

Upper Canal Koala Crossings, Ousedale Creek

Review of Environmental Factors

Prepared for Department of Planning and Environment

June 2023

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Department of Planning and Environment

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Executive Summary

The Department of Planning and Environment proposes to undertake activities which will assist the movement of koalas and other fauna in a known koala corridor at Ousedale Creek, Appin.

The activities proposed comprise the installation of three types of facilities which enable koala movement across the Upper Canal infrastructure, including the local fences, aqueduct and the pipeline, at Ousedale Creek.

The six crossing installations are:

- under fence crossings (x 4 locations)
- an over pipe crossing
- a log climb crossing.

There will also be ongoing monitoring of the crossings using fixed motion-sensor-activated cameras to better understand koala behaviour, and the behaviour of other animals, at the crossing points.

The land is owned by WaterNSW and forms part of the corridor which support the Upper Canal water supply system. The Upper Canal is an item listed on the State Heritage Register but also remains an operational asset in the Sydney water supply system.

The zoning of this land under the Wollondilly Local Environmental Plan 2011 is SP2 Infrastructure (Water Supply System) and the activities are permissible without consent pursuant to Part 13.2 of Chapter 13 in the State Environmental Planning Policy (Biodiversity and Conservation) 2021, which makes specific provision for koala fencing and fauna crossings.

The Review of Environmental Factors (REF) has been prepared to meet the requirements of section 5.5 of the *Environmental Planning and Assessment Act 1979*.

The REF examines the relevant matters affecting or likely to affect the environment by reason of the proposed activities.

After consideration of the various environmental factors, the REF finds that the activities are unlikely to significantly affect the environment.

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1 Introduction

1.1 The site and the background to the proposed activities

The Department of Planning and Environment (DPE) proposes to undertake activities which will assist the movement of koalas and other fauna in a known koala corridor at Ousedale Creek, Appin.

The location of the land where the Upper Canal crosses over Ousedale Creek is at the junction of two lots which are legally described as:

- Lot 1 DP 625921
- Lot 2 DP 625921.

Both lots are owned by WaterNSW and form part of the land corridor which support the Upper Canal water supply system.

The proposed activities will take place only within Lot 1 DP 625921 and Lot 2 DP 625921. Refer to Figure 1.1 and Figure 1.2 respectively.

The site is within Wollondilly local government area (LGA) although the site is also close to the boundary with Campbelltown LGA, and Ousedale Creek itself is situated in both LGAs. The zoning of this land under the Wollondilly Local Environmental Plan 2011 is SP2 Infrastructure (Water Supply System).

Consideration of the land zoning provisions and permissibility are addressed at Section 4.8 of this REF. The local context for the site is shown in Figure 1.3.

A survey plan of the site, prepared by CMS Surveyors, is provided at Appendix A.



Figure 1.1 Lot 1 DP 625921

Source: Six Maps (Lot 1 DP 625921 shown in red outline)



Figure 1.2 Lot 2 DP 625921

Source: Six Maps (Lot 2 DP 625921 shown in red outline)

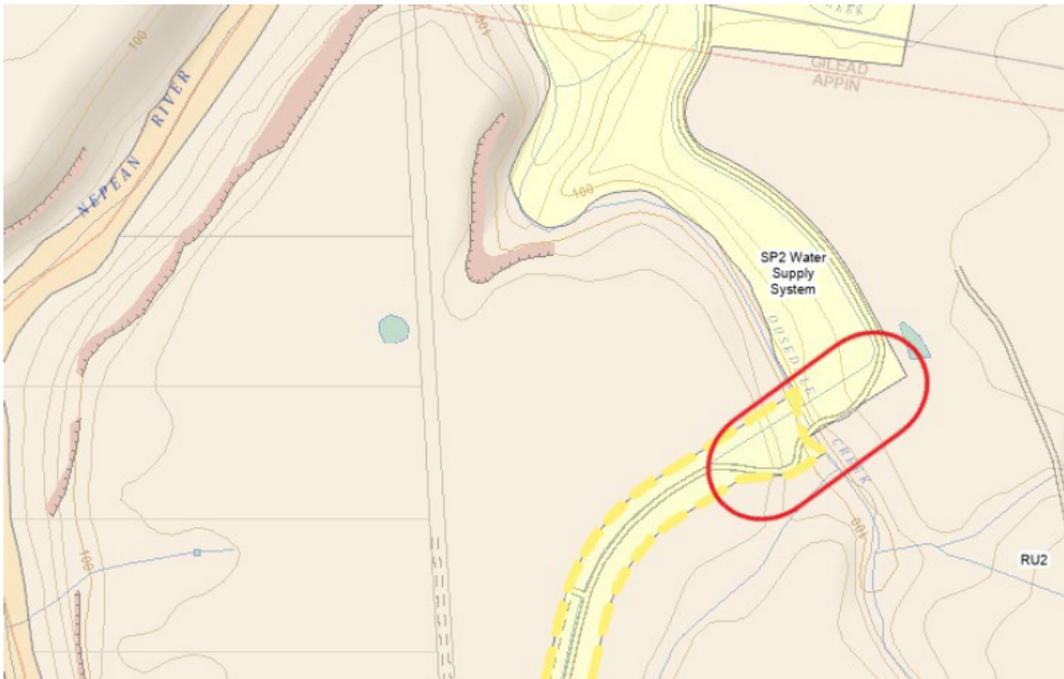


Figure 1.3 Site location

Source: NSW Planning Portal

Note: Site circled in red; Lot 1 DP 625921 boundary shown as yellow line

The site is intersected by the Upper Canal and recognised by the NSW Office of the Chief Scientist and Engineer (CSE 2021) as a potential impediment to the movement of koalas through the Ousedale Creek corridor. Steep terrain along the riparian zone of the creek, an access road and fencing within the site may also impede koala movement.

The Upper Canal is listed on the NSW State Heritage Register and protected by the NSW *Heritage Act 1997*. The Upper Canal is critical water supply infrastructure, and is also considered a controlled area under the *Water NSW Act 2014*.

The site is within lands identified under the Cumberland Plain Conservation Plan (CPCP). It is mapped as excluded land due to the site being within the curtilage of the Upper Canal infrastructure. The CPCP was developed in response to the projected population growth in Western Sydney while protecting biodiversity values, such as threatened plants and animals. The CPCP covers approximately 200,000 hectares of Western Sydney.

The koala (*Phascolarctos cinereus*) population in the south-western Sydney region is one of the biodiversity values to be protected under the CPCP. The CPCP *Sub-Plan B: Koalas* identifies the proposed management and mitigation measures proposed for koala management, including maintaining and restoring connectivity of koala habitat (DPIE 2020b). One of the commitments in *Sub-Plan B* is to secure at least one east-west Koala movement corridor between koala habitat on the Georges River and Nepean River. Ousedale Creek has been identified as the most suitable corridor for this purpose, due to the condition and width of the existing vegetation (CSE 2020).

In 2022 EMM Consulting, in collaboration with TBLD Architects, prepared a feasibility study (Appendix B) for DPE which considered the research regarding the behaviour and movement patterns of koalas, the local landscape and assets, and possible design solutions for the construction of crossings over or under the Upper Canal at Ousedale Creek.

Through a series of consultations with Water NSW, DPE and koala experts, various options for design solutions were developed and considered. The final proposed crossing designs were prioritised by a weighted series of attributes and performance criteria. The final crossing designs which are the basis of this Review of Environmental Factors comprise one 'over pipeline' crossing; one 'log climb' crossing; and four 'under fence' crossings. A copy of the Design Solutions Report (TBLD 2023) is provided at Appendix C.

The crossings to be installed at Ousedale Creek also represent an important opportunity to monitor the behaviour of koalas and other fauna in response to the crossing designs, and to refine or replicate crossings elsewhere within the CPCP area. It is therefore proposed to install a series of motion-activated cameras near the crossings to record the behaviour of fauna and to gather data to inform the design and installation other fauna crossings elsewhere in future.

1.2 Site description

The site at Ousedale Creek is a steeply incised valley with large areas of near vertical sandstone rock escarpments to both sides of the valley. The heritage steel water supply pipeline spans across the valley with a series of mid supports on sandstone pillars, connecting the water supply pipeline to the canal ends on both sides, which terminate at concrete end walls situated on the change of slope on both east and west escarpments. The entire pipeline, canal and associated infrastructure is of heritage significance and requires careful protection.

Excavated sandstone materials were historically placed along the northern edge of the eastern canal, effectively creating a significant barrier to koala movement. Similarly, existing farm fences installed at various locations to the southern edge of the site create an effective barrier to fauna movement. Also, the narrow, fast flowing and flood prone river also creates an effective barrier to koala movement.

The proposed site crossing works have been carefully selected after extensive site analysis to provide effective potential crossing points for koalas and other fauna over the challenging site conditions which present effective barriers to koala and other fauna movement.

1.3 Purpose

The purpose of the proposed works is articulated in the Fact Sheet *Protecting koalas on the Cumberland Plain* published by the Department of Planning and Environment.

Koala numbers are in decline in NSW. The Southern Sydney koala population is found on the south-eastern edge of the Cumberland Plain and is the largest population in the Sydney metropolitan area. It is also one of the healthiest populations in NSW and one of the few that is continuing to grow. Koalas in south-western Sydney live in a landscape of native bushland on the borders of urban areas and rural farmlands. Important koala habitat in this area is connected by key movement corridors. The proximity to urban areas and the presence of roads intersecting some areas of koala habitat currently exposes koalas to key threats, including being hit by cars on local and major roads, drowning in swimming pools, and domestic dog attacks. Without mitigation measures, these threats will increase as new urban areas are developed. Climate change and disease also threaten koalas.

The Cumberland Plain Conservation Plan (the CPCP) includes a koala conservation program that is designed to avoid, mitigate, minimise and offset potential impacts on koalas in south-western Sydney. An outcome of the CPCP is that the "condition of protected koala habitat is improved, connectivity between koala sub-populations is maintained, threats to koalas are managed and the koala population in South Western Sydney persists and thrives".

Further there is a commitment by the NSW Government, under CPCP Sub Plan A, to investigate options for enhancing koala movement across the Upper Canal¹.

1.4 Koala movement

The koala population in southern Sydney is estimated to contain between 600 to 1,000 koalas, and is showing signs of population recovery, partly because young male animals have been able to move through the landscape to new habitat. The area contains the largest Chlamydia-free population of koalas in NSW.

Koalas prefer habitat located on shale and shale-sandstone transition soils and require large areas of habitat to support feeding and breeding. Koalas once inhabited forests and woodlands of the fertile shale soils across the Cumberland subregion, but due to the limited and fragmented nature of the remaining shale forest, the habitat that remains is crucial for koalas to persist in the region.

There are large patches of koala habitat on the eastern edge of the Cumberland Plain, largely surrounding the Nepean and Georges Rivers, and in corridors of vegetation along smaller watercourses in between. Koalas have been recorded throughout the area (refer to the Feasibility Study at Appendix B.1).

Connectivity between Georges River and Nepean River is important for the resilience of the southern Sydney koala population. The Nepean River and Georges River are classified as primary corridors because they are contiguous and represent more than 380 ha of land. There are six secondary corridors that run between the two areas, which are smaller and more fragmented, but nonetheless important in supporting koala movement through the landscape.

Koalas have been found to generally move at ground level and may potentially move a significant distance during a 24 hour period. It is possible for koalas to move between trees where the canopies interlock, but this is uncommon.

Radio-tracked koalas in the local (Campbelltown) area have been observed to occasionally utilise steep sandstone gullies, and thus the koala is known to be capable of crossing steep slopes and have been observed to be very agile at ground level. However, it is considered that the koala would not be able to cross very steep or near vertical cliff-faces.

1.5 Ousedale Creek corridor

The Ousedale Creek corridor runs from the Nepean River in the west, to Appin North in the east.

The bushland in the Ousedale Creek corridor constitutes part of the strategic conservation area under the CPCP and is considered critical habitat to the long-term viability of koalas. In combination with the adjoining Mallat Creek corridor to the north, the corridor contains 390 ha of high quality koala habitat and is expected to support an estimated 20 koalas.

1.6 Koala movement across the Upper Canal

The Upper Canal connects the Upper Nepean dams to Prospect Reservoir over 54 km, supplying on average 20% of Sydney's drinking water. It was constructed in the 1880s and is now heritage listed. The canal contains sections of open canal, tunnels to allow it to pass under hills, and pipelines to cross creeks and gullies.

Where the canal crosses Ousedale Creek, the creek line has steep sandstone cliffs to both sides. At this location, the open canal changes into a steel pipeline with a diameter of approximately 2.3 m. On the upper banks of the creek line, the pipeline is semi-embedded in the ground, and as the banks drop away the pipeline runs across the valley, supported by sandstone pillars. Refer to Photograph 1.1.

¹ CPCP Sub-Plan A; Appendix A; Commitment 7; Action 8c (p 120)

Along the sections of open canal, the vertical sandstone canal walls (up to 1.5–2 m in height) do not allow koalas (or other fauna species) to cross, unless there is infrastructure such as access roads, stormwater drain chutes or bridge gantries across the canal. Where the pipeline is embedded in the ground, there is only a small gap between the cutting in the rock and the wall of the pipeline, with a drop of up to 2 m. In most places, koalas would not be able to get through between the pipeline and the ground. The canal also presents a high risk of drowning if koalas attempt to swim across, or fall in, as they are unable climb out.

The large diameter and hard surface of the steel pipeline is very smooth presenting no grip and therefore not climbable for koalas. Where the ground drops away, there are some sections where there is space for koalas to cross underneath the pipeline, but the ground is very steep, and transitions into vertical cliffs that are impassable to koalas.

As well as the canal infrastructure, there is a former vehicle track and fence line running parallel on the southern side of the canal and pipeline. The fence line also presents a physical barrier to koala movement.



Photograph 1.1 Upper Canal pipeline and column at Ousedale Creek

Source: WaterNSW

1.7 Observations regarding koala crossings at the Upper Canal

Some evidence of fauna movement across the canal alignment was observed during site inspections and crossing designs should aim to enhance the pathways that are already in use (Figure 1.4). Identified movement paths were mostly found passing underneath the pipeline where the banks are not too steep.

On the western bank of Ousedale Creek some fauna species are likely able to pass under the embedded pipeline, where there is a slightly larger gap, as well as under the elevated pipeline at the top of the steep bank. There is a footbridge across the open canal to the west that could provide a potential crossing for koalas, but it is currently considered that this is unlikely to be used due to the materials and design, and also due to the distance away from vegetation preferred for koala movement.

On the eastern side of the creek, the banks are steeper. Two movement paths were visible. A narrow path under the pipeline was observed at the upper eastern edge of Ousedale Creek. The second path potential path leads to a vehicular bridge across the open canal.

Where the fauna movement paths cross the boundary fencing, access holes have been pushed through and under the existing wire mesh fence by fauna, most likely by wombats.

There is also potential that koalas may utilise the bottom of the Ousedale Creek for movement. Koalas can swim, but they may be discouraged from utilising this route by the presence of water at the bottom of Ousedale Creek, and flash flooding, as they will often prefer to stay dry where possible.

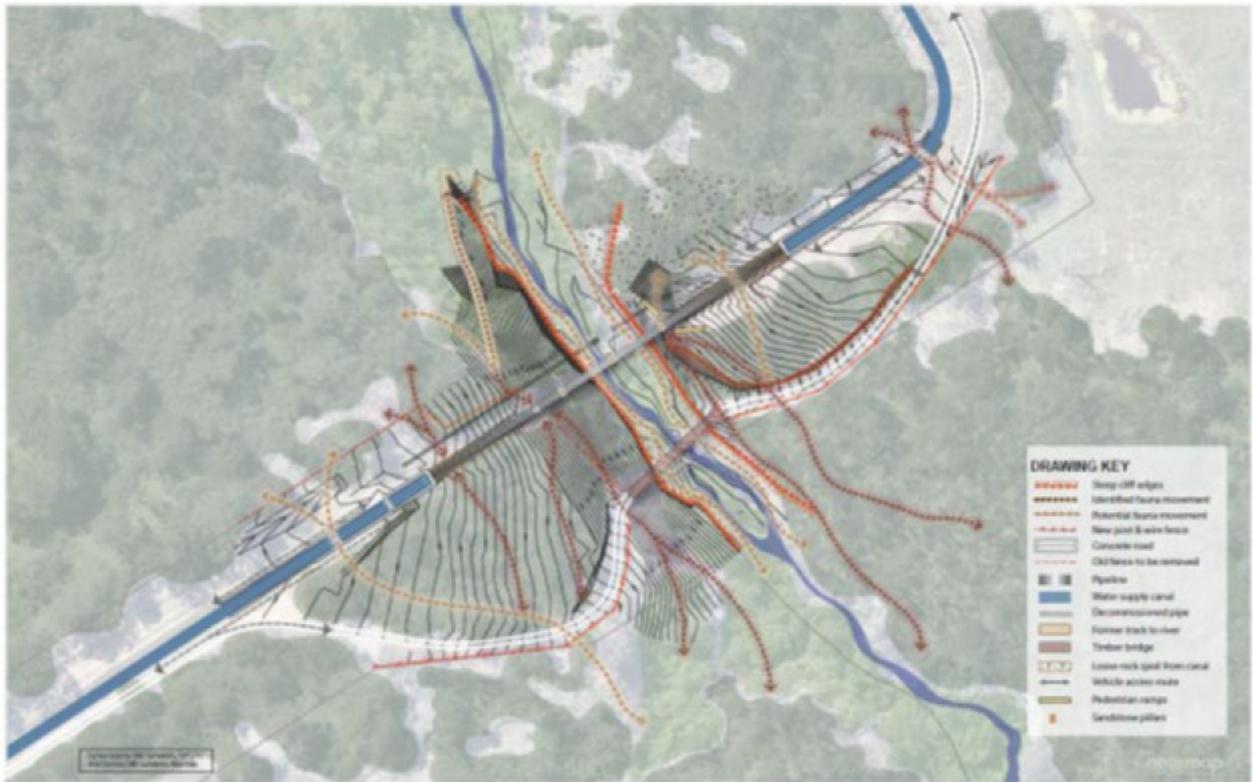


Figure 1.4 Observed fauna movement pathways at the site

Source: EMM/TBLD Feasibility Study

2 Proposed activities

The activities proposed will include the installation of three types of facilities which enable koala movement across the Upper Canal infrastructure, including the local fences, aqueduct and the pipeline, at Ousedale Creek.

The six crossing installations are:

- under fence crossings (x 4 locations) – refer to Figure 2.3
- an over pipe crossing – refer to Figure 2.6
- a log climb crossing – refer to Figure 2.9.

There will also be ongoing monitoring of the crossings using fixed motion-sensor-activated cameras. This is proposed in order to better understand koala behaviour, and the behaviour of other animals, at the crossing points. This will assist DPE and other interested parties in determining the suitability of the various crossing designs and their potential future application in other locations where there may be impediments to koala movement.

