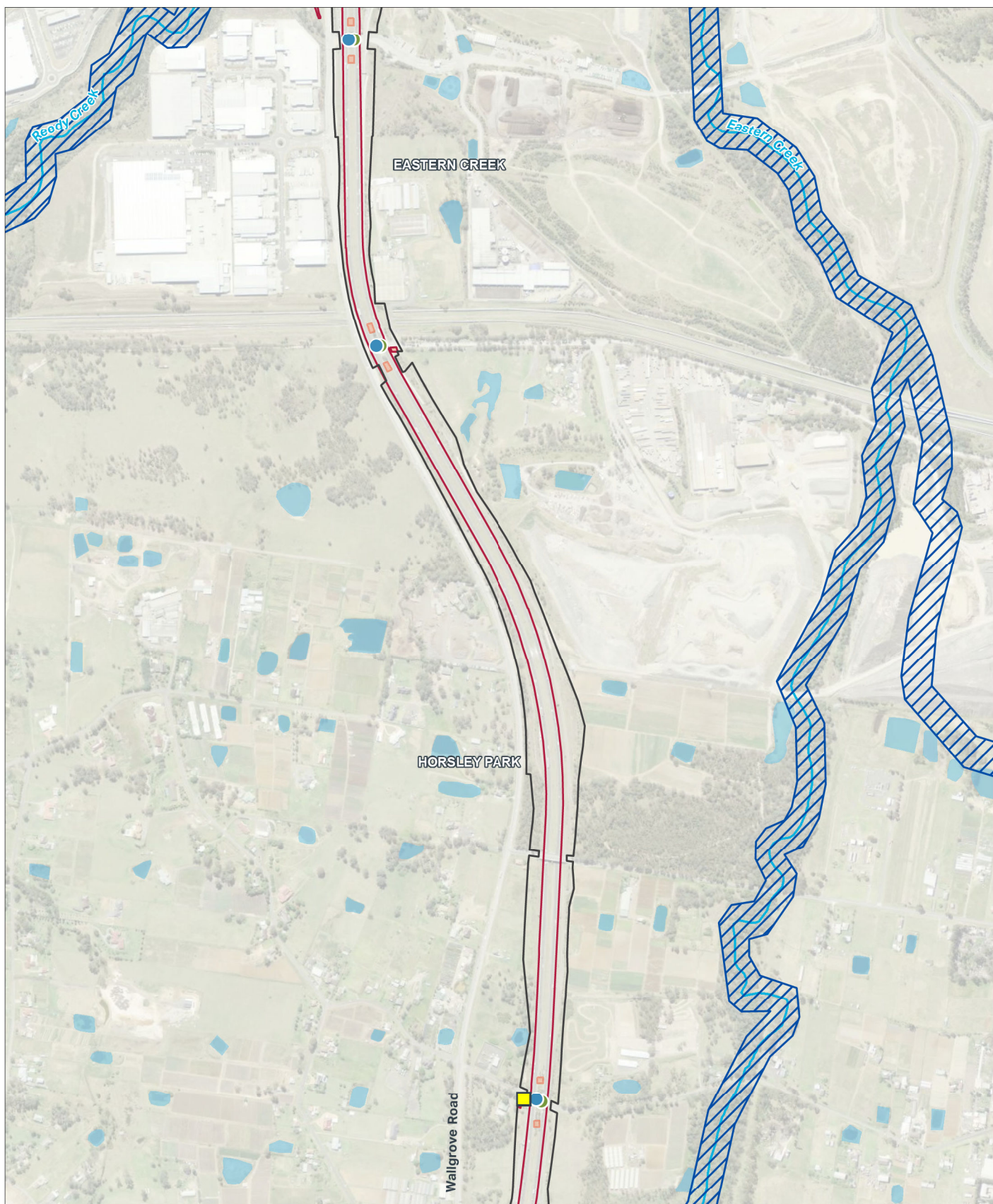


FIGURE 7-62: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (8 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse

- Aquatic survey effort
- Key Fish Habitat
- Proposed bridge widening**
- Northbound
- Southbound