2.1 Koala crossings

2.1.1 Under fence crossings

It is proposed to install four structures to enable koala movement under existing boundary fences at Ousedale Creek. The location of the under fence crossings are shown at Figure 2.1 and also at the same crossings transcribed onto a cadastral layer to indicate the location within Lot 1 DP 625921 and Lot 2 DP 625921 at Figure 2.2.

The ‘under fence’ design provides functional koala and fauna access under fences. The under fence crossings would be lined with wood plastic composite (WPC) profile to deter additional digging, with an agricultural drain to manage surface water flow to grassed areas downslope. The crossings would be hidden within retained grassy vegetation. Landscaping with native grasses will be added close to the crossings, where required.

The under fence design is illustrated at Figure 2.3.

More detailed designs are provided in the drawings prepared by TBLD at Appendix C.

Selected Crossing Assessment

Site Photos



U2 - Formalised Under Fence Crossing Scenario 2



U7 - Formalised Under Fence Crossing Scenario 1



U12 - Formalised Under Fence Crossing Scenario 1



U14 - Formalised Under Fence Crossing Scenario 1

Site Description

- U1** — Low point. Root interference. Crossing not preferable.
- U2** — **Low point with swale in front. Edge of forest, between two trees. Slope 1:8.**
- U3** — Swale running diagonally under fence. 0.3m gap. Crossing not required.
- U4** — Near post junction. Crossing not preferable.
- U5** — Flat ground, swale 2m behind fence. Visible trail. Crossing not required.
- U6** — Narrow gaps under fence on two adjacent locations. Swale 1m behind. Crossing not preferable.
- U7** — **Flat ground, no nearby trees. 1:8 grade downslope. Scats found under fence. Visible connecting track across road up the rock escarpment.**
- U8** — Visibly used track. Existing under fence crossing, to be retained.
- U9** — Existing under barrier and under fence crossing, to be retained
- U10** — Top of the ridge. Flat terrain. Near post junction. Crossing not required.
- U11** — Opening next to rocks. Crossing not preferable in rocky terrain.
- U12** — **Near post junction. Scats found under fence. Tree 1m on south.**
- U15** — Near post junction. Crossing not preferable.
- U13** — Grassy flat ground with scrubs. Damp location. Crossing not required.
- U14** — **Grassy flat ground. Visible track lines behind fence. Scats found nearby.**

DRAWING KEY
 Identified Under Fence Crossings U1 - U15
 Selected Crossing █
 Secondary Crossing █



Figure 2.1 Location of 'under fence' structures

Source: TBLD Architects

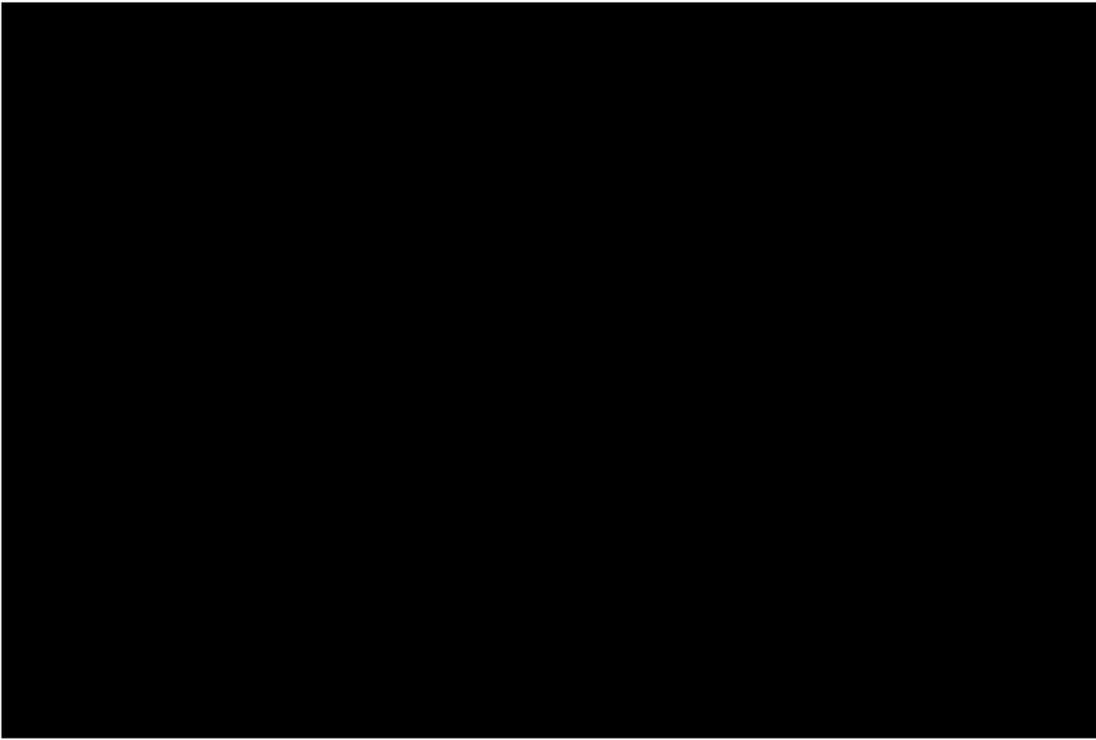


Figure 2.2 Location of four 'under fence' structures – Cadastral image

Source: Six Maps (adapted by EMM)

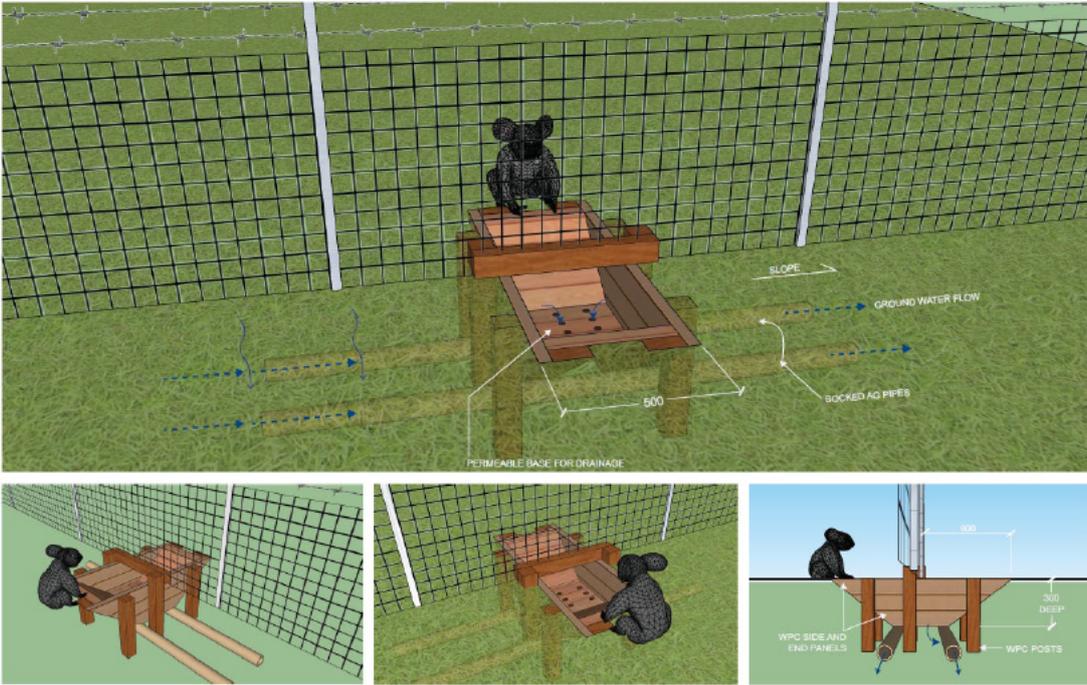


Figure 2.3 Under fence crossing design

Source: TBLD

2.1.2 Over pipe crossing

One over pipe crossing is proposed. The location of the over pipe crossing is shown at Figure 2.4, and also shown with reference to the cadastral layer to indicate the location within Lot 2 DP 625921 at Figure 2.5. The over pipe crossing design is illustrated at Figure 2.6.

The over pipe structure requires the installation of a lightweight ramp panel structure, comprising two ramp components which meet and lock to form a secure and stable bridge. Each ramp section has an incline and functionality suited for ease of koala crossing or access by humans for pipeline maintenance. The design intent includes ensuring that each ramp section of the bridge can be easily opened (i.e. lifted out of the channel area if required for maintenance etc) or closed again to form the bridge, by one adult.

The bridge structure would have sufficient infill on the floor and side panels to prevent fauna falling onto pipeline. The ramps extend from the two banks of the sandstone channel, secured in the middle, and with non-invasive supports to the sides.

The over pipe structure is proposed to be installed at the location where pipeline embedment is deepest in the ground, to minimise ramp height and to encourage fauna to cross over across the pipeline. The structure is designed to safely support human use and loads if used by maintenance staff.

More detailed design particulars are provided in the drawings prepared by TBLD at Appendix C.

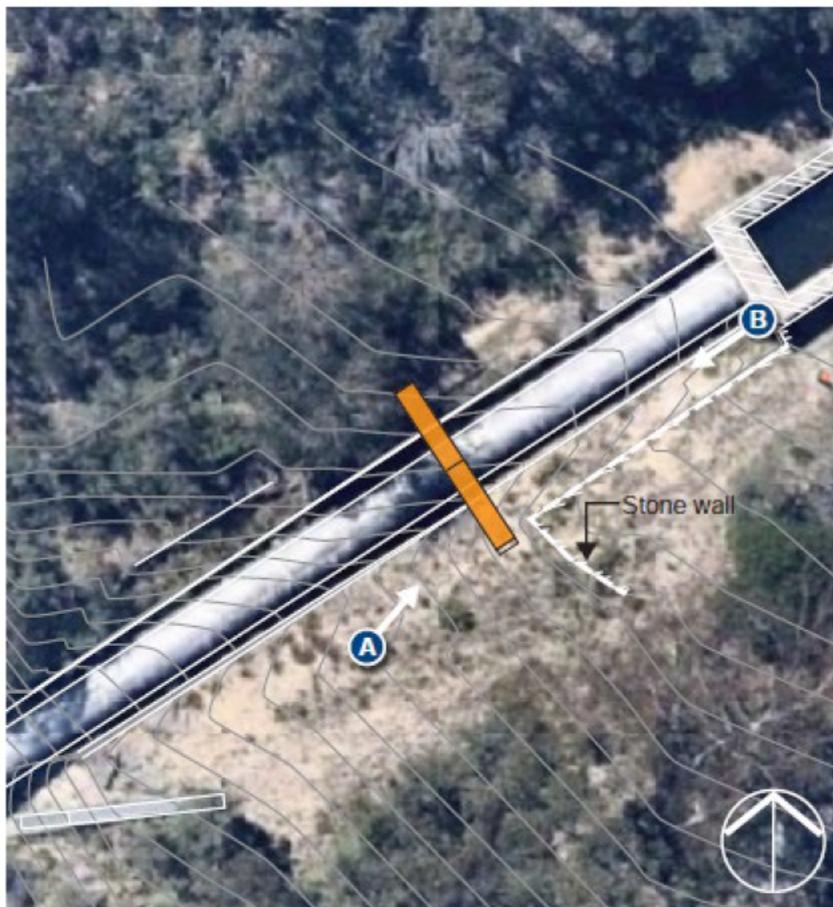


Figure 2.4 Location of 'over pipe' structure

Source: TBLD Architects

Note: Pointers labelled A and B refer to views which are provided in the drawings at Appendix C.

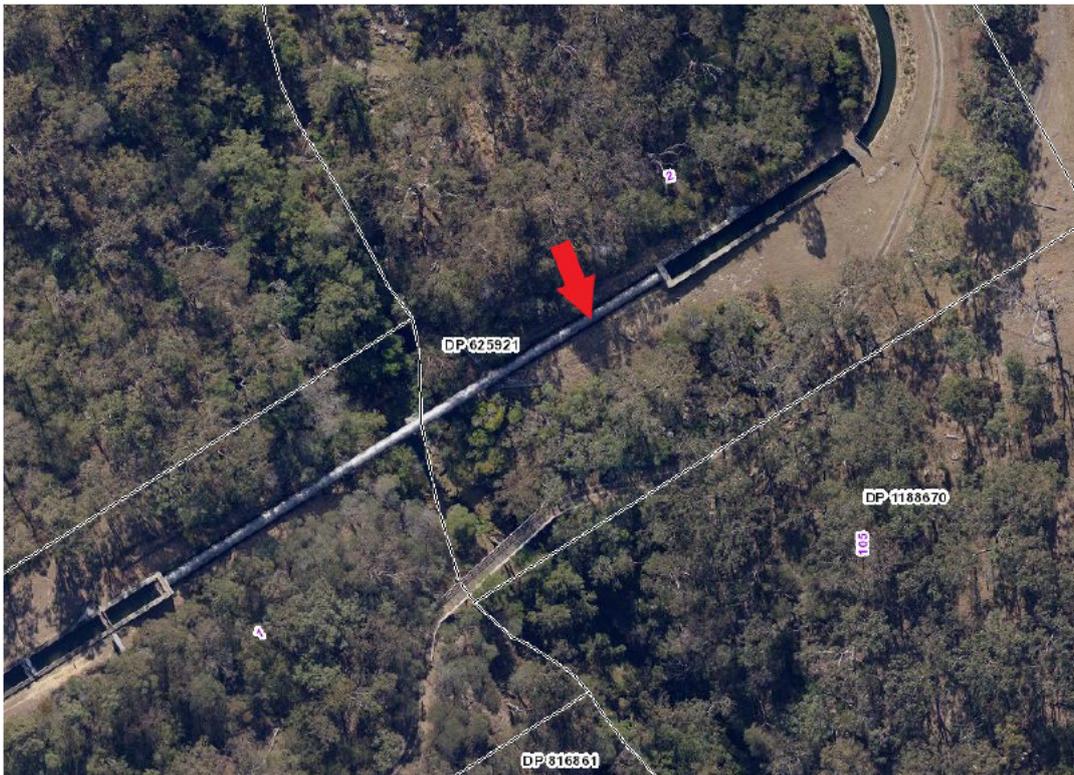


Figure 2.5 Location of 'over pipe' structure – Cadastral image

Source: Six Maps (adapted by EMM)

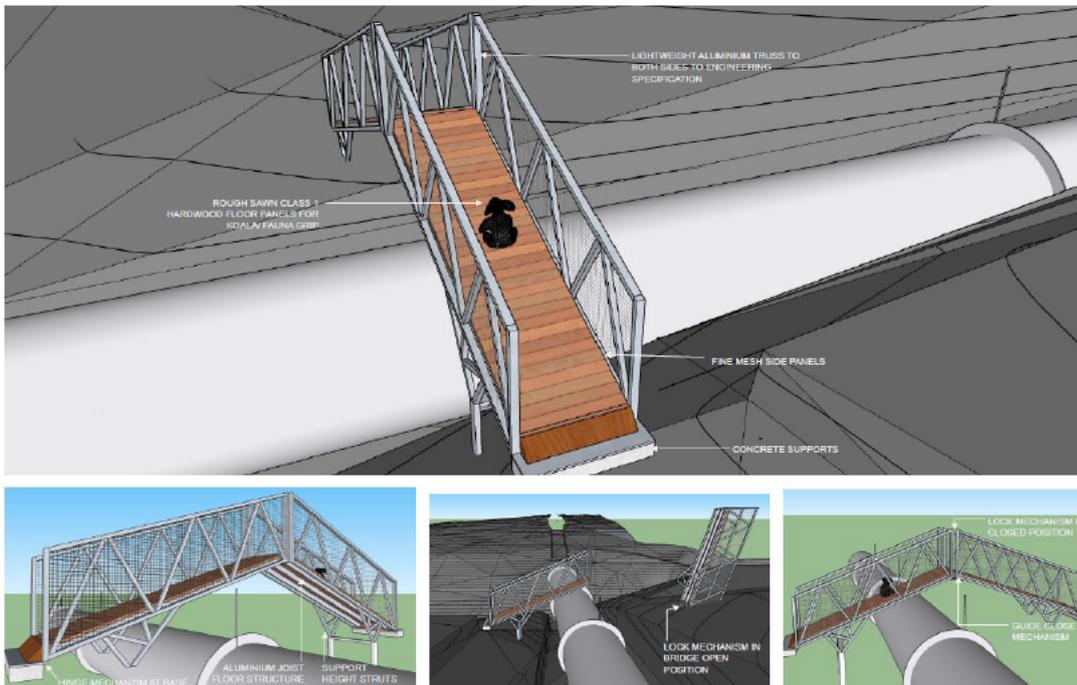


Figure 2.6 Over pipe crossing design

Source: TBLD

2.1.3 Log climb crossing

One log climb crossing is proposed. The location of the log climb crossing is shown at Figure 2.7 and also shown with reference to the cadastral layer to indicate the location within Lot 2 DP 625921 at Figure 2.7. The log climb crossing design is illustrated at Figure 2.9.

The log climb involves the installation of durable hardwood *Eucalyptus* sp. logs to create a log climb structure in location that best matches potential koala movement routes over the unstable rock scree piles near the riparian area of Ousedale Creek. The log climb will be located near the end of decommissioned pipeline towards the north-eastern side of the pipeline over large, exposed rock faces and rock spoil areas.

More detailed design particulars are provided in the drawings prepared by TBLD at Appendix C.



Figure 2.7 Location of 'log climb' structure

Source: TBLD

Note: Pointers labelled A, B and C refer to views which are provided in the drawings at Appendix C.



Figure 2.8 Location of 'log climb' structure – Cadastral image

Source: Six Maps (adapted by EMM)

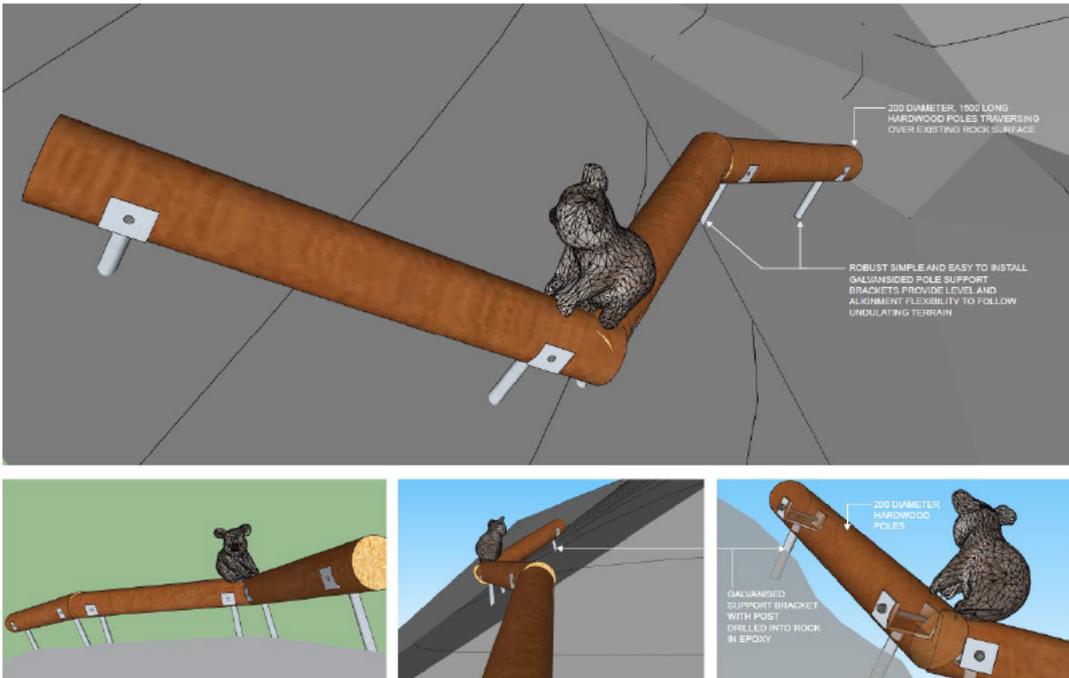


Figure 2.9 Log climb crossing design

Source: TBLD

2.2 Camera monitoring

This project provides an opportunity to advance our understanding of the behaviour of koalas and other fauna when crossings are required to overcome barriers such as fences or infrastructure.