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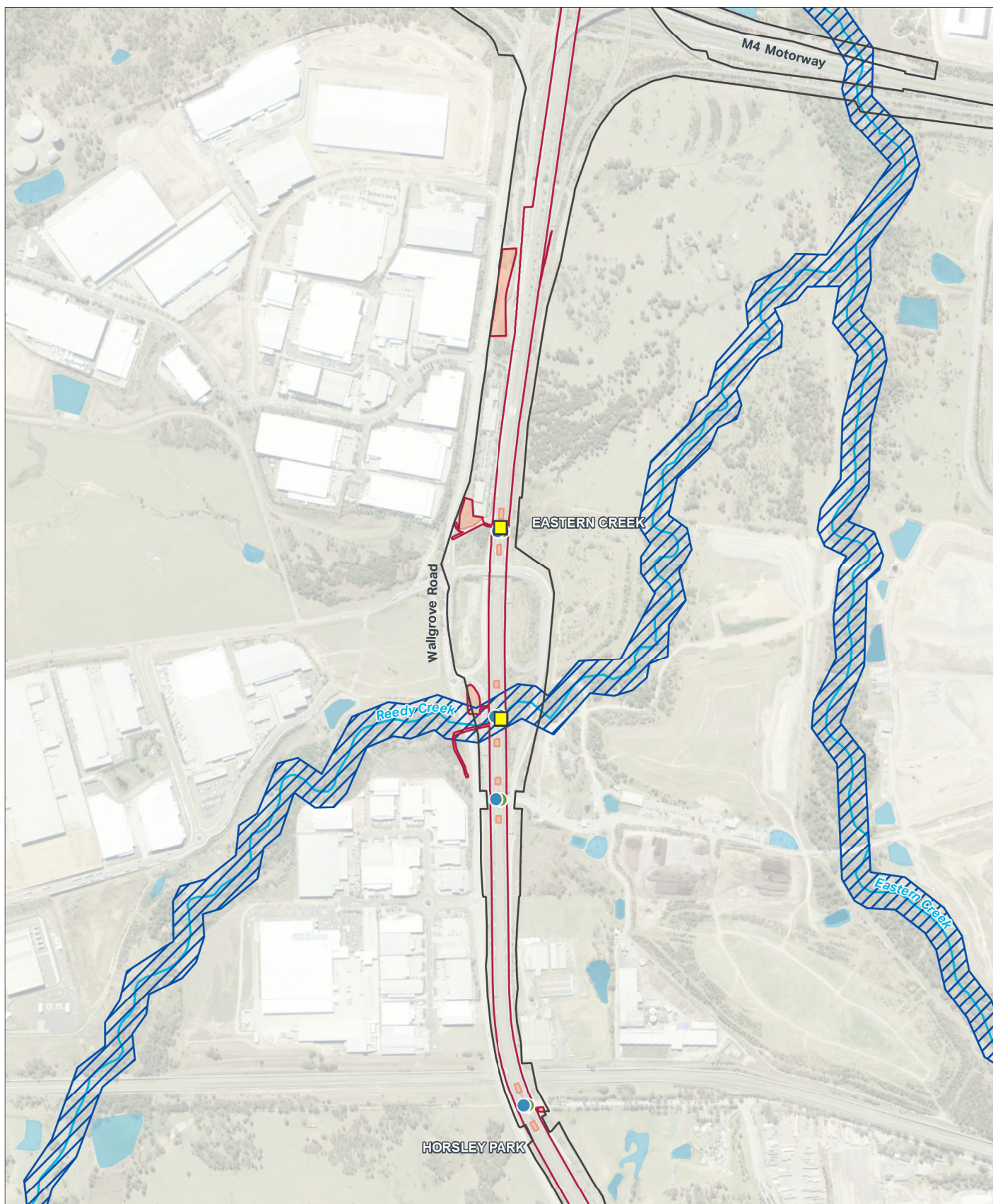


FIGURE 7-63: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (9 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse

- Aquatic survey effort
- Key Fish Habitat
- Proposed bridge widening**
- Northbound
- Southbound



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FIGURE 7-65: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (11 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse

- Aquatic survey effort
- Key Fish Habitat
- Proposed bridge widening**
- Northbound
- Southbound



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FIGURE 7-66: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (12 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse

- Aquatic survey effort
- Key Fish Habitat
- Proposed bridge widening**
- Northbound
- Southbound



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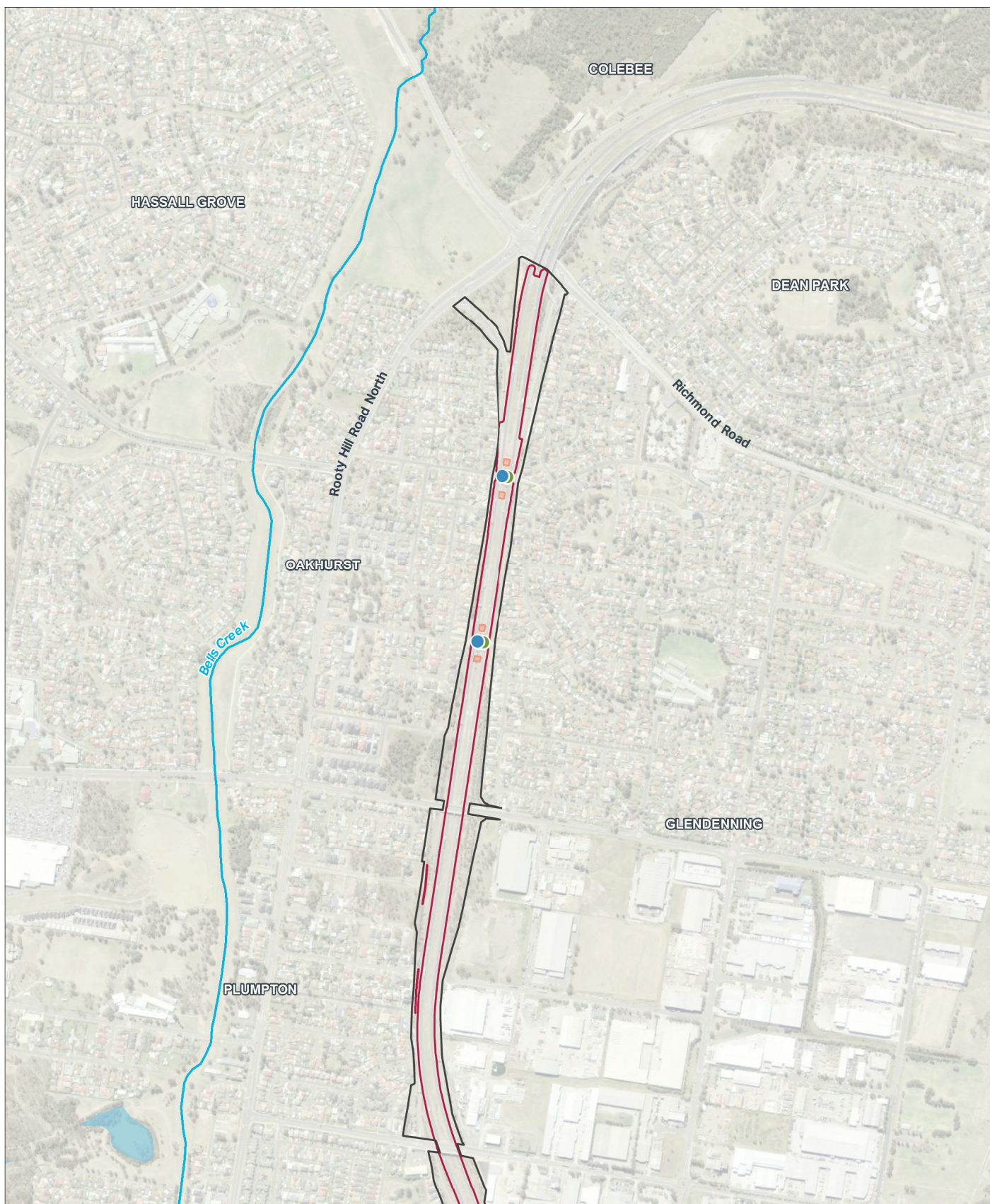