It is therefore proposed to install 18 wildlife cameras for a period of up to five years. Locations will be selected within Lot 1 2 DP 625921 and Lot 2 DP 625921 which are suitably proximate to the koala crossing structures and other areas where fauna movement corridors are likely to exist.

The cameras will be wildlife monitoring cameras (HyperFire 2 Professional White Flash Cameras or similar), which are capable of automatically taking both daytime and night-time images (with flash) when triggered by movement. The cameras will be either mounted on the trunks of trees or on star pickets (Photograph 2.1). Where star pickets are used these will be driven approximately 20 cm into the ground with a mallet.

A camera monitoring plan would be prepared at the time of installation of the cameras. The findings will assist DPE to better understand koala movement and the use of the structures, or other local corridors, by fauna.



Photograph 2.1 Wildlife camera – tree-mounted and picket mounted

As the cameras are automated, signs will be attached or installed in suitable locations within the project area to notify WaterNSW staff or contractors of the presence of the cameras via laminated A4 notices. Refer to Photograph 2.1.

The process for erecting cameras on site will be:

- Fauna monitoring staff as selected by DPE go to the selected location. The locations will be selected based on optimal vision of the crossing path or point.
- Wherever possible the camera will be erected on a tree. Where this is not possible a location for installation of a star picket of 120 cm length will be selected.
- Where installed on trees the camera will be mounted via a strap around the trunk; or where mounted on a star pickets a mounting bracket will be used.

Cameras will be checked periodically (likely every two months) to download images and change batteries.

When monitoring is complete all cameras, star pickets, brackets or other mounts, and signs will be removed.

WILDLIFE CAMERAS OPERATING IN THIS LOCATION

Automatic cameras are located around Ousedale Creek. In some instances the cameras face WaterNSW canal or pipeline.

For more information call Steven Ward, EMM Consulting – 0457 770 411

Figure 2.10 Proposed signage for wildlife camera operations

2.3 Alternatives considered

2.3.1 Do nothing

The 'do nothing' option was, in many respects, considered by the NSW Government in preparing the *Cumberland Plain Conservation Plan: Sub-plan B: Koalas* (DPE 2022) and the commitment to establish the Georges River Koala Reserve. The actions outlined in the CPCP respond to the requirements of the reports of the Office of the NSW Chief Scientist and Engineer². Specifically, Ousedale Creek is identified in the CPCP: Sub-plan B: Koalas as "the most important east–west movement corridor in the Greater Macarthur Growth Area" (p 13) and with regard to the Upper Canal site, the CPCP: Sub-plan B: Koalas states "If feasibility investigations conclude that a crossing is warranted, the project will proceed to design, environmental assessment and construction" (p 23).

Hence a 'do nothing' option is not considered further, and the alternatives considered are limited to design solutions to facilitate the desired fauna movement corridor at Ousedale Creek.

² Office of the NSW Chief Scientist and Engineer (2020) *Report of the Independent Review on the Advice on the protection of the Campbelltown koala population*. Office of the NSW Chief Scientist and Engineer (2021) and *Report of the Independent Review on the Advice regarding the protection of koala populations associated with the Cumberland Plain Conservation Plan*

2.3.2 Use of existing crossing points

There are two existing crossings approximately 110 m north-east and 100 m southwest of Ousedale Creek.

The crossing to the north (refer to Figure 2.11) is likely to be used by some fauna including potentially koalas. There are however two key constraints:

- the fauna which utilise this crossing need to navigate an area without tree cover
- the existing crossing is close to land which is 'urban certified' under the CPCP (refer to Figure 2.12) and will, in future, support development which may further impede the use of the existing crossing by koalas.

The crossing structure to the south (refer to Figure 2.13) is constructed with open grill metal walkways which are unsuited to use by koalas and other fauna. The absence of any evidence of fauna using this crossing point suggests that the material or location are unsuitable.

There are other crossing structures several hundred metres to the north and south of Ousedale Creek which provide access over the open canal sections of the Upper Canal. These are too distant to service the need for koala movement in the Ousedale Creek locality (as required pursuant to CPCP: Sub-plan B: Koalas).



Figure 2.11 Existing crossing - north

Source: Google Earth; EMM Adapted

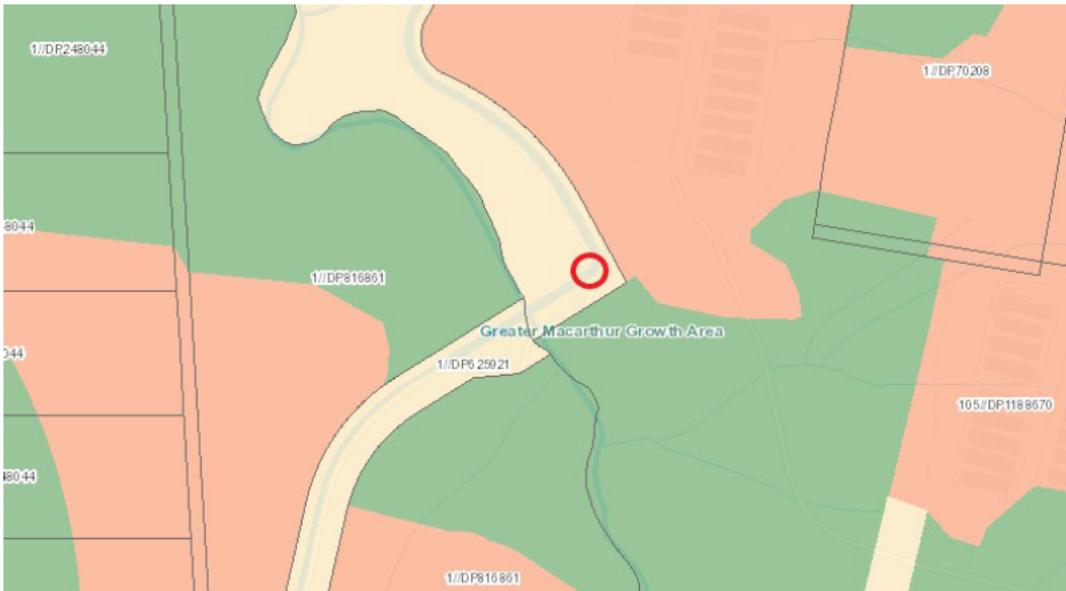


Figure 2.12 Existing crossing - north – CPCP mapping

Source: CPCP Viewer; EMM adapted

Note: Orange indicates Urban Capable Land



Figure 2.13 Existing crossing – south

Source: Google Earth; EMM Adapted

2.3.3 Design alternatives

Design alternatives were informed by the significant experience of Thompson Berrill Landscape Design (TBLD) in landscape infrastructure and functional analysis of fauna movement.

As part of the project development, TBLD consulted with the Sydney Zoo to benefit from their research into koala behaviour. TBLD were provided with a detailed informal and anecdotal briefing by experienced koala keepers as to the various aspects and characteristics of koala behaviour and how it could inform the development and effectiveness of the koala crossing designs. Matters which were the subject of those consultations were:

- consideration of observed behaviours as to how do koalas move in the wild and the extents, range and characteristics of their movement patterns
- characteristics of materials and surfaces the koalas may not prefer to encounter
- characteristics of materials and surfaces that koala are comfortable encountering and climbing
- general behavioural patterns that inform movement, searching and access across ground surfaces
- general behavioural patterns with regard to climbing, walking, leaping and other movements.

The design and feasibility process for the proposed activities was subject to a rigorous process of options identification, concept development and prioritisation.

This process included:

- discussions with koala experts to determine the most suitable design and choice of materials to meet the known behavioural needs of koalas and other fauna
- workshopping a range of designs with representatives and subject matter experts across koala ecology, engineering and planning from WaterNSW and DPE
- preparation of a Prioritisation Matrix to assist the design selection process.

One design, known as the 'under pipe crossing' was considered but was not recommended for the purposes of this project due to the risks associated with possible vibration impacts on the Upper Canal pipeline.

The under pipe option required cutting and excavation of the currently fractured rock faces on both sides of pipeline at the identified location on an existing fauna movement line. The rock slope would be widened, the angle of slope lowered and the surface heavily scabbled to improve grip, providing opportunity for koala and fauna to climb down, pass under the low pipeline supports. It was noted however that construction of rock ramps may cause disturbance to pipeline lining and the heritage fabric of the Upper Canal.

3 Strategic context

3.1 Cumberland Plan Conservation Plan

The CPCP was published by the DPE in August 2022. The CPCP is part of the NSW Government’s commitment to delivering the Western Parkland City, consistent with the Greater Sydney Commission’s strategic vision described in its *Greater Sydney Region Plan: A Metropolis of Three Cities* and *Western City District Plan*.

The CPCP has been prepared to meet strategic biodiversity certification under the NSW *Biodiversity Conservation Act 2016* and strategic assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The geographic area covered by the CPCP extends from north of Windsor to Picton in the south, and from the Hawkesbury-Nepean River in the west to the Georges River near Liverpool in the east. Notably the CPCP will establish a dedicated reserve to protect and restore up to 1,830 hectares of koala habitat along the Georges River, including the land at Ousedale Creek.

The land on which the proposed crossings are situated is mapped under the CPCP as ‘excluded land’. Refer to Figure 3.1. Excluded land is land that has been excluded from the CPCP and for which NSW strategic biodiversity certification and approval through the federal strategic assessment will not be sought.

The subject land is not identified as ‘strategic conservation area’ (cross hatched), ‘urban capable land’ (orange) or ‘avoided land’ (green). As such, the land is not subject to the *Cumberland Plain Conservation Plan Guidelines for Infrastructure Development* (DPE 2022).

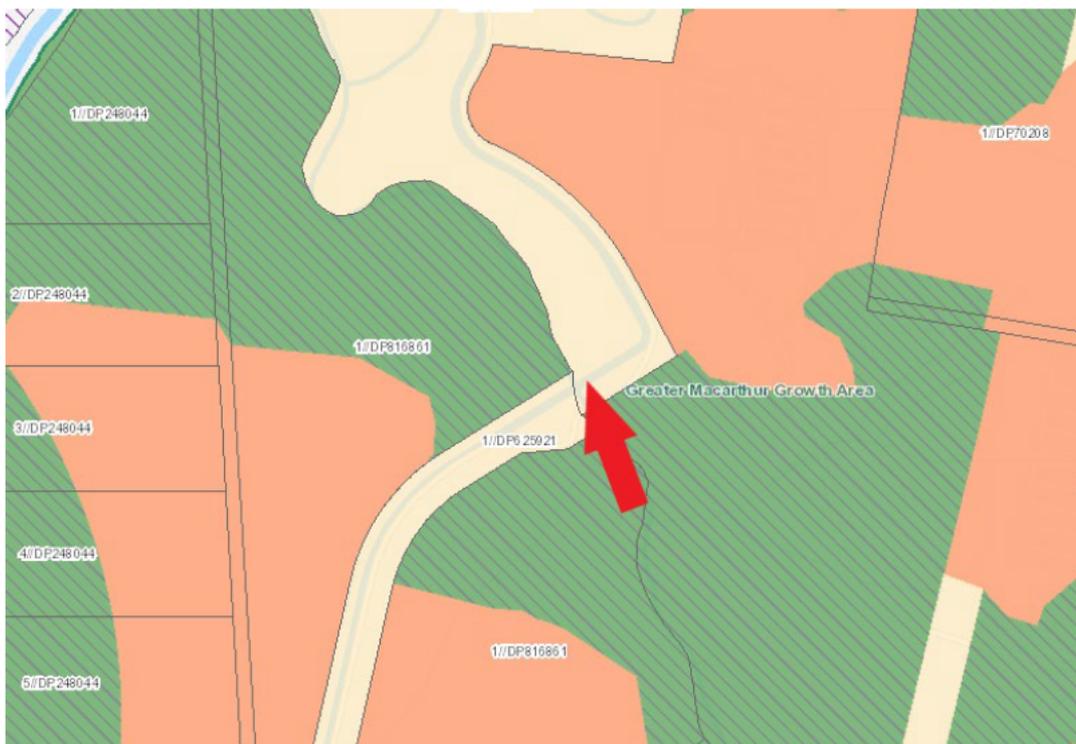


Figure 3.1 CPCP land categories

Source: CPCP Viewer: EMM adapted

The CPCP is supported by two sub-plans:

- Sub-Plan A: Conservation Program and Implementation
- Sub-Plan B: Koalas.

3.1.1 Cumberland Plan Conservation Plan Sub-plan B: Koalas

Sub-plan B: Koalas identifies an action to investigate a potential crossing at the western end of the Ousedale corridor to improve koala movement across the Upper Canal. If feasibility investigations conclude that a crossing is warranted, the project will proceed to design, environmental assessment and construction. The proposed crossing is required to improve east–west koala movement from the Georges River through the Ousedale corridor to the Nepean River.

The Ousedale Creek corridor has been selected as the priority corridor for protection through the CPCP as it supports vegetation in good condition and meets the corridor width recommended by the Office of the NSW Chief Scientist & Engineer (approximate width 598 m).

3.1.2 Greater Macarthur 2040

The NSW Government has prepared *Greater Macarthur 2040: An Interim Plan for the Greater Macarthur Growth Area* (2018) which sets out the strategic planning framework for the growth area.

The plan identifies the koala reserve as a centre-piece of regional planning and identifies the need to install infrastructure to protect koalas.

The Upper Canal is also acknowledged as a significant asset in the local landscape and noted for its heritage value.

Regarding activities on or near the Upper Canal, the plan notes:

Consultation with WaterNSW should occur as early as possible for any development proposal potentially affecting the Upper Canal corridor. WaterNSW will assess proposed developments and activities adjacent to or within the controlled areas to ensure the protection of water quality and WaterNSW infrastructure, the continued safe operation and maintenance of the canal and pipelines, and the consideration of the future construction of a new supply pipeline to replace the Upper Canal (p 21).

4 Statutory and regulatory context

This section examines the key legislation and regulatory instruments which need to be considered to determine the characterisation and approval pathway for the activities described in Chapter 3 of this REF.

4.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the primary statutory instrument for the management and regulation of land use and development in NSW.

The EP&A Act (Section 1.5) defines development as follows:

1.5 Meaning of “development”

(cf previous s 4)

- (1) For the purposes of this Act, *development* is any of the following—
 - (a) the use of land,
 - (b) the subdivision of land,
 - (c) the erection of a building,
 - (d) the carrying out of a work,
 - (e) the demolition of a building or work,
 - (f) any other act, matter or thing that may be controlled by an environmental planning instrument.
- (2) However, development does not include any act, matter or thing excluded by the regulations (either generally for the purposes of this Act or only for the purposes of specified provisions of this Act).
- (3) For the purposes of this Act, the *carrying out of development* is the doing of the acts, matters or things referred to in subsection (1).

This means that, unless specifically excluded by the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation), works such as the construction of fauna crossings are a form of *development* and therefore captured by the EP&A Act.

The EP&A Act also provides for some development to be classified as *exempt development* on the basis that the development has a minor impact. There are environmental planning instruments (such as State environmental planning policies) which include such provisions for exempt development, and these are discussed in the relevant sections below.

If development is not *exempt development*, then Parts 4 and 5 of the EP&A Act become relevant.

4.1.1 The Part 4 approvals pathway

Broadly, Part 4 of the EP&A Act is essentially the default setting for approval pathways. Part 4 applies unless there is a provision under an environmental planning instrument (EPI) that provides for a development to be *permitted without consent* or *exempt development*. If a development is specified in an EPI as being *permitted with consent*, then a Part 4 pathway will apply.

Part 4 includes approval pathways such as local development (i.e. a development application to a local council), complying development (i.e. development authorised by a certifying authority), or other pathways such as State significant development.

4.1.2 The Part 5 approvals pathway

Part 5 of the EP&A Act broadly deals with two circumstances:

- where a public authority is the proponent for a development
- where a third party is the proponent for a development which is *permitted without consent* but that same development nevertheless requires the proponent to obtain a permit, licence or other statutory authorisation from a public authority.

Section 5.5 of the EP&A Act creates a requirement for a *determining authority* to consider the environmental impact of a proposed activity.

The definition of ‘determining authority’ is key here. There are two ways to become a determining authority. Section 5.1 of the EP&A Act provides (underlining added):

determining authority means a Minister or public authority and, in relation to any activity, means the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out.

This means that if a public authority is the proponent (i.e. the first half of the definition), then Section 5.5 will require that public authority to consider the environmental impact before initiating the proposed activity.

It also means if a public authority is required to issue an approval (under other legislation, such as the *Water Management Act 2000*) then the obligation is also placed upon that public authority to consider the environmental impact before issuing the approval, licence or other statutory authorisation (i.e. the second half of the definition).

Note that the obligation in both cases is with the *determining authority* (i.e. the public authority).

Section 5.6 of the EP&A Act provides for the regulations to set out the requirements for environmental impact assessment by a determining authority.

Division 1 of Part 8 of the Environmental Planning and Assessment Regulation 2021 (the EP&A Regulation) provides that the Planning Secretary may issue guidelines in relation to the factors to be considered by a determining authority and the form of the document to be prepared.

Further, Section 171(2) of the EP&A Regulation lists factors to be considered and Section 171(3) requires the preparation of a review of environmental factors (REF) that demonstrates how the environmental factors specified in the environmental factors guidelines were taken into account when considering the likely impact of an activity.

The REF must be published on the determining authority’s website or the NSW planning portal if:

- a) the activity has a capital investment value of more than \$5 million, or
- b) the activity requires an approval or permit as referred to in any of the following provisions before it may be carried out —
 - i. *Fisheries Management Act 1994*, Sections 144, 201, 205 or 219
 - ii. *Heritage Act 1977*, Section 57
 - iii. *National Parks and Wildlife Act 1974*, Section 90

- iv. *Protection of the Environment Operations Act 1997*, Sections 47–49 or 122, or
- c) the determining authority considers that it is in the public interest to publish the review.

4.1.3 Guidelines for Division 5.1 assessments

The Department of Planning and Environment has, pursuant to Section 170 of the EP&A Regulation, published *Guidelines for Division 5.1 assessments* (June 2022).

The guidelines itemise a number of factors to be considered when assessing the impact of a proposed activity.

4.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) is the legislation responsible for the conservation of biodiversity in NSW through the protection of threatened flora and fauna species, populations and ecological communities, and applies to the proposed works.

The BC Act requires (at Part 7) a test to consider whether the proposed activity is “likely to significantly affect threatened species or ecological communities, or their habitats.”

Section 7.3 of the BC Act outlines the test of significance, which includes the impact on the life cycle of species, the extent and composition of the ecological community, and the habitat of threatened species.

4.3 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides for the identification, registration and protection of the State’s historic heritage.

Part 3A of the Heritage Act provides for the establishment of a State Heritage Register (SHR) to be kept by the Heritage Council. The heritage Council can also endorse conservation management plans for listed items.

The Upper Canal System is listed on the State Heritage Register (item SHR#01373).

Part 4 of the Heritage Act provides for the effect of listing on the SHR. This includes the identification of controlled activities, such as an activity to carry out any development in relation to the land on which the building, work or relic is situated, the land that comprises the place, or land within the precinct.

Carrying out a controlled activity requires making application as prescribed under Subdivision 1 of Division 3 of the Heritage Act.

4.4 Environment Protection and Biodiversity Conservation Act (Commonwealth) 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of the environment and related assessment and approvals processes.

The key EPBC Act section of relevance is Section 12 which sets out the requirements for assessing impacts to *matters of national environmental significance*.

The nine *matters of national environmental significance* (MNES) are:

- World Heritage properties
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened species and ecological communities

- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act applies to any group or individual (including State public sector agencies) whose proposed actions may have an impact on MNES. The assessment of MNES impacts is triggered if the proposal has the potential to have a *significant* impact on a MNES.

4.5 State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

State Environmental Planning Policy (Exempt and Complying Development Codes) 2021 (Codes SEPP) offers streamlined assessment processes for specified development provided that certain development standards and other controls are met.

There are general requirements for any development to be considered as *exempt development* (refer to Section 1.16). These requirements include standards such as structural adequacy and satisfying the *Building Code of Australia*; and not being on land identified as outstanding biodiversity value under the *Biodiversity Conservation Act 2016*.

Similarly, there are general requirements for *complying development* (refer to Section 1.18). Complying development must be a type of development which is permitted with consent (a complying development certificate is a type of consent).

The requirements for complying development specifically preclude development requiring an environment protection licence or if it is designated development.

The Codes SEPP also lists a series of specific forms of development and assigns to those types of development a set of development standards which must be satisfied in order to be considered *exempt development* or *complying development*.

There is no specific provision for fauna crossings under the Codes SEPP and the activities assessed under this REF are unlikely to trigger Codes SEPP pathways.

4.6 State Environmental Planning Policy (Biodiversity and Conservation) 2021

Recent amendments to the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (the B&C SEPP) resulted in provision being made, under Part 13.2 of Chapter 13, for koala fencing and fauna crossings:

13.6 Koala fences and fauna crossings

(1) Development involving the erection, maintenance or modification of a fauna crossing or koala fence may be carried out by or on behalf of a public authority without development consent if the crossing or fence is consistent with the Cumberland Plain Conservation Plan.

(2) In this section—

fauna crossing means a crossing to facilitate the movement of fauna across the land

koala fence means a fence used to impede the movement of koalas towards roads and urban land, whether or not the fence is also used for another purpose.

The *Cumberland Plain Conservation Plan (CPCP)* provides for infrastructure to be installed for the purpose of fauna crossings (p 37) and a key deliverable of the conservation program is “installing crossings and fences in key areas to protect koalas and facilitate their safe movement” (p52).

CPCP *Sub-plan B: Koalas* also makes a specific reference as follows (p 23):

Upper Canal crossing

The department is working with Water NSW to investigate a potential crossing at the western end of the Ousedale corridor to improve koala movement across the Upper Canal. If feasibility investigations conclude that a crossing is warranted, the project will proceed to design, environmental assessment and construction. The proposed crossing would improve east–west koala movement from the Georges River through the Ousedale corridor to the Nepean River

4.7 Wollondilly Local Environmental Plan 2011

The Wollondilly Local Environmental Plan 2011 (WLEP) is the relevant local environmental planning instrument for the site.

4.8 Zoning and permissibility

The land within the site is zoned SP2 Infrastructure (Water Supply System) under the WLEP.

The objectives of the SP2 zone are:

- to provide for infrastructure and related uses
- to prevent development that is not compatible with or that may detract from the provision of infrastructure.

Development permitted with consent is:

- aquaculture
- the purpose shown on the **Land Zoning Map**, including any development that is ordinarily incidental or ancillary to development for that purpose
- roads.

The purpose shown on the Land Zoning Map is ‘Water Supply System’. Noting that water supply systems include significant sections of linear infrastructure, such as pipelines, it is typical that ancillary development includes structures or facilities to facilitate access across the pipeline. An example is shown at Photograph 4.1.

Hence, the proposed crossings to facilitate the movement of koalas and other fauna are properly characterised as development ancillary to the purpose of a water supply system, and are therefore permitted with consent pursuant to the WLEP.

Notwithstanding this, as noted elsewhere, the State Environmental Planning Policy (Biodiversity and Conservation) 2021 provides for the crossings to be classified as development permitted without consent. The provisions of the B&C SEPP prevail to the extent of any inconsistency.



Photograph 4.1 Example of an existing crossing at the Upper Canal

Source: DPE

4.9 Summary

Our finding is that the works are classified as development permitted without consent and hence Part 5.1 of the EP&A Act applies, and a REF is required to inform a determination to be made by the applicable delegated determining authority or authorities.

5 Existing environment

5.1 General description

The works will be installed within the north-eastern portion of Lot 1 DP 625921 and the southern-most portion of Lot 2 DP 625921.

The site is within the Wollondilly local government area (LGA). The LGA boundary of Campbelltown is also nearby but the works will be limited to land within the Wollondilly LGA.

5.2 Climate

Appin has an annual temperature range from an average minimum of 3 degrees Celsius in July to an average maximum of 28 degrees Celsius in December, January and February.

Average monthly rainfall is highest in summer and early autumn with a March average of 115.9 mm and a December average of 95.4 mm. Drier months are in winter when the July average rainfall is 25.9 mm and August is 30 mm. ³

5.3 Geology, topography and soils

Ousedale Creek is a tributary of the Nepean River. It also connects with Mallaty Creek. In this location Ousedale Creek a vegetated creek in a deep gully. It is at a terrain elevation of approximately 82 metres above sea level.

The eastern side of the gully is steep, with sheer sandstone cliff faces. The western side of the gully has a shorter sheer cliff but in general is steeply sloping, with a former access track cut diagonally down the western bank face to the north of the pipeline (refer to Appendix A).

The site has three main soil profiles present:

- kurosols
- tenosols
- dermosols.

Kurosols are soils with strong texture contrast between A and strongly acid B horizons which can often have some unusual subsoil chemical features, such as high magnesium, sodium and aluminium. They have generally low agricultural potential due to high acidity, low chemical fertility and generally low water holding capacity. Sodic soil conditions are frequent.

Tenosols are comprised of soils with generally only weak pedologic organisation apart from A horizons (topsoils), excluding soils with deep sandy profiles with a field texture of sand, loamy sand or clayey sand in 80% or more of the upper 1.0 m (Arenosols). Tenosols encompass a diverse range of soils that occur in many parts of Australia, but are typically, very sandy with low chemical fertility, water holding capacity and structure and generally low or very low agricultural potential.

Dermosols are soils with structured B2 horizons (subsoils) and lacking strong texture contrast between A and B horizons, a soil order known for its diversity but that bring together a range of soil with important properties in common. Their physical and chemical characteristics can vary widely, but they generally high agricultural potential due to good structure, moderate to high chemical fertility and water holding capacity.

³ Source: National Oceanic and Atmospheric Administration.

5.4 Water

The Ousedale Creek is a Category 2 watercourse (Strahler classification) and its catchment includes Mallaty Creek and Lily Ponds Gully, both of which flow into Ousedale Creek.

The catchment extends east from the Nepean River to the general alignment of Appin Road.

5.4.1 Existing water quality

Water quality monitoring in Ousedale Creek (conducted from 2002 to 2008)⁴ made the following observations:

i Dissolved oxygen

7% of the observations exceeded the upper trigger concentration recommended by ANZECC.

ii pH

14% of observations exceeded the upper trigger concentration recommended by ANZECC.

iii Phosphorus

84% of observations exceeded the ANZECC trigger level.

iv Nitrogen

82% of observations exceeded the ANZECC trigger level.

5.5 Biodiversity

5.5.1 Koalas

Koalas are known to occur in the region, and the Ousedale and Mallaty Creek corridors are predicted to support around 20 koalas. Although koalas were not detected around the canal during monitoring for feasibility studies, it is considered that they would need to move through the site when moving between larger areas of surrounding habitat.

5.5.2 Habitat description

The site of the proposed works spans the eastern and western banks of Ousedale Creek. Where the Upper Canal crosses Ousedale Creek, the creek line has steep rocky slopes on both banks, limiting fauna movement between the creek itself and habitat on the upper banks.

The upper banks, where the proposed works are located, comprises eucalypt woodland (largely ironbarks, Grey Gum and stringybarks) with a mid-storey of native species such as *Acacia* and *Allocasuarina*, and a ground layer of native grasses, forbs and ferns. The species are a mix of those found in shale and sandstone areas. The plant community type (PCT) mapped in this area is PCT 3321 – Cumberland Shale-Sandstone Ironbark Forest (DPE 2022a).

⁴ Source: GHD (2015) Greater Macarthur Water Management Report, prepared for NSW Department of Planning and Environment.

The creekline itself contains wetter habitat that would occasionally be inundated during high rainfall periods. The canopy layer is sparse, but includes *Allocasuarina* species and Water Gum (*Tristaniopsis laurina*). The PCT is mapped as PCT 3145 – Cumberland Bangalay x Blue Gum Riverflat Forest. Habitat in the creek line will not be impacted by the proposed works.

The habitat within the corridor experiences some current disturbances due to clearing around existing infrastructure, and weed invasions from surrounding agricultural land. In particular, areas adjacent to the canal and pipeline are highly disturbed due to previous and ongoing maintenance, including vegetation clearing (mowing or slashing).

5.5.3 Site assessments to date

As part of the feasibility study completed by EMM in 2022, the site was visited by EMM ecologists on four occasions between March and June 2022. During these visits, the habitat in the area was assessed for suitability for koalas as well as other fauna species. All areas of the proposed works in this report were surveyed during these site visits.

Motion sensor cameras were deployed at ten locations along the canal, pipeline, road and fence line, aiming to determine the ability of fauna to cross the existing infrastructure and move through the corridor. The cameras were deployed for three months from March to June 2022, and every instance of fauna presence captured, both native and exotic, was recorded.

A range of native mammal, bird and reptile species were recorded during the camera monitoring. These included larger mammals such as Brushtail Possum (*Trichosurus vulpecula*), Swamp Wallaby (*Wallabia bicolor*), Common Wallaroo (*Osphranter robustus*), and Common Wombat (*Vombatus ursinus*); smaller mammals such as Bush Rat (*Rattus fuscipes*), Short-beaked Echidna (*Tachyglossus aculeatus*), Eastern Ringtail Possum (*Pseudocheirus peregrinus*), and *Antechinus* sp.; native birds including Superb Lyrebird (*Menura novaehollandiae*), Wonga Pigeon (*Leucosarcia melanoleuca*) and a range of woodland birds; and Eastern Water Dragons (*Intellagama leseurii*).

Several exotic species were recorded during monitoring, including Red Fox (*Vulpes vulpes*), cats (*Felis catus*), Goats (*Capra hircus*), Black Rat (*Rattus rattus*) and feral deer. Results of the monitoring are provided in the report at Appendix F.

5.5.4 Impact areas

For the purposes of the biodiversity impact assessments, impact areas have been defined through discussions of the construction process with TBLD. The impact areas used for the biodiversity assessments (outlined in Table 5.1) include the following components:

- areas directly impacted by the proposed crossing structures
- 1.5 m buffer around each crossing structure, to account for incidental disturbance caused during construction. This buffer is conservative, and lasting impacts within this area are likely to be minimal, if any
- areas that will be temporarily impacted within the laydown area during the construction phase.

The nature of the impacts is described in more detail for each crossing structure in Section 7.1.1. In summary, vegetation clearing will be limited to small areas of groundcover species, and all shrubs and trees will be avoided.

Table 5.1 Impact areas used in biodiversity impact assessments

Description	Total area (m ²)
Fence crossings – four locations	40
Bridge crossing over pipeline – one bridge, the footprint will be split between two landing points on either side of the canal	20
Log climb – one location, approximately 18 m long	54
Combined laydown areas – one location	24
Total	138

5.5.5 Likelihood of occurrence assessment process

A list of threatened species and communities with potential to occur on the site, listed under both the BC Act and EPBC Act, has been generated based on the following databases:

- threatened species records from the Atlas of NSW Wildlife (Bionet) (DPE 2023)
- vegetation associations report from the threatened biodiversity data collection (TBDC) (DPE 2023), based on the PCTs mapped for the site on the NSW State Vegetation Type Map (DPE 2022a)
- protected matters search tool (PMST) (DCCEEW 2023a).

The list of potential threatened entities includes 11 threatened ecological communities, 85 threatened fauna species, and 55 threatened flora species. Each species or community has been assessed for likelihood of occurrence within the site, based on distribution, available habitat, and existing records in the area. Due to the small extent of the impact areas compared to the site as a whole, distinction has been made between the likelihood of a species occurring on the site compared to within the actual impact areas. The likelihood of occurrence has been allocated to one of the categories outlined in Table 5.2.

Table 5.2 Likelihood of occurrence criteria

Likelihood	Description	Further assessment conducted?
Excluded	The potential for the species to occur is so unlikely as to not be worth considering.	No
Unlikely	The species is unlikely to occur on the site or use the habitats present, but may utilise the area on rare occasions	No
May occur within the site	The broader site provides some suitable habitat for the species, and the species is known to occur in the region. The species is unlikely to use the habitat within the impact areas.	No
Potential to occur within impact areas	The impact areas provide suitable habitat for the species, and the species is known to occur in the region.	Yes

The full likelihood of occurrence assessment is provided in Appendix D, including justifications as to whether or not species or communities are expected to occur on the site.

5.5.6 Entities requiring assessment

The species with potential to occur in the impact areas will require further assessment to determine if any potential impacts would be significant. Table 5.3 summarises the threatened species and communities deemed to have potential of occurring within the impact areas on the site. The impact to these species will be addressed in Section 7.1.

Although some threatened species have the potential to occur within the site generally, assessments have been limited to the impact areas of the proposed works. The entities requiring assessment include eight threatened flora species, two invertebrates, one reptile, one reptile, and one threatened ecological community. Full justifications for each species and community can be found in the likelihood of occurrence assessment in Appendix D.

Table 5.3 Threatened species and communities requiring impact assessment

Scientific name	Common name	BC Act status	EPBC Act status
Threatened ecological communities			
Shale Sandstone Transition Forest in the Sydney Basin Bioregion		CE	CE
Flora			
<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E	E
<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	E	-
<i>Hibbertia puberula</i>	-	E	-
<i>Hibbertia superans</i>	-	E	-
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	V	E
<i>Tetratheca glandulosa</i>	Tetratheca glandulosa	V	-
Fauna - Bats			
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (formerly Eastern Bentwing Bat)	V	-
Fauna - reptiles			
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V
Fauna - invertebrates			
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E	-
<i>Pommerhelix duralensis</i>	Dural Land Snail	E	E

5.6 Hazards

5.6.1 Bush fire

The land is mapped as a mix of Category 1 (forest, woodland), Category 2 (grassland) and Buffer land within the Wollondilly LGA.

The land immediately adjacent to the Upper Canal water supply infrastructure is relatively cleared and the selection of materials for the construction of the 'over pipe' crossing and 'under fence' crossings will utilise fire resistant materials as far as possible.

The 'log climb' crossing will require combustible material in the form of hardwood logs but this is not considered to materially add to the fuel load in the event of a bushfire.

The proposed reliance on pre-fabrication of metal components off-site reduces the need for 'hot work' at the site and therefore mitigates the risk of ignition from works occurring on site.

5.6.2 Flood

A minor portion of Lot 2 DP 625921, being along the south-western border of the lot abutting Ousedale Creek, is identified on Wollondilly flood mapping but the land to be used for the installation of the crossings is outside land mapped as flood prone.

Generally, the steeply incised nature of Ousedale Creek will limit the area likely to be impacted by flood events. Refer to Figure 5.1.



Figure 5.1 Flood prone land

Source: Wollondilly Shire Council Geographic Information System

Note: Flood prone land is the riparian zone which is shown without any shading overlay.

5.6.3 Mine subsidence

The site is located within a mapped mine subsidence district. Initial advice was sought from the NSW Department of Customer Service, Subsidence Advisory Office, on 18 October 2022.

Development within a mine subsidence district requires approval from Subsidence Advisory NSW.

Subsidence Advisory records indicate there is a current mining lease under the site. The mapping advice on the Planning Portal indicates that Mine Subsidence Guideline 5 applies to this land.

Guideline 5 applies to properties within mine subsidence districts assessed by Subsidence Advisory NSW as likely to be undermined in the future with moderate subsidence-induced ground movements up to and including:

- maximum Horizontal Ground Strain: 3 mm/m tensile or compressive
- maximum Tilt: 7 mm/m
- minimum Radius of Curvature: 5 km (hogging and sagging).

5.6.4 Underground coal mining

The site for the proposed works is adjacent to, but not within, land mapped as underground coal mining – shown as purple overlay in Figure 5.2. The mapping is not linked to statutory provisions.



Figure 5.2 Underground coal mining

Source: NSW Planning Portal Spatial Viewer

5.7 Existing local land uses

The land on which the proposed koala crossing will be installed is zoned as SP2 (Water Supply System) under the Wollondilly Council Local Environmental Plan 2011.

Surrounding land zonings include a C2 Environmental Conservation zoning for the Nepean River. All other local land use zoning is RU2 Rural Landscape. Refer to Figure 5.3.

Consistent with those land use zonings, the surrounding development is generally agricultural and includes tracts of remnant vegetation, particularly along waterways such as Ousedale Creek, Mallaty Creek and Nepean River.