FIGURE 7-67: AQUATIC HABITAT IN THE VICINITY OF THE PROPOSED MODIFICATION SHEET (13 OF 13)

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Construction ancillary facility
- Waterbody
- Watercourse
- Proposed bridge widening**
 - Northbound
 - Southbound



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7.6.5 Impact assessment

Impacts to biodiversity from construction and operation of the proposed modification are described in this section, and include potential impacts to:

- Terrestrial biodiversity including:
 - Native vegetation
 - TECs and potential serious and irreversible impacts (SAILs)
 - Threatened fauna habitat
 - Prescribed impacts
 - Spread of weeds
- Aquatic habitat.

Construction

Potential impacts on biodiversity values from construction of the proposed modification are described in Table 7-50, and summarised as follows:

- Direct removal of 7.48 ha of modified native vegetation containing seven PCTs, aligning to six TECs
- Removal of 2.31 ha of foraging habitat for the Southern Myotis (*Myotis Macropus*)
- Removal of fauna habitat (native vegetation and drainage lines)
- Disturbance to sections of 18 creeklines ranging from smaller 1st order unnamed creeks through to larger 5th order streams (Cabramatta Creek).

An assessment of significance under the EPBC Act was required for the Critically Endangered Ecological Community Cumberland Plain Woodland in the Sydney Basin Bioregion, which concluded that a significant impact because of the proposed modification was unlikely. This is further detailed in the sections below.

No flora or fauna listed under the EPBC Act are considered affected species. Therefore, there is no requirement for a controlled action referral under the EPBC Act referral regarding Commonwealth threatened species, communities or populations.

Table 7-50 Assessment of construction impacts on terrestrial biodiversity

Impact	Likelihood	Extent of impact due to the proposed modification
Removal or modification of native vegetation	Known	Around 7.48 ha of native vegetation (highly modified and invaded by introduced species), which may provide fauna habitat, would be removed. Ecosystem credits generated to offset native vegetation are detailed in Section 7.6.6 .
Loss of individuals of a threatened species	None	No threatened flora or fauna were identified or considered likely to occur within the area of direct impact. No threatened species are likely to be harmed as part of the proposed modification.
Removal or modification of threatened species habitat other than native vegetation (micro-habitat features)	None	No threatened species habitat (excluding native vegetation) was identified within the study area.
Death through trampling or vehicle strike	Low	Construction of the proposed modification is unlikely to cause death through trampling or vehicle strike.

Impact	Likelihood	Extent of impact due to the proposed modification
Death through poisoning	Low	No poisons are proposed to be used as part of the proposed modification. Harmful substances used in construction or weed management would all be controlled as per applicable requirements under Australian Standards.
Fragmentation	Low	Around 7.48 ha of modified native vegetation would be permanently removed. Given that about half (5.32 ha) of this is grassland, and the remainder regrowth, it is not considered to contribute to fragmentation of remnant native vegetation in the locality.
Removal of hollow-bearing tree	Known	One hollow-bearing tree located north of Eastern Road is likely to require removal as part of the proposed modification. This tree is unlikely to be used by native fauna, and would not be used by any species credit species of fauna. A dead stag is present in the Zone C-3 construction ancillary facility at Eastern Creek, which is suspected of containing small hollows. The requirement to remove or retain this tree would be confirmed during construction planning.

Prescribed impacts

'Prescribed impacts' include impacts on biodiversity values in addition to, or instead of clearing native vegetation or loss of habitat. For example, the removal of non-native vegetation and human-made structures, or impacts on the movement of threatened species that maintains their life cycle.

The following prescribed impacts are potential risks during construction of the proposed modification:

- Hydrological process sustaining/interacting with rivers, streams or wetlands, given disturbance of overland and underground flows may affect flow of creeks
- Vehicle strikes on threatened species, given plant, machinery and vehicles using the construction ancillary facilities may cause species mortality or injury.

These impacts are likely to be adequately managed by the mitigation measures provided in **Section 7.6.6**.

Native vegetation and threatened ecological communities

The proposed modification would require an area of native vegetation removal. The native vegetation is in a degraded state however provides potential foraging resources for insectivorous, frugivorous and nectivorous fauna. The removal of this vegetation cannot be further avoided or mitigated. This statement is further discussed in further detailed in Table 7-51. As per the BAM (DPIE, 2020), **Section 7.6.6** details the biodiversity credits required to offset the unavoidable impacts of the proposed modification.

Key Threatening Processes

There are 39 Key Threatening Processes (KTP) listed under the BC Act and/or EPBC Act. The only relevant KTP that would occur as a result of the proposed modification is the 'clearing of native vegetation' (i.e. permanent removal of 7.48 ha of non-planted native vegetation). The majority of this vegetation is highly modified, subject to edge effects and impacted heavily by weed invasion. Intact and better condition areas of native vegetation have been avoided as part of the proposed modification.