The nearest urban settlements are in Douglas Park (approximately 4.4 km to the south-west) and Appin (approximately 3.7 km to the south-east). Rural residential areas are dispersed across the rural zones lands.

The Hume Motorway (M31) is approximately 1.8 km to the west. Appin Road (B69) is approximately 3 km to the east of the site.

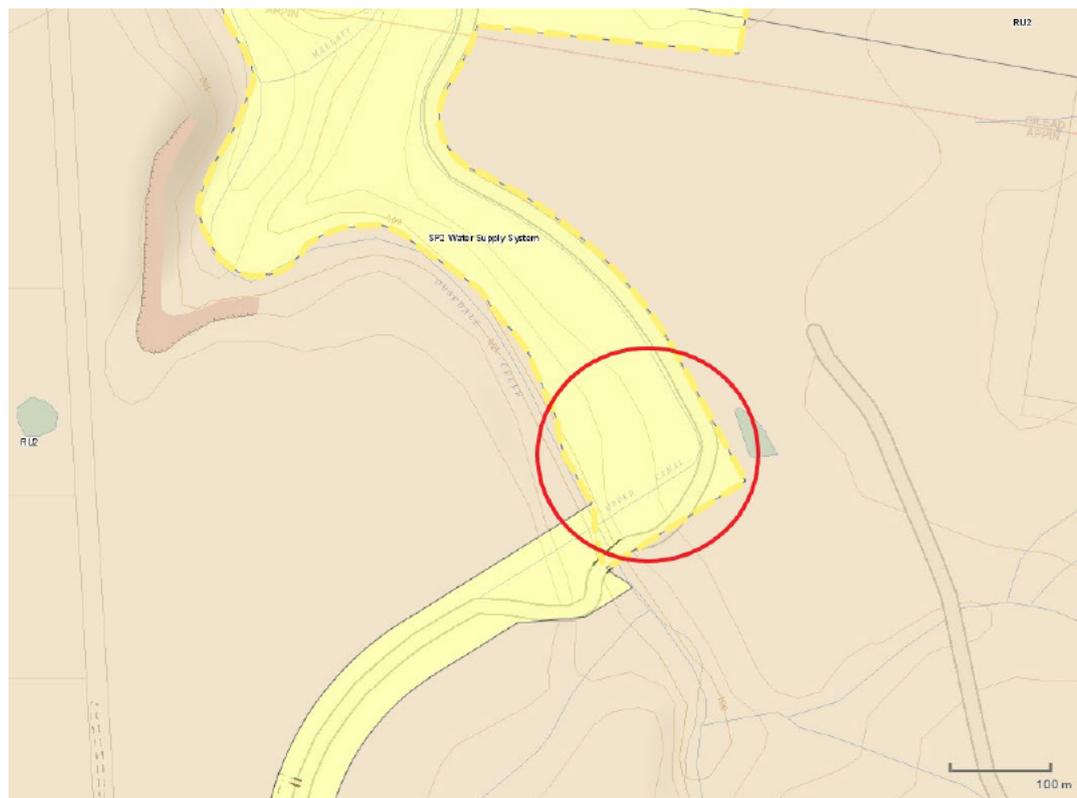


Figure 5.3 Land zoning relative to site (site identified by red circle)

Source: NSW Planning Portal

5.8 Anticipated future local development

The key potential future developments that could have an impact on the movement of koalas are outlined below:

- Adjacent land use – the private land adjacent to the study area is currently rural. This will change to low or medium density residential land use in the future, which would bring significantly higher vehicular and pedestrian activity to the area, reduce mature tree cover in the adjacent areas and increase the ‘hardened’ stormwater catchment entering the Ousedale Creek catchment.
- Fencing – future fencing to the eastern side of the maintenance access road likely to be a standard WaterNSW 2.4 m chain link mesh fence, with triple strands of barbed wire to the top, to effectively prevent pedestrian access into the study area for safety and security purpose. The time frame for this higher fencing is dependent on adjacent development timing.
- WaterNSW development standards – any proposed works are not to limit the ability of WaterNSW to maintain access along Upper Canal.
- WaterNSW future works – any proposed works are not to limit the future ability of WaterNSW to augment supply and install additional water supply infrastructure, which could include a duplicate pipeline.

5.9 Socio-economic context

The site is located away from most population centres. The nearest towns are Appin (approximately 3.7 km to the south-east) and Douglas Park (approximately 4.4 km to the south-west). The regional centre of Campbelltown and surrounding suburbs such as St Helens Park and Rosemeadow are approximately 6.5 km to the north-east.

The Australian Bureau of Statistics (ABS) census data (2021) for the Gilead district indicates a population of 882 people with a media age of 74. There were 444 private dwellings recorded, with an average of 1.6 people per household and an average of 1.6 vehicles per household. Median weekly household income was recorded as \$758. Unemployment was recorded as 6.2%. People in full time work accounted for 41.7% of the population.

Approximately 1.4% of the population identified as Aboriginal or Torres Strait Islander. The cultural background of most residents is Australian, English, Irish, Scottish and German.

The land is within the Tharawal (Dharawal) Local Aboriginal Land Council area.

6 Stakeholder and community consultation

TBLD consulted with the Sydney Zoo as part of their research into understanding koala behaviour. TBLD conducted a visit in early September and met with the Animal Care Manager. TBLD were provided with a detailed informal and anecdotal briefing by experienced koala keepers as to the various aspects and characteristics of koala behaviour and how it could inform the development and effectiveness of the TBLD koala crossing designs. Matters which were the subject of those consultations were:

- consideration of observed behaviours as to how do koalas move in the wild and the extents, range and characteristics of their movement patterns
- characteristics of materials and surfaces the koalas may not prefer to encounter
- characteristics of materials and surfaces that koala are comfortable encountering and climbing
- general behavioural patterns that inform movement, searching and access across ground surfaces
- general behavioural patterns with regard to climbing, walking, leaping and other movements.

There was also consultation with Muru Mittigar, representing Traditional Dharawal Owners, to consider cultural and heritage values in the vicinity of the proposed activities. Site based consultation occurred on 28 April 2023. Further details and recommendations arising from these consultations are provided at Section 7.2.2 of this REF.

7 Impact assessment

7.1 Biodiversity

7.1.1 Description of impacts to biodiversity

The potential impacts to biodiversity from the proposed works are limited in their extent and nature. The intent of the work is to provide crossing points that are appealing to koalas, therefore limiting impacts to the surrounding habitat is imperative and has been considered throughout the design process.

No shrubs or trees will be impacted, with vegetation clearing limited to small areas of groundcover species. The small amount of clearing makes it unlikely that any fauna species will be negatively impacted by the proposed works in the long term.

i Combined laydown areas

On the eastern side of Ousedale Creek, one temporary laydown area will be used for both the over-pipeline crossing and the log climb structure. This will be used to stockpile the required materials and to compile the frames for the bridge structure. This laydown will be placed in an existing cleared area on the southern side of the canal. No vegetation clearing will be required, however some impact to flora may be caused during the construction phase when items are placed on top of groundcover vegetation.

ii Under fence crossings

The under fence crossings will be dug by hand, with only a small amount of vegetation clearing required (approximately 1 m² at each location). All surrounding vegetation will remain intact, with only groundcover species occurring within the actual impact footprint being removed. An impact area has been defined to include a 1.5m buffer around the crossing points, to account for incidental disturbance caused during construction.

All the proposed locations for the under fence crossings have been previously cleared and are dominated by exotic species, however there is some potential for threatened flora species to occur. The area to be impacted is highly unlikely to provide critical habitat for any fauna species.

iii Over pipe crossing

The construction of the over pipeline crossing does not require any clearing of vegetation. The direct impact is limited to the area underneath the footings on either side, which will be placed on top of existing groundcover (approximately 0.6m² on each side). An impact area has been defined to include a 1.5 m buffer around each footing, to account for incidental disturbance caused during construction.

The location of the over pipeline crossing is in a cleared area adjacent to the pipeline. There are some groundcover species present in the area so there is some potential for impacts to threatened flora species, but the impact areas are unlikely to provide critical habitat for fauna species.

iv Log climb crossing

The direct impacts from the log climb structure are limited to the attachment points of the steel cradles that will support the logs. These will be bolted into the rock surface, or small footings will be poured in loose areas, with existing rocks replaced on top of the footings once complete. No vegetation clearing is required, and all materials will be brought in by hand. A 3 m wide impact area has been defined along the alignment of the logs, to allow for incidental disturbance caused during construction.

The location of the log climb structure is in more intact habitat, but vegetation cover along the alignment of the log is limited due to its placement over the steep rocky areas of the site. The rocks themselves may provide some habitat for threatened species, but impacts to habitat will be minimal due to the lack of vegetation clearing.

7.1.2 Positive impacts and monitoring

The proposed crossing structures will have a net positive impact on biodiversity within the corridor. By design, the impacts associated with their installation are very low due to the small impact footprints, placement within already disturbed areas, and the design to cause minimal disturbance. The installation of the crossings seeks to improve fauna connectivity for a range of species in the area, in particular targeted at Koala connectivity, and to better connect areas of habitat on the east and west sides of the Upper Canal.

The proposed camera monitoring provides an opportunity to check if the crossings structures are being utilised by native fauna. The impacts of the camera monitoring program would be nil from a biodiversity perspective, and the data collected may inform the design of future fauna crossings to help improve habitat connectivity in other areas, either locally or more broadly.

7.1.3 Impact reduction measures

To further reduce the impacts resulting from the crossing structures, it is proposed that a pre-clearance survey is undertaken by a qualified ecologist, looking specifically for small, threatened flora species growing within the impact areas, including temporary laydowns. If individuals are recorded, there may be opportunities to adjust the position of the crossings or laydown area to avoid impacts.

This survey is not intended to be a comprehensive flora survey, as target species will have different survey periods that may not align with the timing of the survey and construction. It is intended to reduce impacts to any threatened species that can be identified at the time of survey. Threatened flora species found growing nearby to the impact areas can be flagged to avoid any incidental impacts during the construction period.

7.1.4 Assessments of significance

Initial discussions with TBLD determined that the proposed works would not have any impact on tree or shrub species. The impact areas for the fence crossings, over pipe crossing and laydown area do not contain any trees or shrubs. No vegetation clearing is required for the log climb, and any construction impacts to trees or shrubs within the impact area can be avoided during detailed design and micro-siting of the structure.

There are no predicted impacts to threatened bird or mammal species, due to habitat clearing being limited to a small area of groundcover vegetation only. Any immediate impacts to these species are unlikely due to their mobility. A such, significant impact assessments were not completed for potentially occurring threatened tree, shrub, bird or mammal species.

Significant impact assessments were completed under the BC Act and EPBC Act for 13 species with potential to occur within the impact areas, as outlined in Table 5.3.

The proposed works are unlikely to have a significant impact on any of the threatened species and communities assessed, as outlined in the tables below. Generally, the area of impact is too small to be considered significant for any of the species considered, especially given the existing disturbance in the impact areas.

i Biodiversity Conservation Act

Assessments of significance have been completed for species and communities listed under the BC Act that could occur in the impact areas. Given the minor level of impacts expected and the similar habitats in which they occur, related species have been grouped and assessed together and a similar approach was used for threatened ecological communities (TECs).

Table 7.1 Assessment of significance for threatened ecological communities

Criteria	Discussion
Community assessed	<i>Shale Sandstone Transition Forest in the Sydney Basin Bioregion</i>
a) in the case of a threatened species, whether the proposed development or activity 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 TEC being assessed.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—	
i. 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	<p>Within the area covered by the CPCP, there is at least 1,915 ha of the BC Act listed community (DPE 2022b). The proposed activity will impact up to 0.01ha of the community, which represents 0.0007% of the extent in the CPCP area. The impact area represents 0.0001% of the estimated remaining extent of the whole community across its range (9,950 ha).</p> <p>Within the impacted area, only a small proportion of the works involve vegetation clearing, and will take place in areas that are already disturbed.</p> <p>The limited extent of the impacts is unlikely to significantly affect the extent of the community.</p>
ii. 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	The activity comprises minor clearing in areas that are already disturbed and will not, in the locality, substantially and adversely modify the composition of the ecological communities and place them at risk of extinction.
c) in relation to the habitat of a threatened species or ecological community—	
i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity	The activity will remove up to 0.01 ha of 9,950 ha of potential habitat for the communities which represents a minor reduction (0.0001%). Only a small proportion of that extent involves vegetation clearing.
ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	The activity comprises minor clearing for the creation of Koala crossings. Clearing of these discrete areas will not fragment habitat for this communities.
iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The habitat within the impact areas is currently disturbed by ongoing clearing for the maintenance of the canal and pipeline, as well as weed invasion from surrounding agricultural land. The small area of habitat to be impacted is highly unlikely to be important to the survival of the community in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The impact areas do not contain any areas of outstanding biodiversity value. Accordingly, the activity will not impact areas of outstanding biodiversity value.

Table 7.1 Assessment of significance for threatened ecological communities

Criteria	Discussion
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	<p>Key threats to the community are clearing of native vegetation, Invasion of native plant communities by exotic perennial grasses, and Invasion and establishment of exotic vines and scramblers.</p> <p>Although the activity will impact some small areas, it only represents a minor reduction (0.01 ha), of which only a small proportion involves the clearing of vegetation. The works are unlikely to increase the invasion of exotic species, as the sites are already impacted by weeds, and the construction work does not require any soil to be brought in.</p>
Conclusion	The activity is unlikely to result in a significant impact on this community.

b Flora

Table 7.2 Assessment of significance for threatened plants

Criteria	Discussion
Species assessed	Bynoe's Wattle (<i>Acacia bynoeana</i>), Bauer's Midge Orchid (<i>Genoplesium baueri</i>), Narrow-leaf Finger Fern (<i>Grammitis stenophylla</i>), <i>Hibbertia puberula</i> , <i>Hibbertia superans</i> , Sydney Plains Greenhood (<i>Pterostylis Saxicola</i>), Eastern Australian Underground Orchid (<i>Rhizanthella slateri</i>), and <i>Tetratheca glandulosa</i> .
a) in the case of a threatened species, whether the proposed development or activity 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	Given the small footprint of the crossing structures, it is unlikely that the proposed works will affect any individuals of these species. The impact areas for the proposed works are small and discrete, so it is unlikely that dispersal or regeneration will be impacted. Should any of the threatened species occur within the impact areas, it is unlikely that a viable local population would be placed at risk of extinction due to the very small footprint.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—	
i. 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, as only threatened species are being assessed.
ii. 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, as only threatened species are being assessed.
c) in relation to the habitat of a threatened species or ecological community—	

Table 7.2 Assessment of significance for threatened plants

Criteria	Discussion
<p>i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity</p>	<p>The activity will remove up to 0.01 ha of potential habitat for threatened plant species detailed above, which represents a minor reduction given the extent of available habitat in the Ousedale Creek corridor.</p> <p>The areas to be cleared are already highly disturbed and do not represent optimal habitat for any of the above species.</p> <p>In addition, the implementation of mitigation measures such as a pre-clearance survey (Section 7.1.3) will minimise impacts on potentially occurring individuals.</p>
<p>ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity</p>	<p>The activity comprises minor clearing for the creation of koala crossings. Clearing of these discrete areas will not fragment habitat for these species.</p>
<p>iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality</p>	<p>The habitat to be impacted is already in a disturbed state due to clearing for maintenance of the canal and pipeline, as well as the presence of weed species. The species are unlikely to depend on the habitat being removed, especially given the limited extent of the impacts.</p> <p>Some individuals may be present in the habitat to be impacted, but it is unlikely to be important to their long-term survival in the locality.</p>
<p>d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</p>	<p>The impact areas do not contain any areas of outstanding biodiversity value. Accordingly, the activity will not impact areas of outstanding biodiversity value.</p>
<p>e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.</p>	<p>One key threatening process affecting these species is relevant to the activity:</p> <ul style="list-style-type: none"> • clearing of native vegetation. <p>Although the activity will impact a small area (<0.01 ha vegetation clearing), it represents a minor reduction for all plant species discussed. The areas to be cleared have already been cleared in the past for maintenance of the canal and pipeline. All intact vegetation containing shrubs and trees will be avoided. The activity will not increase any other key threatening process.</p>
<p>Conclusion</p>	<p>The activity is unlikely to result in a significant impact on the aforementioned species.</p>

Table 7.3 Assessment of significance for fauna - reptile and snail species

Criteria	Discussion
Species assessed	Broad-headed Snake (<i>Hoplocephalus bungaroides</i>), Cumberland Plain Land Snail (<i>Meridolum corneovirens</i>), Dural Land Snail (<i>Pommerhelix duralensis</i>)
a) in the case of a threatened species, whether the proposed development or activity 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	<p>The Broad headed snake breeds from autumn to spring and females give birth between January and April, every second year. At this time of year, gravid females and juveniles use rocky habitat with cool, shaded rocks and crevices. There is some potential for Broad-headed snakes to use the rocky habitat near the log climb, but there will be no lasting impact to the habitat.</p> <p>The snail species lay eggs in moist, dark areas, such as under logs. It is not expected that the impact areas would provide any suitable breeding habitat features.</p> <p>The proposed works are unlikely to affect the life cycle of the species.</p>
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—	
i. 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, as only threatened species are being assessed.
ii. 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, as only threatened species are being assessed.
c) in relation to the habitat of a threatened species or ecological community—	
i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity	<p>The activity will impact up to 0.01ha of potential habitat for threatened species detailed above, which represents a minor reduction given the extent of available habitat in the Ousedale Creek corridor. Of that 0.01 ha, only a small proportion comprises vegetation clearing.</p> <p>In addition, the implementation of mitigation measures (Section 7.1.3) will minimise impacts on any individuals present.</p>
ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	The activity comprises minor clearing for the creation of koala crossings. Clearing of these discrete areas will not fragment habitat for these species.
iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The habitat to be impacted is already in a disturbed state due to clearing for maintenance of the canal and pipeline, as well as the presence of weed species. The species are unlikely to depend on the habitat being removed, especially given the limited extent of the impacts. The species may use the habitat occasionally, but it is unlikely to be important to their long term survival.

Table 7.3 Assessment of significance for fauna - reptile and snail species

Criteria	Discussion
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The impact areas do not contain any areas of outstanding biodiversity value. Accordingly, the activity will not impact areas of outstanding biodiversity value.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	<p>One key threatening process affecting these species is relevant to the activity:</p> <ul style="list-style-type: none"> clearing of native vegetation. <p>Although the activity will impact some areas, it represents a minor habitat reduction for all species discussed. Of the 138 m² within the impact area, only a small proportion of this involves vegetation clearing. The activity will not increase any other key threatening process.</p>
Conclusion	The activity is unlikely to result in a significant impact on the aforementioned species.