A dead stag suspected to contain small hollows, is present in the Zone C-3 construction ancillary facility at Eastern Creek approaching the Westlink M7/M4 Motorway (Light Horse) Interchange. As it is unknown if this tree would be retained, the removal of hollow-bearing trees KTP may potentially be exacerbated by the proposed modification if it were to be removed.

The majority of the remaining KTPs are either avoided through mitigation or are not relevant to the proposed modification (refer to Section 3.2.5 of **Appendix H** (Biodiversity development assessment report) for further details).

Table 7-51 Direct impacts on native vegetation in the study area

PCT and direct impacts						TECs		
PCT No	PCT name	Condition	Vegetation zone code within study area	Construction impact (ha)	Operational impact (ha)	Associated TEC	BC Act status*	EPBC Act status*
724	Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate	1	0.11	0	Shale Gravel Transition Forest in the Sydney Basin Bioregion	E	CE
725	Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate	2	0.08	0	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E	CE (however patch ineligible due to existing condition)
835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	10	0.10	0.01	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	CE (however patch ineligible due to existing condition)
		Low	5	0.74	0.18			

PCT and direct impacts						TECs		
PCT No	PCT name	Condition	Vegetation zone code within study area	Construction impact (ha)	Operational impact (ha)	Associated TEC	BC Act status*	EPBC Act status*
849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	3	2.37	0	Cumberland Plain Woodland in the Sydney Basin Bioregion	E	CE (however ineligible in certain areas due to existing condition)
		Low	8	0.58	0			
850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Low	4	0.70	0.08			
		Moderate	9	0.13	0			
1737	Typha rushland	Moderate	11	0.09	0	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	N/A
		High	6	0.01	0.003		E	
1800	Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Poor	13	0.56	0.14	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	E (however patch ineligible due to existing condition)
		Low	7	0.68	0.02			
		Moderate	12	1.33	0.33			
Total				7.48	0.76			

*Notes: E: Endangered; CE: Critically Endangered.

No threatened species at risk of SAI are known or considered likely to occur within the study area.

Two of the PCTs associated with TECs recorded in the study area are at risk of SAI, as the proposed modification would require some TEC vegetation removal. Impacts of the proposed modification on these TECs at risk of SAI are described in Table 7-52.

Table 7-52 Assessment of construction impacts on TECs at risk of SAI

TEC	Area (ha) impacted	Operational impacts
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (CRCIF)	0.08	<ul style="list-style-type: none"> This is about 0.01% of the remaining CRCIF in NSW The area of CRCIF to be impacted has little to no structural integrity, has low floristic diversity and its ecological processes have been disrupted such that the community's functioning is reduced PCT 825 (moderate) has a Vegetation Integrity (VI) of 25.4 while the benchmark data for this TEC is around 93.3, which suggests this CRCIF is in a degraded state The proposed widening would result in the removal of 0.08 ha of isolated patches of wooded CRCIF from the study area, and a highly fragmented landscape; however, this clearance of vegetation is unlikely to result in an adverse impact on the movement of pollinator vectors and other dispersal mechanisms operating within the CRCIF present within the locality. These patches are generally isolated and do not form an important part of the TEC in the locality Other larger, contiguous areas of the TEC present in the locality and surrounding region would not be reliant on the 0.08 ha of CRCIF proposed to be removed for its long-term survival
Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW)	3.78	<ul style="list-style-type: none"> The proposed modification is expected to impact 3.78 ha of CPW (consisting of poor (2.37 ha), low (1.28 ha) and moderate (0.13 ha) condition states). This is about 0.03% of the remaining CPW in NSW and includes a grassland variant of CPW but compares it to a vegetation mapping project that does not generally include such variants (it includes wooded areas only). As such, a comparison to the vegetation mapping undertaken would take into consideration only the wooded variants of CPW present on the study area to be impacted (the low and moderate condition states of the relevant PCTs), and thus result in an even smaller proportion of CPW in NSW. Based on this analysis, the total area of CPW to be impacted is 1.41 ha, which represents 0.01% of the remaining CPW in NSW. The area of CPW to be impacted (62% grassland) has little to no structural integrity, has low floristic diversity and its ecological processes have been disrupted such that the community's functioning is reduced. The poor, low and moderate vegetation zones of CPW have a low Vegetation Integrity score (8.7, 23.1 and 41.5, respectively), compared to the benchmark data for this TEC (around 94.4), which suggests this CPW is in an extremely degraded state. The proposed modification would result in the removal of 1.41 ha of isolated patches of wooded CPW from the study area, and a highly fragmented landscape; however, this

TEC	Area (ha) impacted	Operational impacts
		clearance of vegetation would not result in an adverse impact on the movement of pollinator vectors and other dispersal mechanisms operating within the CPW present within the locality.

Threatened terrestrial fauna habitat

Potential construction impacts to threatened fauna habitat would be limited to bridge works, as some of the bridges and nearby habitat that would be affected by the proposed modification provide potential roosting habitat for the Southern Myotis. While the species was not observed during the microbat assessment, Southern Myotis is assumed to utilise the study area for foraging purposes only. Thus for the purpose of the BAM, and as the field survey was conducted on the shoulder of the recommended survey period for this species, Southern Myotis is considered present. Additionally, based on the guidelines of the Threatened Biodiversity Data Collection (TBDC) it was found a total of 2.31 hectares of potential foraging habitat for the Southern Myotis is required to be offset as a result of the proposed modification. A species polygon for Southern Myotis, in accordance with section 5.2.5 of the BAM, has been prepared (see **Appendix H** (Biodiversity development assessment report)).