Table 7.4 Assessment of significance for fauna – Large Bent-winged Bat

Criteria	Discussion
Species assessed	Large Bent-winged Bat (<i>Miniopterus orianae oceanensis</i>)
a) in the case of a threatened species, whether the proposed development or activity 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	<p>Large Bent-winged Bats roost in caves, derelict mines, storm-water tunnels, buildings and other man-made structures. They breed and rear young in large colonies within maternity caves. Their diet consists of insects, with foraging primarily taking place above the tree canopy.</p> <p>The proposed works will not impact on maternity caves or alter foraging habitat for the species. As such, the proposed works are not expected to effect the life cycle of the species.</p>
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—	
i. 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, as only threatened species are being assessed.
ii. 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, as only threatened species are being assessed.
c) in relation to the habitat of a threatened species or ecological community—	
i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity	No breeding or foraging habitat for the species is expected to be removed or modified by the proposed works.

Table 7.4 Assessment of significance for fauna – Large Bent-winged Bat

Criteria	Discussion
ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	No breeding or foraging habitat will be fragmented or isolated by the proposed works. The presence of over-pipe crossing structures may slightly modify aerial routes for the species (e.g. fly-ways), but this is not expected impact access to other areas of habitat.
iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	No breeding or foraging habitat will be removed, modified, fragmented or isolated by the proposed works.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The impact areas do not contain any areas of outstanding biodiversity value. Accordingly, the activity will not impact areas of outstanding biodiversity value.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	<p>Key threatening processes for the Large Bent-winged Bat are:</p> <ul style="list-style-type: none"> • disturbance by recreational cavers and general public accessing caves and adjacent areas particularly during winter or breeding • loss of high productivity foraging habitat • introduction of exotic pathogens, particularly white-nose fungus • cave entrances being blocked for human health and safety reasons, or vegetation (particularly blackberries) encroaching on and blocking cave entrances • hazard reduction and wildfire fires during the breeding season • predation by feral cats. <p>The proposed works will not contribute to any of the key threatening processes listed for the species.</p>
Conclusion	The activity is unlikely to result in a significant impact on the aforementioned species.

ii **Environment Protection and Biodiversity Conservation Act**

An assessment of significance has been completed for species listed under the Commonwealth EPBC Act that are likely to occur in the impact areas. The species have been grouped by conservation status, in accordance with the criteria for vulnerable species in Matters of National Environmental Significance: *Significant Impact Guidelines 1.1* (DoE 2013).

Table 7.4 Assessment of significance for vulnerable species

Criteria	Discussion
Species assessed	Broad-headed Snake (<i>Hoplocephalus bungaroides</i>) and Bynoe's Wattle (<i>Acacia bynoeana</i>)
EPBC Act conservation status	Vulnerable
1. Long-term decrease in the size of an important population.	<p>No important populations have been defined for the Broad-headed snake or for Bynoe's Wattle as there are no adopted recovery plans for these species.</p> <p>Given the limited distribution of both species, it is assumed that any individuals present on the site would be part of an important population.</p> <p>The proposed works are unlikely to impact the Broad-headed Snake due to the very small footprint of the works. The impacts to the habitat of this species will be temporary only, during construction of the log climb. All rocks and habitat will be replaced as they were once construction is finished, and no vegetation will be cleared.</p> <p>The proposed works are unlikely to impact Bynoe's Wattle due to the very small footprint of the works. A pre-clearance survey will be undertaken to identify any individuals from the impact area prior to works, and there may be an opportunity to move the locations of some structures to avoid impacts if individuals are found. Regardless, the area to be cleared within the impact areas is unlikely to sustain many individuals of Bynoe's wattle, so very few are likely to be removed as part of the works.</p> <p>It is therefore unlikely that the works will reduce the size of an important population of the above species.</p>
2. Reduce area of occupancy of an important population.	<p>No important populations have been defined for the Broad-headed snake or for Bynoe's Wattle as there are no adopted recovery plans for these species.</p> <p>The area of occupancy for the Broad-headed snake is unlikely to be reduced, as there will be no long-lasting impacts to the rocky habitat on site. Impacts for this species will be limited to disturbance during construction, while the mounts for the log climb structure are being installed on the rocky slope. All rocks will be replaced if they are moved during the construction process.</p> <p>The area of occupancy for Bynoe's Wattle will be reduced as a result of the minor areas of clearing required. The total impact area is approximately 0.01 ha, but only a small proportion of this area involves the removal of potential habitat through clearing or the permanent construction of structures on top of habitat.</p>
3. Fragment an important population into two or more populations.	<p>The activity comprises minor clearing for the creation of koala crossings. Clearing of these discrete areas will not fragment habitat for these species.</p> <p>The proposed works are unlikely to obstruct genetic exchange in the area for Bynoe's Wattle due to the discrete nature of the clearing and the extent of suitable habitat surrounding the impact areas. Broad-headed Snakes are mobile, and temporary impacts to a small area of rocky habitat will not fragment any population that is present on the site. The over pipe crossing may facilitate connectivity for all fauna species.</p>
4. Adversely affect habitat critical to the survival of a species.	<p>Critical habitat has not been defined for the Broad-headed Snake or Bynoe's Wattle.</p> <p>The habitat present within the impact areas is unlikely to be critical for the survival of the Broad-headed Snake, given the limited extent of the proposed impacts. Potential shelter sites for the species within the impact area of the log climb are mostly underneath loose rocks, which is not considered optimal habitat. There are few if any suitable crevices in stable rocks.</p> <p>The habitat within the impact areas for the other structures is suitable for Bynoe's Wattle, but due to its limited extent is highly unlikely to be critical to the survival of the species.</p>

Table 7.4 Assessment of significance for vulnerable species

Criteria	Discussion
5. Disrupt the breeding cycle of an important population.	<p>No important populations have been defined for the Broad-headed snake or for Bynoe’s Wattle as there are no adopted recovery plans for these species.</p> <p>The Broad headed snake breed from autumn to spring and females give birth between January and April, every second year. At this time of year, gravid females and juveniles use rocky habitat with cool, shaded rocks and crevices. There is some potential for Broad-headed snakes to use the rocky habitat near the log climb, but there will be no lasting impact to the habitat.</p> <p>After a pre-clearance survey and micro-siting of the works, it is unlikely that the proposed works will affect any individuals of Bynoe’s Wattle. The impact areas for the proposed works are small and discrete, so it is unlikely that dispersal or regeneration will be impacted.</p> <p>The breeding cycles of the species are unlikely to be affected by the proposed works.</p>
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	<p>Up to 0.01 ha of potential habitat for these species will be impacted, with only a small proportion of that area to be cleared.</p> <p>The impact areas are located in sub-optimal habitat due to existing disturbances on the site, including clearing and weed invasion. The works are unlikely to further decrease the quality of remaining habitat on the site.</p> <p>The minor reduction in habitat is not deemed significant and will not reduce the quality of the remaining habitat for either of these species.</p>
7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat.	<p>The impact areas are located within habitat that already experiences disturbance from invasive species.</p> <p>There is the potential for minor weed incursion into the impact areas because of the planned soil disturbance. To mitigate this risk, soil will only be disturbed where necessary (some impact areas do not require any soil disturbance, only above ground disturbance). Where soil disturbance is planned it will be restricted to within the designated impact areas. Further relevant mitigation measures include operating with clean tools and ensuring that any vehicles that access the impact areas are clean and free of plant matter.</p> <p>The proposed works will not have any impact on invasive species that are harmful to the Broad-headed Snake, such as cats and foxes, which are already present on the site.</p> <p>Hence, the proposed works will not increase the risks associated with invasive species.</p>
8. Introduce disease that may cause the species to decline.	<p>Conservation advice for these species does not state whether they are susceptible to disease. However, disease outbreaks normally occur in wild animal populations when sufficient stress is caused through large-scale habitat removal. As the activity requires a minor reduction in habitat, the activity is considered unlikely to introduce disease that would impact the Broad-headed Snake. An introduction of disease into the soil is unlikely due to the minimal ground disturbance and mitigation measures mentioned above, and hence is unlikely to affect Bynoe’s Wattle.</p>
9. Interfere substantially with the recovery of the species.	<p>There are no adopted recovery plans for the Broad-headed snake or for Bynoe’s Wattle.</p> <p>Given the minor disturbances associated with the work and the existing disturbance on the site, it is considered unlikely that the works will interfere with the recovery of either species.</p>
Conclusion	The activity is unlikely to result in a significant impact on these species.

b Critically endangered and endangered species

Table 7.5 Assessment of significance for critically endangered and endangered species

Criteria	Discussion
Species assessed	Dural Land Snail (<i>Pommerhelix duralensis</i>), Bauer's Midge Orchid (<i>Genoplesium baueri</i>), Sydney Plains Greenhood (<i>Pterostylis saxicola</i>), and Eastern Australian Underground Orchid (<i>Rhizanthella slateri</i>).
EPBC Act conservation status	Endangered
1. Lead to a long-term decrease in the size of a population.	<p>The impacts to the habitat of the Dural Land Snail will be minor, due to the limited extent of the impact areas. The proposed works are unlikely to impact any local population of the Dural Land Snail. A pre-clearance survey is unlikely to detect all instances of the three orchid species, as their flowering periods do not overlap, with Bauer's Midge Orchid flowering from December to April, and the other species flowering between September and November.</p> <p>Regardless, due to the minor extent of clearing required and the existing disturbance on site, the impact areas are unlikely to support enough individuals that their removal would lead to a decrease in any population.</p> <p>It is therefore unlikely that the works will reduce the size of an important population of the above species.</p>
2. Reduce area of occupancy of the species.	<p>The area of occupancy for these species will be reduced as a result of the minor areas of clearing required. The total impact area is approximately 0.01 ha, but only a small proportion of this area involves the removal of potential habitat through clearing or the permanent construction of structures on top of habitat.</p> <p>The habitat being impacted is not optimal for any of the above species due to the current level of disturbance at the site.</p>
3. Fragment an existing population into two or more populations.	<p>The activity comprises minor clearing for the creation of koala crossings. Clearing of these discrete areas will not fragment habitat for these species.</p> <p>The proposed works are unlikely to obstruct genetic exchange in the area for the orchid species due to the discrete nature of the clearing and the extent of suitable habitat surrounding the impact areas. Dural Land Snails are mobile, and impacts to a small area of habitat will not fragment any population that is present on the site.</p>
4. Adversely affect habitat critical to the survival of a species.	<p>The habitat present within the impact areas is unlikely to be critical for the survival of the Dural Land Snail, given the limited extent of the proposed impacts. The impact areas contain little leaf litter or structures on the ground, so likely do not provide optimal habitat for this species.</p> <p>The habitat within the impact areas provides some habitat for the orchid species, but due to its limited extent is highly unlikely to be critical to the survival of the species.</p>
5. Disrupt the breeding cycle of a population.	<p>The Dural Land Snail lays eggs in moist, dark areas, such as under logs. It is not expected that the impact areas would provide any suitable habitat features for breeding.</p> <p>The impact areas are small and discrete, so it is unlikely that dispersal or regeneration of the orchid species will be impacted.</p> <p>The breeding cycles of the species are unlikely to be affected by the proposed works.</p>
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	<p>Up to 0.01 ha of potential habitat for these species will be impacted, with only a small proportion of that area to be cleared.</p> <p>The impact areas are located in sub-optimal habitat due to existing disturbances on the site, including clearing and weed invasion. The works are unlikely to further decrease the quality of remaining habitat on the site.</p> <p>The minor reduction in habitat is not deemed significant and will not reduce the quality of the remaining habitat for any of these species.</p>

Table 7.5 Assessment of significance for critically endangered and endangered species

Criteria	Discussion
7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	<p>The impact areas are located within habitat that already experiences disturbance from invasive species.</p> <p>There is the potential for minor weed incursion into the impact areas because of the planned soil disturbance. To mitigate this risk, soil will only be disturbed where necessary (some impact areas do not require any soil disturbance, only above ground disturbance). Where soil disturbance is planned it will be restricted to within the designated impact areas. Further relevant mitigation measures include operating with clean tools and ensuring that any vehicles that access the impact areas are clean and free of plant matter.</p> <p>The proposed works will not have any impact on invasive species that are harmful to the Dural Land Snail, such as introduced predators, which are already present on the site.</p> <p>Hence, the proposed works will not increase the risks associated with invasive species.</p>
8. Introduce disease that may cause the species to decline.	<p>Conservation advice for these species does not state whether they are susceptible to disease.</p> <p>An introduction of disease into the soil is unlikely due to the minimal ground disturbance and mitigation measures mentioned above, and hence is unlikely to affect the above species.</p>
9. Interfere with the recovery of the species.	<p>There are no adopted recovery plans for the above species.</p> <p>Given the minor disturbances associated with the work and the existing disturbance on the site, it is considered unlikely that the works will interfere with the recovery of any of the species.</p>
Conclusion	The activity is unlikely to result in a significant impact on these species.

c Critically endangered and endangered ecological communities

Table 7.6 Assessment of significance for critically endangered and endangered ecological communities

Criteria	Discussion
Species assessed	<i>Shale Sandstone Transition Forest of the Sydney Basin Bioregion</i>
EPBC Act conservation status	Critically endangered
1. Reduce the extent of an ecological community.	<p>The proposed works have been designed to avoid as many impacts to native vegetation and potential endangered ecological communities (CEEC) as practicable.</p> <p>The proposed activity would impact approximately 0.01 ha of the CEEC. Of this 0.01 ha, only a small proportion involves vegetation clearing.</p> <p>The impact areas are placed in areas that are already disturbed and have been previously cleared. In effect, the works are unlikely to reduce the extent of the CEEC.</p>
2. Fragment an ecological community.	<p>The areas impacted are within a biodiversity corridor. Impacts from the proposed activity constitute a minor reduction in the CEEC (0.01 ha). Due to the minor and discrete nature of the proposed activity the project is unlikely to obstruct genetic exchange in the biodiversity corridor, and consequently is unlikely to significantly fragment or isolate any occurrence of the community.</p>
3. Adversely affect critical habitat.	<p>No critical habitat, as defined under Section 207A of the EPBC Act, has been identified or included in the register of critical habitat for the CEEC.</p> <p>Areas critical to the CEEC, as listed in the conservation advice (DoE 2014), are those that meet the minimum condition thresholds. While the impact areas have potential to meet the minimum condition thresholds, they are placed in highly disturbed locations with very little native vegetation cover. The proposed activity is unlikely to have a significant adverse impact on critical habitat for the community.</p>

Table 7.6 Assessment of significance for critically endangered and endangered ecological communities

Criteria	Discussion
4. Modify or destroy abiotic factors (such as water, nutrients, or soil) necessary for an ecological community's survival.	As the proposed activity would impact small discrete areas, it is not expected to significantly alter the existing abiotic factors which currently exist within the area. The proposed structures require very little ground disturbance, and will largely be placed on top of the ground. The only excavation required is for the small areas of the fence crossings, which will be to a depth of approximately 30 cm. It is unlikely that the crossing structures will impact any abiotic factors on the site, due to the nature of their design and construction.
5. Change in the species composition of an ecological community.	<p>There is the potential for minor weed incursion into the impact areas because of the planned soil disturbance. To mitigate this risk, soil will only be disturbed where necessary (some impact areas do not require any soil disturbance, only above ground disturbance). Where soil disturbance is planned it will be restricted to within the designated impact areas. Further relevant mitigation measures include operating with clean tools and ensuring that any vehicles that access the impact areas are clean and free of plant matter.</p> <p>The impact areas are located within habitat that is already disturbed and contains weed species. Given the minor nature of the proposed activity and the mitigation measures in place to protect the CEEC, it is unlikely that there will be a substantial change to the species composition of the listed community.</p>
6. Reduction in the quality or integrity of an ecological community, including:	Due to the minor impact of the proposed activity, it is unlikely to cause any substantial reduction in quality or integrity of the community outside of the area of direct impact.
a) Assisting invasive species.	<p>Due to the minor impact of the proposed activity and the weed mitigation measures proposed in Criteria 5 of this table, it is unlikely to cause any substantial reduction in quality or integrity of the community.</p> <p>Furthermore, the impact areas are located within habitat that is already disturbed through clearing and weed invasion.</p>
b) Regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community.	No regular mobilisation of chemicals or pollutants are planned as part of the proposed activity.
7. Interfere with recovery.	<p>No recovery plan is required for this EEC as it is not considered to provide benefits above existing mechanisms (DCCEE 2023b).</p> <p>The proposed action could potentially contribute to the following EPBC-listed threatening processes:</p> <ul style="list-style-type: none"> land clearance dieback caused by the root-rot fungus (<i>Phytophthora cinnamomi</i>) loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants. <p>Mitigation measures will be applied to minimise the risk of impacts such as weed invasion and the introduction of pathogens. Weed mitigation measures discussed in Criteria 5 of this table are also relevant to the management of pathogens such as root-rot fungus.</p> <p>Removal of 0.01 hectares, albeit minor, would contribute to the land clearance key threatening process affecting the community. Due to the small area of impact and placement within a disturbed area, this activity is unlikely to interfere with the recovery of the CEEC.</p>
Conclusion	Based on the above assessment, the activity is unlikely to significantly impact the CEEC.

7.2 Aboriginal cultural heritage

7.2.1 Overview

There are two components which have been completed for the assessment and consideration of Aboriginal cultural heritage:

- Aboriginal Cultural Values Assessment, prepared by Muru Mittigar
- Aboriginal Due Diligence Assessment, prepared by EMM.

7.2.2 Aboriginal Cultural Values Assessment

Muru Mittigar, on behalf of DPE, engaged with Traditional Dharawal Owners to undertake a cultural and heritage assessment of the Upper Canal region before works commenced to ensure that DPE had a greater understanding of the cultural significance of the area to the Dharawal nation.

A site visit was conducted on 28 April 2023 during which cultural information was shared regarding stories and cultural values associated with the site.

Through the on-site consultation, Aboriginal representatives noted the presence of rock shelters nearby with an engraving of a koala which tells the story of the koala in the region. The representatives also identified the Dharawal connection to the land, the plants and the animals which are critical to maintaining the story, the song, the lore, and the beliefs of their culture.

The advice prepared by Muru Mittigar states that many physical items remain in the area and that these show the local story and also a broader story across the country. They sought a genuine and respectful attempt to protect and preserve all aspects of Aboriginal values.

Recommendations by Muru Mittigar include:

- engaging with first nations people at the early stage of all projects
- adopting and increasing cultural understanding within the project.

A summary of the consultation and recommendations have been prepared by Muru Mittigar and is provided at Appendix G.

7.2.3 Aboriginal Due Diligence Assessment

This assessment provides a review of the potential impact of the proposed activities (installation of koala crossings) on Aboriginal heritage in accordance with the Heritage NSW *Due Diligence Code of Practice for the Protection of Aboriginal Objects* (DECCW 2010) in satisfaction of requirements and/or recommendations of the following:

- *Environmental Planning and Assessment Act 1979*
- *National Parks and Wildlife Act 1974*.

This assessment has included desktop assessment and site inspection. The desktop assessment has identified that there are no previously registered Aboriginal objects within the study area, and that based on the environmental landforms present and historical disturbance activities the study area is predicted to have low archaeological sensitivity, and it is against expectation for Aboriginal objects to occur. The proposed activity is unlikely to result in harm to Aboriginal objects.

This due diligence assessment has considered the potential for Aboriginal heritage impacts across the entirety of the study area (design options). It is an initial investigation of constraints and opportunities pertaining to existing and potential Aboriginal heritage sites and/or places within or in the immediate vicinity of the study area. It is not an Aboriginal Cultural Heritage Assessment (ACHA) and is not sufficient to support an application for an Aboriginal Heritage Impact Permit (AHIP), in accordance with section 90 of the *National Parks and Wildlife Act 1979* (NPW Act).

7.2.4 Methods

The Due Diligence Code of Practice outlines guidelines used to determine whether activities are likely to harm an Aboriginal object/s and, if so, what measures can be taken to avoid that harm.

This assessment has followed the Due Diligence Code of Practice which in summary involves:

- a search of the Aboriginal Heritage Information Management System (AHIMS) database
- consideration of the environmental context for the presence of Aboriginal objects or places
- consideration of existing Aboriginal cultural heritage studies in the area and region for the presence of Aboriginal objects or places
- a site inspection
- determination of whether further heritage investigation and impact assessment is required.

If the assessment determines that Aboriginal objects or places are likely to be harmed, an AHIP is required to manage harm as defined by Part 6, Section 86 of the NPW Act.

7.2.5 Environmental context

The project area sits within a transitional landscape bordering parts of the Woronora Plateau and the Southern Highlands. These areas are generally at the interface of Hawkesbury Sandstone and Wianamatta Shale geology and represent favourable conditions for rock shelter habitation, stone hatchet manufacture and open camp site occupation. Essentially, rugged sandstone landscapes transition into open rolling hills within just a few kilometres. This would have provided Aboriginal people with a diverse landscape for occupation ranging from habitable shelters protected from the elements to open landscapes near various stream networks suitable for short- and long-term open site camping. Current archaeological information shows Aboriginal people generally favoured either flat, elevated areas or sandstone overhangs in areas of high relief, near fresh water sources, as occupation sites. Grinding grooves found on flat sandstone outcrops within or adjoining stream beds shows people favoured these places to sharpen stone axes.

7.2.6 Database search

A search of the AHIMS was undertaken on 28 November 2022, covering an area of 53.5 km² centred on the project area. The search returned a total of 111 registered Aboriginal sites.

Eight sites were listed as duplicates and one site was listed as 'not a site'. Therefore, the following discussion relates to the 101 remaining individual valid sites (see Table 7.7).

Artefact scatters (n=45, 44.6%) were the most common site type in the search area, followed by rock shelters (n=31, 30.7%). Other site types included: potential archaeological deposits (n=10, 9.9%), culturally modified (i.e. carved or scarred) trees (n=10, 9.9%) and grinding grooves (n=5, 4.6% of total).

This range of site types reflects the transitional nature of the landscape and geology mentioned above. The distribution of registered sites in the search area suggests a spatial bias towards riparian corridors, road corridors, and zones of residential or industrial development; in other words, where archaeological compliance associated with development has been carried out. Having said that, Aboriginal sites (most often artefact scatters and rock shelters) may be expected to occur throughout the landscape at varying densities. No registered Aboriginal sites are located within 200 m of any potential crossing location; the closest site is located 240 m south-east of under fence crossing #U12.

Table 7.7 Summary of AHIMS search results

Site type	Frequency	% of total
Artefact scatter	45	44.6
<i>Undefined artefact scatter</i>	25	
<i>Low density artefact scatter (2–14)</i>	4	
<i>Medium density artefact scatter (15–30)</i>	2	
<i>Isolated find</i>	14	
Culturally modified tree	10	9.9
Grinding groove	5	4.9
Potential archaeological deposit (PAD)	10	9.9
Rock shelter	31	30.7
<i>Rock shelter with art</i>	12	
<i>Rock shelter with art and PAD</i>	4	
<i>Rock shelter with art; Grinding groove</i>	3	
<i>Rock shelter with art; Medium density artefact scatter</i>	1	
<i>Rock shelter with art; Undefined artefact scatter</i>	5	
<i>Rock shelter with PAD</i>	5	
<i>Rock shelter; Midden; Undefined artefact scatter</i>	1	
Grand total	101	100

7.2.7 Site inspection

An inspection of potential crossing locations was undertaken by Cameron Neal (EMM Archaeologist) on 7 December 2022 (Plate 7.1 to Plate 7.14).

The local landscape is characterised by deeply incised creek valleys and sandstone outcrops interspersed with sloping to flat landforms. Design Solution 1 (DS1) crossings (including U2, U7, U12 and U14) were located underneath the wire fenceline to the east and south of the access road adjoining Upper Canal (Plate 7.1 to Plate 7.8). These locations were inspected for surface Aboriginal objects and assessed for potential to contain subsurface archaeological deposits. Visibility was low to nil at U2 and moderate at U7, U12 and U14. Design Solutions 2 and 3 (DS2 and DS3) straddled the canal pipeline and featured sandstone outcrops, and were therefore inspected for surface Aboriginal objects as well as rock shelters, grinding grooves, and rock art. Visibility here ranged from low to moderate (Plate 7.9 to Plate 7.14).

All design solutions were situated on moderate to steep slopes in areas subject to previous disturbance. DS1 crossing locations are considered to have been disturbed by the establishment of the Upper Canal access road as well as the establishment of the wire fenceline. DS2 and DS3 crossing locations have been highly disturbed through the quarrying of stone for the canal and pipeline cutting as well as the installation of footings for the pipeline.

No Aboriginal objects were encountered during the site inspection. Where visibility was poor, the micro-environment was considered unsuitable (e.g. too steep) for intensive use or habitation by past Aboriginal people, and no rock shelters, rock art, or grinding grooves were encountered.

Overall, characteristics of the local landscape and nature of previous disturbance suggests that all Design Solution locations have low archaeological sensitivity.



Plate 7.1 View south-east across Design Solution 1, Crossing U2 showing Upper Canal access road



Plate 7.2 View north-east across Design Solution 1, Crossing U2 showing Upper Canal access road and slope



Plate 7.3 View south-east across Design Solution 1, Crossing U7 showing Upper Canal access road



Plate 7.4 View south-west across Design Solution 1, Crossing U7 showing Upper Canal access road and slope



Plate 7.5 View south-east across Design Solution 1, Crossing U12 showing Upper Canal access road



Plate 7.6 View south-east across Design Solution 1, Crossing U12 showing moderate visibility



Plate 7.7 View south-east across Design Solution 1, Crossing U14 showing nil visibility



Plate 7.8 View south-east across Design Solution 1, Crossing U14 showing nil visibility



Plate 7.9 View south-west across Design Solution 2, showing moderate visibility and Upper Canal pipeline



Plate 7.10 View north-east across Design Solution 2, showing moderate visibility and Upper Canal pipeline



Plate 7.11 View south-west across Design Solution 3, showing incised creekline, Upper Canal pipeline and associated infrastructure



Plate 7.12 View west across Design Solution 3, showing examples of disturbance from Upper Canal pipeline and associated infrastructure



Plate 7.13 View east across Design Solution 3, showing examples of disturbance from Upper Canal pipeline and associated infrastructure



Plate 7.14 View north-east across Design Solution 3, showing examples of disturbance from Upper Canal pipeline and associated infrastructure

7.2.8 Conclusions and recommendations

The desktop assessment has identified that there are no previously registered Aboriginal objects within the study area, and that based on the environmental landforms present and disturbance noted, the study area is predicted to have low archaeological sensitivity; and it is against expectation for Aboriginal objects to occur. The proposed development activity is unlikely to result in harm to Aboriginal objects.

On the basis of the above findings, the following recommendations are made:

- Development activities within the study area may proceed with caution. The development is considered to have a low likelihood of Aboriginal objects being present. However, the nature of disturbance does not preclude the potential for isolated finds.
- In the event that unexpected Aboriginal objects or suspected skeletal material are discovered during any ground disturbance activity, the following procedure should be followed:
 1. If any Aboriginal object is discovered and/or harmed in, or under the land, while undertaking the proposed development activities, the proponent must:
 - a) not further harm the object
 - b) immediately cease all work at the particular location
 - c) secure the area so as to avoid further harm to the Aboriginal object
 - d) notify Water NSW and Heritage NSW by telephone as soon as practical, providing any details of the Aboriginal object and its location
 - e) not recommence any work at the particular location unless authorised in writing by Heritage NSW.

2. In the event that suspected human skeletal material is unexpectedly encountered during the activity, work must stop immediately, the area secured to prevent unauthorised access and NSW Police and Heritage NSW contacted.
3. Cooperate with the appropriate authorities and relevant Aboriginal community representatives to facilitate:
 - a) the recording and assessment of the find(s)
 - b) the fulfilment of any legal constraints arising from the find(s), including complying with Heritage NSW directions
 - c) the development and implementation of appropriate management strategies, including consultation with stakeholders and the assessment of the significance of the find(s).

If any Aboriginal objects are later identified within the study area, this report cannot be used to support an application for an AHIP. Such an application would require more detailed investigation involving the preparation of an Aboriginal Cultural Heritage Assessment (ACHA) and a formal process of Aboriginal community consultation.

7.3 Historic heritage

The Upper Canal is an operational WaterNSW asset listed on the State Heritage Register, constituted under *Heritage Act 1977*. The significance of the Upper Canal System is managed under a Conservation Management Plan (CMP) prepared by the Government Architects Office (NSW Government Architect's Office 2016).

Division 2 of Part 4 of the *Heritage Act 1977* ('the Heritage Act') provides at Section 57 for controlled activities prevents certain works unless the subject of an approval granted under Subdivision 1 of Division 3 in Part 4 of the Heritage Act – commonly referred to as a Section 60 Approval. Subsection 57(1)(e) includes "carry out any development in relation to the land on which the building, work or relic is situated, the land that comprises the place, or land within the precinct". All of the proposed crossing structures will be situated within the land mapped as the Upper Canal heritage item on the State Heritage Register. This provision means that the proposed activities require an approval under section 60 of the Heritage Act.

A Statement of Heritage Impact (SoHI) has been prepared and is provided at Appendix E.

The proposed area of the activities relative to the State Heritage Register listed area is shown at Figure 7.1.

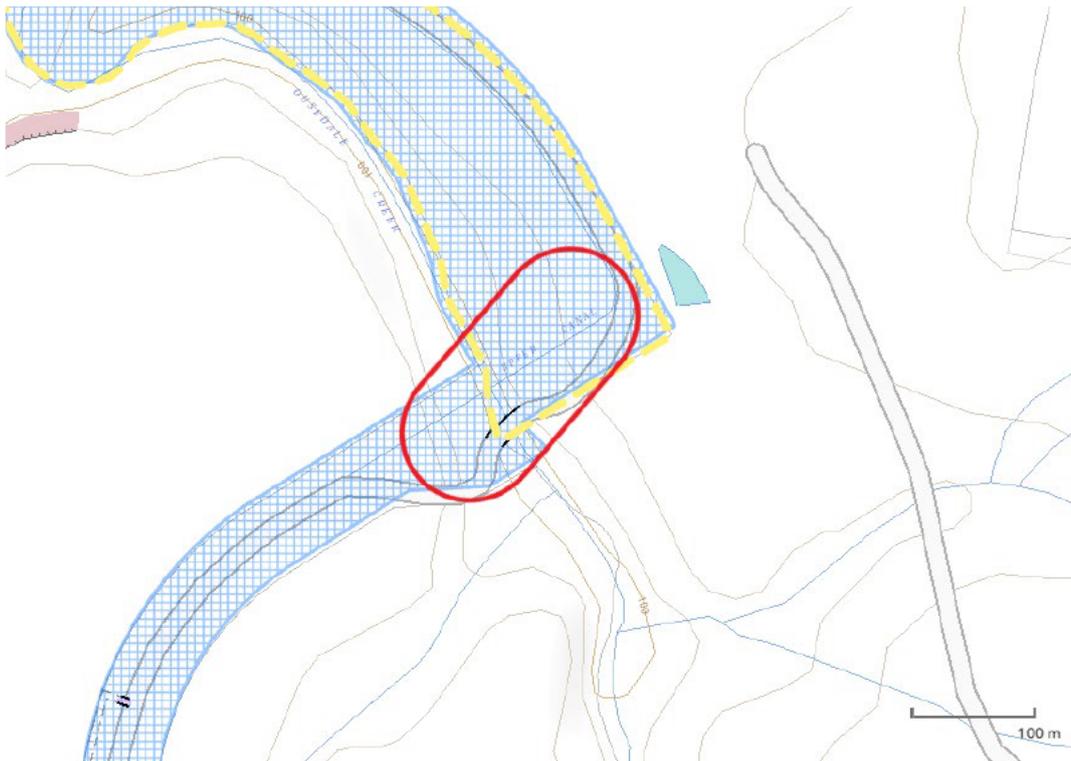


Figure 7.1 Upper Canal State Heritage listing relative to the area of activities

Source: NSW Planning Portal, 2023

Note: the blue hatched area indicates State heritage listing. The red outline indicates the section of the Upper Canal proposed for the koala crossings.

7.3.1 Assessment of impacts

An assessment of the proposed installations concluded that the works would not have more than a minor impact the heritage significance of the Upper Canal.

Key assessment findings were:

- The installation would result in a localised change in views of the pipeline, but the works are reversible, with no direct impacts to fabric of significance.
- The materiality and form of the installation is not discordant with the industrial built form of the Upper Canal, looking much like a pedestrian/maintenance crossing (of which there are several in existence already) and therefore adheres to Policy 50 and 51 of the CMP. For reference, CMP Policy 50 states “When there is a requirement for new buildings or structures to be constructed within the Canal corridor, ensure they are of a similar size, scale, form and building materials to those of heritage significance formerly constructed along the Canal” and Policy 51 states “Ensure new buildings or structures are unobtrusive and set back from elements of exceptional significance where those structures would have a negative visual or physical impact on those elements”.
- There will be no direct impacts to the fabric of the Upper Canal as per CMP Policy 58. Policy 58 considers the installation of new walkways, steps and handrails and states “Replace existing walkways, steps and handrails or construct new walkways, steps and handrails in steel, which is compatible with historic construction materials for these elements”. It is also reiterated that the installations are reversible and, if removed, there will be no damage to the Upper Canal or impact to its significance.

- The aesthetic significance, as defined in the Statement of Significance, refers to the tree plantings and the sections of open canal, not the pipeline sections. The crossings have been proposed in locations of lesser aesthetic significance, thereby reducing the aesthetic and visual impact.
- There will be no impact, direct or indirect to the aesthetic tree plantings.
- The installations are located in an area that is not readily accessible to the general public. Those seeing the changes to the visual presentation of the pipeline would be limited to WaterNSW maintenance staff as the Upper Canal corridor is classified as a controlled area and public access is prohibited.
- The installations comply with the relevant CMP Policies, of particular relevance are CMP Policies 51 and 52 'New Buildings and Structures within the Canal Corridor', and also Policy 58 'New Walkways, Steps and Handrails'.

7.3.2 Conclusions and recommendations

Pursuant to Section 62 of the Heritage Act, consideration is required of (amongst other things):

- the extent to which that application, if approved, would affect the significance of any item as an item of the environmental heritage
- any applicable conservation management plan.

The matters under Section 62 have been addressed in the SoHI and the finding is that the activities will have a minor impact on the environmental heritage of the Upper Canal System.

The following recommendations are made:

- Approval under Section 60 of the Heritage Act is required as the works will occur within the curtilage of the item listed on the SHR. It is EMM's opinion that the project meets the criteria for a fast track application, however, the proponent should consult with Heritage NSW to confirm prior to lodging the application.
- This SoHI should be lodged in support of the Section 60 application, whether fast track or otherwise.
- A photographic archival recording should be prepared in advance of works as per CMP Policy 3 'Elements of Exceptional Significance', Policy 4 'Elements of High Significance' and Policy 40 'Keep Records'.
- WaterNSW should be provided with documentation to include in their records regarding the changes made in the curtilage of the SHR-listed item, as per CMP Policy 41 which states "Keep and archive ongoing, informal records of changes to the Canal".
- In the unlikely event that archaeological resources are found during construction, an unexpected finds procedure must be included in the construction environmental management plan.

For full details please refer to the Statement of Heritage Impact at Appendix E.

7.4 Water quality

The works require minimal soil disturbance and do not require the importation of materials likely to generate pollutants or alter the existing water quality.

Water impacts are therefore considered to be negligible.

Flood impacts are considered at Section 5.6.2 of this REF.

7.5 Visual

7.5.1 Visual impact assessment methodology

The methodology for visual impact of the structures is assessed using the principles and standards described in the *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute and Institute of Environmental Management & Assessment, 2013).

When assessing the visual impacts of a proposed project, there are two high-level variables to be considered:

- the visual effect
- the sensitivity of the receptors to the visual effect.

Visual effect is concerned with the activities and the extent to which they will contrast to or integrate with the existing landscape. It considers the size or scale of the change, the duration of the change, and reversibility of the change. It also considers design elements such as form, shape, texture and line relative to the host landscape.

Three factors are considered when evaluating the visual effect:

- contrast
- integration
- the magnitude of the change.

Note that the visual effect is not the same as the visual impact. In order to understand the impact, we not only need to understand the visual effects associated with the proposed development, but also the visual sensitivity of local receptors to a landscape change as described by the visual effects. In short, visual effects describe the characteristics of the source and visual sensitivity describes the characteristics of the receivers.

Visual sensitivity is concerned with the people or locations likely to have visibility of the development. It considers the nature of the receptors and considers factors such as the planar distance between the receptor and the proposed development, relative elevations, the relationship of the receptor to the development, and any intervening or mitigating factors such as vegetation.

The ranking of visual sensitivity depends on how critically the change to the landscape is likely to impact the people living at or visiting locations from which a primary view is available to the proposed development.

Not all places where a view is possible will have residents or visitors. Furthermore, those locations that *do* have residents or visitors are not usually equal in terms of the likely duration of the view (for example from a moving vehicle vs from a living room), the number of people experiencing the view, or the importance of the amenity or view integrity to the viewpoint. In this respect, the primary view from a residential dwelling or a tourist lookout (as an example) will have a higher sensitivity than a view from a passing vehicle or a remote agricultural location.

When combined, those two variables of visual effect and visual sensitivity determine the significance of the overall visual impact. Visual impact is generally rated as low, moderate or high.

7.5.2 Visual effect

The visual effect of the facilities (i.e. the extent to which the introduced visual elements create contrast or integrate with the host environment) is considered first.

The 'under fence' crossings are minor structures at ground level and provide low contrast and good integration with the landscape. These are also very trivial structures in terms of magnitude, being small scale and generally below ground level. The overall visual effect is therefore ranked as low.