It is recommended that field survey in accordance with the bat survey guidelines (OEH, 2018) and TBDC be undertaken in spring to confirm whether Southern Myotis is using the study area for its foraging purposes.

A Microbat Management Plan would be prepared to limit construction impacts on potential roosting habitats. If bat sightings occur during additional surveys at the any of the bridge locations, these sites should be investigated by a qualified ecologist prior to construction work in these areas. These mitigation measures have been included in Table 7-56.

Spread of weeds

Some weeds would be removed during the vegetation clearing required for the proposed modification. The BDAR is not required to assess the direct impacts of weed removal.

Given the presence of weeds in the study area (refer to Table 7-49), there is potential for disturbance of vegetation to lead to the spread and/or intensification of weeds. If not appropriately managed, this may indirectly affect native flora and fauna in adjoining areas by further reducing habitat quality, altering the structure and composition of vegetation and increasing competition for resources.

The implementation of mitigation measures outlined in **Section 7.6.6** would minimise the potential for the spread of weeds from construction activities.

Aquatic habitat

The risk and severity of potential impacts to the aquatic environment were assessed for the construction of the proposed modification and are detailed in Section 6.1 of Annex 1 of **Appendix H** (Biodiversity development assessment report). Potential impacts with moderate to high residual risk are shown in Table 7-53.

The level of impact is described as very low, low, medium or high based on the potential impact, potential impact severity prior to any mitigation or mitigation measures, and/or probability of occurrence. The residual risk to aquatic ecosystems is based on the potential impact, following the application of mitigation measures (as discussed in **Section 7.6.6**). Definitions used in the impact assessment are detailed in **Appendix H** (Biodiversity development assessment report).

With the implementation of appropriate mitigation, most residual risks to aquatic habitats from construction of the proposed modification are low. Where 'high' to 'moderate' residual risks have been identified, specific measures in Table 7-56 have been provided to limit the severity of impact.

Table 7-53 Potential construction impacts to aquatic habitat

Hazard	Potential impact	Potential severity	Likelihood of occurrence	Residual risk
General construction	Release of alkaline concrete wash water from stored concrete materials and plant or equipment washout waste, which may cause localised groundwater or surface water contamination.	Low – Water quality is unlikely to be measurably affected by localised alkaline materials to the extent that it could affect the aquatic ecology of the waterways present in the construction footprint.	Moderate – Potential for alkaline material to enter waterway after rainfall events.	Low – The severity is low and mitigation measures would be installed to capture runoff from these materials.
Flood and flow paths during construction	The ancillary facilities have potential to impact local flooding conditions by altering flow depths, velocities, or flow paths. Alternatively, portable buildings and large unsecured construction objects have the greatest potential to affect flooding. They can be carried away by deep floodwaters and worsen local flood conditions by blocking bridges, culverts, and flood control structures downstream.	Low – Local aquatic habitat may be temporarily altered by a change in hydraulics, however this is not expected to change the ecology of the waterway.	Low	Low – The severity and likelihood of this risk occurring are low. Where possible, facilities should be located above areas that are susceptible to flooding.
Leaks and spills	Leaks and spills of chemicals and other hazardous construction materials, and uncontrolled discharge of contaminants to receiving waterways.	Moderate – Any chemical or hazardous substance spill could be toxic to aquatic flora and fauna, could have acute impacts and lead to localised mortality.	Moderate	Low – Mitigation measures including site management and bunding and spill management procedures be in place to reduce the risk to the receiving environment.

Hazard	Potential impact	Potential severity	Likelihood of occurrence	Residual risk
Stockpiles and contaminants	Movement of loose material stored within the ancillary facilities has the potential for sedimentation within adjoining watercourses and habitat degradation along natural waterways. Discharges of sediment-laden stormwater from stockpiles may result in an increase of particulate-bound contaminant loading to natural waterways, water pollution and toxicity issues to resident biodiversity plus stimulation of the growth of nuisance plants, algae, and cyanobacteria from increased nutrients.	High – There is significant risk associated with liberation of legacy contaminants which could lead to mortality or bioaccumulation in aquatic fauna.	Moderate	Moderate – The construction management plan would need to carefully consider mitigation measures to reduce the likelihood of uncontrolled releases in order to reduce this risk significantly.
Controlled discharges	Disposal requirements for excess site water including stormwater collected in sediment basins or dewatering of groundwater from deeper excavations.	Moderate – The impact to aquatic ecology is dependent on how the dewatering is managed and the quality of water in the sediment basins. The future Environment Protection Licence (EPL) would have requirements and control measures to mitigate impacts to the aquatic environment.	Low	Low – Limited dewatering would be appropriately managed under a dewatering plan and in accordance with EPL conditions. Additionally, it is expected that contaminants or poor water quality would be appropriately treated prior to any discharge.

Hazard	Potential impact	Potential severity	Likelihood of occurrence	Residual risk
Temporary stream realignment	A realignment has the potential to increase stream velocity and severity of flooding, causing erosion and releasing sedimentation downstream of the realignment. This could reduce water quality if not mitigated.	Moderate-High – This would depend on locations and sensitivity of the waterways. Minor tributaries or drainages, or highly altered waterways are expected to have minor changes to the aquatic ecology whereas higher order perennial or intermittent streams (e.g. Cabramatta Creek) could experience a greater magnitude relative change to the aquatic environment. It is expected that the impact would have short term effect on aquatic flora and fauna locally through obstruction of fish passage, altering existing flow paths and removal of aquatic habitat.	High	High – The residual risk to the aquatic environment is high and should be avoided where possible. Management plans, including an erosion and sediment control plan, would be required to conduct stream realignments. Work would need to be conducted under relevant EPL conditions and Conditions of Approval, and in accordance with policies, standards and procedures for working in waterways. Additionally, fish may need relocating if sections of waterway become cut off from the main channel. Monitoring of the works would also need to be incorporated into the management of these works.
Temporary waterway crossings	Temporary waterway crossings are likely to be required to provide access for the works and for haul roads across the construction footprint. These crossings would typically utilise pipes or culverts to allow water flow beneath the access tracks. A stream crossing has potential to affect fish passage. Erosion and sedimentation could also affect the waterway if not mitigated.	Moderate-High – This would depend on locations and sensitivity of the waterways. Minor tributaries or drainages, or highly altered waterways are expected to have minor changes to the aquatic ecology whereas higher order perennial or intermittent streams (e.g. Cabramatta Creek) could experience a greater magnitude relative change to the aquatic environment. It is expected that the impact would have short term effect on aquatic flora and fauna locally through obstruction of fish passage, altering existing flow paths and removal of aquatic habitat.	High	High – The residual risk to the aquatic environment is high. Management plans would be required for creek crossings. Temporary waterway crossings would be designed in accordance with policy guidelines and requirements. The crossings would be required to maintain low flow conditions and be checked by a qualified person to confirm no adverse flooding impacts would occur during design flood events.

Hazard	Potential impact	Potential severity	Likelihood of occurrence	Residual risk
Platform in waterway	Partial reclamation of a creek bed may be required for temporary works access and for working platforms during construction, specifically for the bridge widening works or drainage works. The original creek alignment would remain with only partial impact on the creek from the temporary works. Erosion and sedimentation could also affect the waterway if not mitigated.	High – This would depend on locations and sensitivity of the waterways. Minor tributaries or drainages, or highly altered waterways are expected to have minor changes to the aquatic ecology whereas higher order perennial or intermittent stream (e.g. Cabramatta creek) could experience a greater magnitude relative change to the aquatic environment. It is expected that the impact would have short term effect on aquatic flora and fauna locally through obstruction of fish passage, altering existing flow paths and removal of aquatic habitat.	High	High – The residual risk to the aquatic environment is high and should be avoided where possible. Management plans would be required for works conducted in the waterway. Work must be carried out in accordance with Managing Urban Stormwater – Soils and Construction Volume 1 Fourth Edition (Landcom, 2004) and Transport standard procedures.

Operation

Overall, the likelihood of impacts on biodiversity values from the operation of the proposed modification have been identified in Table 7-54. Mitigation measures described in Table 7-56 would be implemented to minimise operational biodiversity impacts and would be incorporated in the existing Biodiversity Management Plan.

Table 7-54 Potential impacts on biodiversity values during operation of the proposed modification

Impact	Likelihood	Extent of impact as a result of the proposed modification
TECs and potential serious and irreversible effects	Low	It is unlikely that the operation of the proposed modification would further impact on the TECs at risk of SAIL. The vegetation within the study area is already subject to direct and indirect impacts from the existing Westlink M7. The addition of an inside lane to each carriageway and associated works from the proposed modification is not expected to increase adverse biodiversity impacts on terrestrial biodiversity, including to TECs at risk of SAIL.
Prescribed impacts	Low	It is unlikely that there would be a change in the prescribed impacts currently experienced in the Westlink M7 environment, which would currently include vehicle strikes on threatened species which may cause species mortality or injury due to vehicles, plant and machinery using the operational motorway and the motorways operational ancillary facilities.
Predation by domestic and/or feral animals	Low	The proposed modification would not increase the presence of domestic or feral animals in the local area.
Impacts from changes to shade/shelter, and loss of individuals through exposure caused by habitat removal	Low	The proposed modification would result in the removal of 7.48 ha of vegetation. However, the vegetation consists of relatively small, fragmented areas in relatively poor condition, providing minimal habitat only. It is noted that the widening of 23 bridges would increase shade. While this may provide additional shelter for local ground dwelling fauna, it has the potential to stifle the regeneration of native vegetation. Habitat to be removed in the study area is dominated by grassland and semi-mature regrowth. Therefore, the proposed modification is not considered likely to cause a loss of individuals through exposure.
Loss of individuals through starvation	Low	Removal of potential habitat on the study area is not considered likely to cause loss of individuals through starvation. It is likely to be used seasonally/occasionally as a foraging resource by insectivorous, frugivorous and nectivorous species occupying a much larger territory and relying on other resources throughout the rest of the year.
Edge effects (noise, light, traffic)	Low	The study area currently experiences impacts from noise and light due to traffic using the Westlink M7. The proposed modification is not likely to further adversely affect any threatened animals that may utilise the study area.

Impact	Likelihood	Extent of impact as a result of the proposed modification
Deleterious hydrological changes	Low	The proposed modification would alter runoff flows throughout the study area. Any impacts beyond the study area during or after construction are expected to be minor and would be managed by existing stormwater drainage for the Westlink M7, and upgraded drainage in some instances. Further detail regarding hydrological changes are detailed in Section 7.4 (Hydrology and flooding) and Section 7.5 (Surface and groundwater).
Contamination of groundwater, surface water and creeks present	None	Stormwater from the Westlink M7 would be managed within the existing drainage infrastructure. While contaminants may be transported into the wider hydrological system it is unlikely to increase the current levels significantly. Further detail is provided in Section 7.5 (Surface and groundwater).
Weed invasion	Low	The study area, including the construction ancillary facilities and drainage lines, is already highly weed-infested. The proposed modification is considered unlikely to significantly increase weed invasion. Weed species would be managed by a regular schedule of weed management as part of the existing maintenance schedule within the Westlink M7 lease area.
Increased human activity within or directly adjacent to sensitive habitat areas	Low	Sensitive habitat areas are already impacted by human activity. The proposed modification would not further accommodate human activity beyond what is currently taking place.

Aquatic habitat and key fish habitat

The risk and severity of potential impacts to the aquatic environment were assessed for the operation of the proposed modification and are detailed in Table 7-55 and with the implementation of appropriate mitigation measures summarised in Table 7-56, the residual risk of operational impacts to aquatic habitats is likely to be low.

The operational impacts associated with the proposed modification would potentially affect KFH; however, most impacts associated with sedimentation and water quality would be reduced through the existing stormwater infrastructure, which would be upgraded or augmented where required to maintain existing function. The potential operational impacts would include an increase in shading from the widened bridges in these already modified areas. However, given that the condition of aquatic and riparian vegetation associated with streams that are mapped as KFH are considered to provide limited ecological function within the construction footprint, there is likely to be negligible impact to aquatic ecology associated with KFH in these areas. In addition, mitigation measures under Operational Management Plans, including ongoing monitoring and maintenance of water quality and storm water infrastructure would be used to manage potential operational impacts.

Groundwater dependant ecosystems

The potential operational impact of the proposed modification has been considered in terms of groundwater quality and groundwater flows.

Runoff from the Westlink M7 would be retained within the approved project's existing sedimentation ponds prior to discharging to nearby creeks. As indicated in **Section 7.5** (Surface and groundwater), the operation of the proposed modification would aim to meet the ANZECC water quality objectives. While pollutants may be transported into the wider hydrological system of the area it is unlikely to result in an increase the current surface water or groundwater concentrations. Operation of the proposed modification would not result in an ongoing take of groundwater during operation that would alter groundwater quantity or flows through the study area (Refer to **Section 7.4** (Hydrology and flooding)),

Section 7.5 (Surface and groundwater) and **Appendix H** (Biodiversity development assessment report).

Table 7-55 Potential operational impacts to aquatic habitat

Hazard	Potential impact	Potential severity	Likelihood of occurrence	Residual risk
Discharge associated with wet weather stormflows	<p>The key pollutants contained in road runoff include:</p> <ul style="list-style-type: none"> Suspended solids as a result of pavement wear, tyre wear, atmospheric deposition, and deposition from vehicles Heavy metals bound to dust particles washed off pavement surface Oil and grease and other hydrocarbons deposited by vehicles Nutrients as a result of atmospheric deposition. 	<p>Low – As discussed in Section 7.5, negligible differences are expected between the median pollutant and nutrient concentrations with or without the proposed modification. Also, that the median concentrations of total suspended solids and levels of turbidity are below the guideline values set out in the water quality objectives, and are typically less than or similar to the levels recorded in the receiving watercourses.</p> <p>Modelling of post-modification conditions for nitrogen levels in Maxwells Creek, Cabramatta Creek, Lower Hinchinbrook Creek and Eskdale Creek were 14 to 48 per cent higher than the existing measured levels of total nitrogen. In the instance that during detailed design that it cannot be demonstrated that the existing operational stormwater quality controls would be effective in mitigating potential impacts, then additional mitigation measures would be identified and implemented to address this potential impact (see Appendix G (Surface water and flooding assessment)).</p>	<p>Low – Discharges are likely to occur when the waterway is experiencing runoff from a highly urbanised catchment and any impact to aquatic ecology is likely to be immeasurable.</p>	<p>Low – It is expected that the overall risk to the receiving environment is low and the existing operational stormwater quality controls would be effective in mitigating potential impacts, or modified to ensure that they are effective.</p>

Hazard	Potential impact	Potential severity	Likelihood of occurrence	Residual risk
	Scouring and erosion of drainage channels and creeks at entry of stormwater discharges due to increased rates of water flow because of higher surface area of impervious surfaces.	Low – Any impacts to aquatic habitat are likely to be localised to entry points. Scour protection is already present as part of the existing stormwater infrastructure with only minor impacts expected on both the depth and velocity of flow in the receiving drainage lines downstream of the Westlink M7 corridor.	Low	Low – The severity is low as existing stormwater measures are mitigating this potential impact.
In-channel flow modifications caused by structural emplacements	Alterations to erosion and deposition zones around bridge footings, culverts or pipes leading to habitat modification in the waterway's channel bed. This impact is envisaged to be localised. It could lead to formation of turbulent flows and secondary flow circulation patterns around structures.	Moderate – Potential localised change around permanent structures. This can lead to erosion and sedimentation and affect aquatic habitat and flora and fauna. Change in flow hydraulics could potentially act as a barrier to fish movement in sensitive waterways. It is noted that scour protection measures would be incorporated into the detailed design using standard Transport procedures to manage localised increases in velocities and scour potential around new bridge piers.	Moderate	Low – The residual risk is low as the bridges, culverts and pipes would be designed in accordance with necessary guidelines to limit potential hydraulic impacts. Minor changes to flow or flooding are not expected to impact the aquatic environment.

7.6.6 Management and mitigation

Based on the findings of the assessment above, Table 7-56 summarises the recommended mitigation measures to manage the potential biodiversity impacts during construction of the proposed modification. Operational mitigation measures will be incorporated into the existing Biodiversity Management Plan where required.

Measures related to minimising impacts to surface water quality are contained in **Section 7.5**.

Table 7-56 Mitigations measures

Impact	ID	Mitigation measure	Responsibility	Timing
Identified biodiversity values	B1	<p>A Biodiversity Management Plan will be developed to include, but not be limited to, the following:</p> <ul style="list-style-type: none"> • A Microbat Management Plan by a microbat specialist to be created (prior to construction) • Environmental site inductions • Demarcation of clearing areas and 'No Go' zones through fencing and inclusion in the Construction Environmental Management Plan (CEMP), in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) • Methods of vegetation removal • Protocols for tree clearing including pre-clearing surveys and mitigation measures for any fauna encountered • Erosion and sediment controls including dust suppression and minimisation of dust generation • Rehabilitation methods including management of native and riparian vegetation, weeds, fauna habitat • Weed prevention measures and management of priority weeds within the study area in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) • Regular scheduled litter and waste removal from the study area • Implementation of an unexpected species find procedure, particularly for bridge widenings and microbats • Habitat will be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) 	Construction contractor Westlink M7 operator	Prior to construction Construction Operation

Impact	ID	Mitigation measure	Responsibility	Timing
		<ul style="list-style-type: none"> Rehabilitation strategy for waterways after the removal of temporary waterway crossing and diversions, including erosion and sediment control, management of flow, stockpile management, stabilisation of bed and banks and revegetation Any large woody debris to be retained within the retained portions of the study area to provide refuge habitat for invertebrates and reptiles (<i>Guide 5: Re-use of woody debris and bushrock</i>) (RTA, 2011). 		
	B2	An ecologist to inspect the study area, including drainage and creek lines and relocate any amphibians prior to and during vegetation clearing.	Construction Contractor	Prior to construction
	B3	Undertake field survey in accordance with the bat survey guidelines (OEH, 2018), Appendix F of the <i>Microbat Management Guidelines</i> (Transport for NSW, 2021a) and TBDC to confirm whether Southern Myotis is using the Subject Land for its foraging purposes, and refine the offset obligation for this species, as required.	Westlink M7 operator	Prior to construction
	B4	Bridge works, as a potential habitat for microbat species, are to be undertaken in accordance with Appendix F of <i>Microbat Management Guidelines</i> (Transport for NSW, 2021a).	Construction contractor	Construction
	B5	If sediment/erosion booms are used, they are placed so they do not obstruct fish passage, where possible.	Construction contractor	Construction
	B6	Design of temporary waterway crossings and diversions are consistent with <i>Managing Urban Stormwater: Soils and construction – Volume 1 and 2D</i> (DPIE, 2004) and <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI, 2013) and <i>Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull, 2003).	Construction contractor	Construction
	B7	Relocation of native fish by a trained aquatic ecologist if they become stranded due to waterway diversions, temporary crossings or dewatering activities.	Construction contractor	Construction
	B8	A detailed water monitoring program will be implemented during construction, where site observations are recorded by a suitably qualified person, and will include:	Construction contractor	Construction

Impact	ID	Mitigation measure	Responsibility	Timing
		<ul style="list-style-type: none"> Routine inspections of temporary waterway crossings, waterway diversions and dewatering activities Rapid geomorphic survey, including aquatic macrophyte mapping, bank erosion, channel stability and sediment deposition Stormwater discharges into the receiving watercourses, including an estimate of flows, visual appearance, and water quality (handheld meter) testing on an opportunistic basis Visual and olfactory observation of pollution (e.g. oil sheens, coarse debris, odours) Opportunistic observations of aquatic fauna (e.g. stranded fish). 		
	B9	Landscaping to focus on utilising naturally occurring endemic tree and shrub species, in accordance with the updated Landscape Plan for the Westlink M7.	Construction contractor	Construction
	B10	Monitoring and maintenance of all established erosion and sedimentation controls.	Construction contractor Transport	Construction Operation
	B11	Existing Westlink M7 Operational Environmental Management Plan to be consulted, updated, and utilised.	Westlink M7 operator	Operation

Offsetting requirements

Biodiversity offsets

A vegetation integrity assessment using the Biodiversity Assessment Methodology Credit Calculator was undertaken to identified ecosystem credit species (species that can be reliably predicted based on the PCT), and 'species credits' (species that require credits/offsets). The results are outlined in Table 7-57, which outline the need for ecosystem credits and species credits to offset for impacts of the proposed modification to PCT vegetation and foraging habitat for the Southern Myotis.

No threatened biodiversity listed on the EPBC Act are required to be offset for the proposed modification, as the proposed modification is considered unlikely to result in a significant impact on any threatened biodiversity listed under the EPBC Act. The proposed modification would not impact any flora credit species, so no flora species credits are required to offset the proposed modification.

Table 7-57 Impacted areas that require credit offsetting

Item	Impact area (ha)	Required credits
Ecosystem credits		
PCT 724 – Castlereagh shale - gravel transition forest (moderate), vegetation zone 1	0.11	2
PCT 725 – Castlereagh Ironbark forest (moderate), vegetation zone 2	0.08	1

Item	Impact area (ha)	Required credits
PCT 835 – Cumberland riverflat forest (low), vegetation zone 5	0.74	9
PCT 849 Cumberland shale plains woodland (low), vegetation zone 8	0.58	7
PCT 850 – Cumberland shale hills woodland (low), vegetation zone 4	0.70	12
PCT 850 – Cumberland shale hills woodland (moderate), vegetation zone 9	0.13	3
PCT 1737 – Typha rushland (moderate), vegetation zone 11	0.09	2
PCT 1737 – Typha rushland (high), vegetation zone 6	0.01	1
PCT 1800 – Cumberland Swamp Oak riparian forest (low), vegetation zone 7	0.68	8
PCT 1800 – Cumberland Swamp Oak riparian forest (moderate), vegetation zone 12	1.33	22
Total ecosystem credits	4.45	67
Species credits		
Foraging habitat for the Southern Myotis	2.31	33
Total species credits	2.31	33

Other offsets for impacts to aquatic biodiversity

The proposed modification would not significantly impact waterways, aquatic habitat or ecology, riparian vegetation, threatened aquatic species listed under the Fisheries Management Act, key threatening processes or downstream environments including KFH. As such, other offsets for impacts to aquatic biodiversity are not required for the proposed modification.