The 'log climb' structure will also provide negligible contrast to the host environment due to the use of natural materials as the basis for the structure, and will visually integrate with the landscape. The magnitude of the structure is relatively small as the logs are placed at ground level. The overall visual effect is therefore ranked as low.

The 'over pipe' structure will be visible from within the Upper Canal corridor. There has been an effort to ensure colours are recessive and materials integrate with the immediate context of the pipeline, nevertheless the structure is of moderate magnitude and is considered to create a low to moderate visual effect.

Some consideration is also given to the effect that the structure will have on the surveillance of pipeline condition by WaterNSW staff or contractors. WaterNSW has indicated that visual monitoring of pipe operation is a regular requirement, and that any feature which obstructs visual inspection (for example, checking for leaks) will, to a small degree, inhibit the ease with which a line of sight can be obtained for the purpose of pipeline inspections. This is not a usual consideration for visual impact assessment, and is not contemplated in the *Guidelines for Landscape and Visual Impact Assessment*, but is acknowledged as a legitimate factor for consideration regarding the visual effect of the over pipe structure.

On this basis, the visual effect of the over pipe structure is considered to be moderate.

7.5.3 Visual sensitivity

This area is not a 'public domain' precinct, is not accessible to the broader community and is maintained as a secure asset by WaterNSW. The only receptors who will occasionally find the proposed 'over pipe' structure within their viewshed are WaterNSW contractors or maintenance workers. These receptors are not resident in the location, are not visiting the location for available views, and the duration of their stay in the location would be brief.

Considering again the desire expressed by WaterNSW for maintenance staff to have full and unimpeded visual surveillance of the pipeline, this does not impact their sensitivity to the visual effect but is acknowledged as an operational need.

The sensitivity of these receptors is therefore considered to be low.

7.5.4 Visual impact

The nearest residential receptors are approximately 1.2 km to the west (380 Moreton Park Road) and 1 km to the south (415 Macquariedale Road). At this distance, and noting the intervening vegetation, the proposed crossings will not be visible.

The absence of nearby sensitive receptors such as residential dwellings, commercial premises, tourism destinations, lookouts or public roads means that the various components of the proposed activities are unlikely to be within any viewshed of concern.

The only crossing structure which exhibits any material effect, and which causes any meaningful visual impact, is the over pipe structure.

Based solely on the methodology prescribed in *Guidelines for Landscape and Visual Impact Assessment*, the ranking of the over pipe structure would be identified as minor.

The operational need for visual surveillance by WaterNSW maintenance staff is not technically within the range of factors considered for visual impact assessment, however it is acknowledged as this has emerged as a relevant matter for WaterNSW, the operational aspects – including visual constraints on monitoring pipe condition – are addressed separately in Section 7.6.

7.5.5 Visual impact related to heritage values

The visual impact of the 'over pipe' structure on the heritage values of the Upper Canal is considered in the historic heritage assessment at Section 7.3 of this REF.

7.5.6 Camera installations

The camera installations will represent very minor elements in the overall landscape and will not be permanent fixtures. The visual effect of the cameras is therefore considered to be low, and the visual impact also will be minor.

7.6 Operational impacts

The Upper Canal, constructed in the 1880s, is a critical component of the water supply for Sydney. It transfers water from the Upper Nepean System to the Prospect Water Filtration Plant or Prospect Reservoir. Its function includes balancing supplies, providing water security and flexibility in management of water quality. The maintenance of the Canal is undertaken in accordance with a programmed plan of work covering the short, medium, and long-term management requirements. These strategies all follow the policy and guidelines outlined within the *Conservation Management Plan 2016*.

Operationally, it is an objective of WaterNSW to provide safe access, security and operation to staff and other authorised users for required activities on the Upper Canal. This objective is driven by the *Work Health and Safety Act 2011* and WaterNSW Policy.

Maintenance of the Upper Canal is largely condition-based with a variety of sources of condition data including observations from Operations and Maintenance staff, security patrols, turbidity instrumentation, periodic condition surveys, laser scan surveys and wet weather drainage performance surveys (i.e. increased surveillance during wet weather). Typical activities include visual assessments, condition reporting, water quality monitoring, including regular equipment checks; maintenance of the control gates, vegetation control, track maintenance, maintaining surface drainage systems, this includes clearing vegetation, maintaining design grade and flushing out drains; and planned and ad hoc repairs to the structural integrity of the canal structure and associated assets.

7.6.1 Over pipe structure

The addition of a structure over the pipeline at Ousedale Creek has both operational advantages and disadvantages.

The over pipe structure has been specifically designed to allow humans, as well as fauna, to cross the canal. This structure, if installed, would provide access for WaterNSW staff and other authorised persons to cross the canal and can therefore deliver benefits for tasks such as maintenance checking or repairs in the local area.

The disadvantage is that the over pipe crossing interrupts, to a small degree, the otherwise unencumbered line of sight that would be available to maintenance staff or other authorised persons. The over pipe structure is 1,100mm wide and provides a clearance above the pipe of 1,400mm. The over pipe structure also sits above the safety post attached to the top of the pipe and therefore provides sufficient space for a person to travel along the top of the pipeline safely. The visual surveillance of the pipe is therefore impeded slightly however it will not prevent the continued routine maintenance and monitoring practices required by WaterNSW.

7.6.2 Log climb

The rock scree next to Ousedale Creek is not known to be a corridor required to be unencumbered for routine maintenance and monitoring practices by WaterNSW staff or contractors. There is not expected to be any impact on operational requirements for pipe maintenance or surveillance.

7.6.3 Under fence crossings

While all of the under fence crossings are within the heritage curtilage for the Upper Canal, these are not likely to cause any impediment or risk for routine maintenance and monitoring practices by WaterNSW staff or contractors.

7.6.4 Camera installations

In the interests of both the data researchers and the WaterNSW staff visiting the location, signage will alert all persons present to the presence of motion-sensor cameras. These small items are unlikely to cause any impediment or risk for routine maintenance and monitoring practices by WaterNSW staff or contractors.

7.7 Noise and vibration

7.7.1 Interim Construction Noise Guideline

The *Interim Construction Noise Guideline* (ICNG) (DECC 2009) is the NSW Government guide for the management and mitigation of construction noise. The objectives of the guideline relevant to the planning process are to promote a clear understanding of ways to identify and minimise noise from construction and to identify 'feasible' and 'reasonable' work practices. The guideline recommends standard construction hours where noise from construction activities is audible at residential premises (i.e. assessment locations), as follows:

- Monday to Friday 7:00 am to 6:00 pm
- Saturday 8:00 am to 1:00 pm
- no construction work is to take place on Sundays or public holidays.

The proposed activities for the construction and installation of the koala crossings will occur within these recommended times.

The ICNG provides two methodologies to assess construction noise emissions. The first is a quantitative approach, which is suited to major construction projects with typical durations of more than three weeks. This method requires noise emission predictions from construction activities at the nearest assessment locations and assessment against ICNG recommended noise levels.

The second is a qualitative approach, which is a simplified assessment process that relies more on noise management strategies. This method is suited to short-term infrastructure and maintenance projects of less than three weeks.

This assessment has adopted a qualitative approach. Given the short construction period proposed and limited residential premises nearby, further assessment is not deemed necessary.

7.7.2 Impacts

Vibration and settlement impacts are considered to be of concern with respect to the Upper Canal due to its age.

At present, no Australian Standards exist for the assessment of damage caused by vibration. WaterNSW accepts Line 3 of Table 1 from the current German Standard DIN 4150 – Part 3 – *Structural Vibration Part 3: Effects of vibration in structures* as the maximum allowable limit of vibration acceptable at water supply infrastructure.

Noting that the construction and installation of the crossings will only require the use of standard power tools over brief periods, and the distance of at least 1 km to the nearest residential receptors, there impact of noise and vibration will be negligible. Nevertheless, standard strategies may be applied to minimise noise and vibration impacts. Examples of noise management strategies are detailed in Section 7.7.3 of this REF.

7.7.3 Noise management strategies

i Work practices

Good work practice methods include:

- regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration
- practices consistent with Water NSW *Guideline for development adjacent to the Upper Canal and Warragamba Pipelines* (2021) – notably Sections 2.52. and 2.53
- implementation of feasible and reasonable mitigation measures that reduce construction noise levels
- avoiding the use of public address systems or other methods of site communication that may unnecessarily impact upon nearby residents
- develop routes for the delivery of materials and parking of vehicles to minimise noise
- where possible, avoid the use of equipment that generates impulsive noise
- notify residents prior to the commencement of intensive works.

ii Plant and equipment

Additional measures for plant and equipment include:

- where possible, choose quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks
- operate plant and equipment in the quietest and most efficient manner
- regularly inspect and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.

7.8 Air quality

There is no activity or substance associated with the proposed activities which will generate dust or odour to the extent that receptors (a minimum of 1 km away) will be impacted.

7.9 Contamination

The site is at the intersection of two lots (Lot 1 DP 625921 and Lot 2 DP 625921). The site is currently occupied by the Upper Canal and open space easements on either side containing vehicle tracks. The canal infrastructure was constructed between 1880 and 1888. The surrounding area has currently and historically been used for agricultural purposes, including the construction of poultry farms.

To evaluate potential contamination impacts, a desktop review of the proposal site and surrounding area was undertaken. The assessment of potential contamination impacts comprised a review of available databases including:

- identification of known contaminated sites within or surrounding the Site footprint as detailed on the on the NSW Environment Protection Authority (EPA) List of NSW contaminated sites notified to EPA
- identification of any properties within the Site and surrounding lands which are listed on the NSW EPA Contaminated Land Record of Notices

- identification of current or historical land uses located in proximity to the Site that are considered likely to have caused contamination
- visual identification of potentially contaminating activities in proximity to the site
- review of the NSW Government's MinView and SEED online databases.

7.9.1 Review of background data

A review of contamination related publicly available databases was undertaken for the site and surrounding area. A review of the background search information relating to the site is summarised below:

- Ousedale Creek is located within the site and flows into the Nepean River to the north
- the site is not located within NSW Government SEED acid sulfate soil (ASS) mapping
- three groundwater wells are located within one kilometre (km) of the site used for unknown, monitoring and water supply purposes
- Cumberland Shale-Sandstone Ironbark Forest is present on the site, which is identified as a low probability Groundwater Dependant Ecosystem (GDE)
- no sites notified as contaminated to the EPA or contaminated land record notices are identified within 1 km of the site
- no licences, clean up or penalty notices were identified within 500 m of the site. In the wider local area, Hillcrest Park Piggery is located approximately 2.3 km to the north-west which has been subject to a Clean Up Notice (No. 1029326) in 2003 for organic solid wastes and licence (No. 421) that was surrendered in 2004
- one exploration (Title No. 396) and two mining titles (Title No. 767 and 388) for coal are held by Endeavour Coal Pty Limited.

Based on the review completed, the following potential sources of localised contamination were identified:

- The Upper Canal was built pre-1900s. A heritage steel water supply pipeline spans across the valley with a series of mid supports on sandstone pillars, connecting the water supply pipeline to the canals ends on both sides, which terminate at concrete end walls situated on the change of slope on both east and west escarpments. The flaking of historically applied lead based paint over its lifetime may have impacted surrounding localised surface soils.
- There is no obvious evidence of historical land fill or waste disposal, however this cannot be precluded.

7.9.2 Preliminary conceptual site model

A preliminary conceptual site model (CSM) has been developed to identify existing known sources and areas of contamination, associated potential impacts to human health and ecological receptors and to identify exposure source, pathway, receptor (S-P-R) linkages. Refer to Table 7.8.

Table 7.8 Preliminary conceptual site model

Source	Contaminant	Exposure pathways	Receptors	Comment
Application and flaking of lead-based paints on Canal water supply pipeline	Lead	<p>Exposure pathways:</p> <ul style="list-style-type: none"> • Dermal contact or incidental ingestion of soil. • Inhalation of dust and/or vapour in outdoor air or construction trench. • Plant uptake and/or ingestion by animals. 	<ul style="list-style-type: none"> • Future construction workers involved in the development of the Site. 	<p>Potential – The historical application of lead-based could accumulate within soils or creek bed and adjoining dam.</p> <p>A S-P-R linkage for human and ecological receptors could exist if lead-impacted surficial soil is disturbed and accessible.</p>
Historical land fill or waste disposal	Asbestos and lead	<ul style="list-style-type: none"> • Migration through surface water runoff. • Vertical leaching of CoPCs via rainfall. <p>Migration pathways:</p> <ul style="list-style-type: none"> • Surface run-off into Ousedale Creek. • Excavation and re-location of soil/fill during future development activities. • Atmospheric dispersion (aeolian transport) of dust or fibres, derived from contaminated soil. 	<ul style="list-style-type: none"> • Users of adjacent properties. • Aquatic ecosystems in Ousedale Creek and terrestrial ecosystems in the adjacent bushland. 	<p>Unlikely – The potential exists for minor historical land fill or waste disposal on the site.</p> <p>A S-P-R linkage for human and ecological receptors could exist if fill or waste is encountered on the site and if it is disturbed, however it is noted site works are not expected to involve significant earthworks.</p>

7.9.3 Construction

Potential construction issues at this site may include:

- disturbance or disposal of surficial soil potentially impacted with lead sourced from flaking paint from the historical canal water pipeline
- disturbance of buried waste
- demolition and disposal of remnant structures containing hazardous building materials such as asbestos and/or lead paint
- contamination of soils and groundwater due to spills or leaks of fuels, oils or other hazardous substances.

The disturbance of encountered fill material should be avoided where possible during earthworks, if disturbance is not avoidable an assessment of the material may be required. Any excavated fill should be classified in accordance with the NSW EPA (2014) Waste Classification Guidelines, prior to off-site disposal to a licensed facility.

7.9.4 Safeguards and mitigation measures

Based on the identified potential impacts, the following safeguards and mitigation measure are anticipated to be required for the management of soil and contamination.

Table 7.9 Safeguards and management measures for soil and contamination

Risk	Management measure	Responsibility	Timing
Soils	<p>A construction environmental management plan (CEMP) would be prepared which will incorporate environmental management procedures and control measures for soil and water, including:</p> <ul style="list-style-type: none"> • An initial testing regime for determining if surface soil has been impacted by lead. • An unexpected finds protocol for soil and water contamination, including procedures to identify and manage contamination, if encountered. • Procedures for the handling, storage and disposal of waste including contaminated materials. • Surface water management and sediment and erosion control measures including a progressive erosion and sediment control plan for the works. • Water quality control measures are to be used to prevent any materials (e.g. concrete, grout, soil slurry) entering waterways. • Remediation and rehabilitation requirements. 	Contractor	Construction works
Soils	<p>Erosion and sediment control measures are to be implemented and maintained to:</p> <ul style="list-style-type: none"> • Prevent soil and sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets. • Reduce water velocity and capture sediment on site. • Minimise the amount of material transported from site to surrounding pavement surfaces. • Divert clean water around the site. 	Contractor	Construction works
Accidental spill	<p>Emergency spill management measures will be developed in the CEMP, and including:</p> <ul style="list-style-type: none"> • Spill management measures in accordance with the relevant EPA guidelines. • Initial response and containment (e.g. shutting valves, crimping of hoses, use of booms, pads and absorbent material). • Notification of emergency services and relevant authorities e.g. (DPI). 	Contractor	Construction works
Asbestos management	<p>An Asbestos Management Procedure (AMP) would be developed in the CEMP to address unexpected finds of ACM during construction. Specifically, protocols would be stipulated for separation, monitoring, validation and clearance of asbestos.</p> <p>The AMP and associated Standard Work Procedures would satisfy the requirements of:</p> <ul style="list-style-type: none"> • Work Health and Safety Regulation 2017. • The Safe Work Australia Asbestos Codes of Practice and Guidance Notes: <ul style="list-style-type: none"> – <i>Code of Practice: How to Manage and Control Asbestos in the Workplace.</i> – <i>Code of Practice: How to Safely Remove Asbestos.</i> 	Contractor	Construction works
Unexpected contamination finds	<p>An unexpected finds procedure would be included in the CEMP. An unexpected find is potential contamination that was not previously identified during this contaminated land review.</p>	Contractor	Construction works

Table 7.9 Safeguards and management measures for soil and contamination

Risk	Management measure	Responsibility	Timing
Unexpected contamination finds	<p>The procedure would include (as a minimum) that in the event of an unexpected find:</p> <ul style="list-style-type: none"> • Notification to WaterNSW. • Excavation works would temporarily be suspended at the location of the unexpected find, the environment manager contacted and the area of concern appropriately isolated. • Subject to the nature of the unexpected find, the area would be inspected by a contaminated land consultant and if required, appropriate sampling and analysis would be undertaken, the sampling works would be documented in a report. • The requirement for additional controls would be assessed by the consultant and implemented by the proponent. • Workplace health and safety and environmental protection requirements would be reviewed, depending on the type of unexpected finds encountered. 	Contractor	Construction works

7.10 Public safety

The site is within land controlled by WaterNSW and is fenced.

The risk of unauthorised access is considered to be low.

Nevertheless, standard public safety measures such as work site signage and the secure storage of any plant and equipment will be implemented.

7.11 Socio-economic

The manufacture, fabrication and installation of the crossing structures will provide a minor economic input to the regional economy.

The greater socio-economic benefit is anticipated to arise from the improved capacity for local koala populations to move between areas of suitable habitat for food and mating purposes. A more resilient local koala population may ultimately lead to economic inputs through regional tourism and retention of natural capital.

There is no identifiable socio-economic cost to the installation of the crossings. The works do not sterilise the use of land or compromise existing economic activity.

7.12 Waste management

The structural elements of the proposed crossings will be, as far as possible manufactured and fabricated off-site. This results in very low levels of waste being generated from the construction activities at the site.

The waste streams likely to be generated are small scale packaging, minor offcuts of materials, and waste from consumable items such as food and drink containers.

These minor quantities of waste will be removed from site by the team engaged to install the facilities and disposed to appropriately licensed waste management facilities for recycling or disposal to landfill.

7.13 Cumulative effects

A search of the NSW Department of Planning and Environment Major Projects website (30 January 2023) identified local projects (being projects at Menangle, Wedderburn and Gilead). One project is identified:

7.13.1 Menangle Sand and Soil Quarry (Project 85/2865)

This quarry is on the Nepean River approximately 5 km to the norther of the Ousedale Creek site.

It is unlikely to have any cumulative impact on, or with, the proposed koala crossings.

7.14 Summary of factors to be considered

As required by the *Guidelines for Division 5.1 Assessments* (DPE) the relevant environmental factors have been considered. Refer to Table 7.10.

Table 7.10 Factors to be considered

#	Factor	Finding
A	Any environmental impact on a community.	Negligible impact on any nearby residents of broader community.
B	Any transformation of a locality.	Minor transformation of a locality. The activity seeks to make a positive transformation for local koala populations by facilitating movement through this corridor.
C	Any environmental impact on the ecosystems of the locality.	Negligible impact on ecosystems. Positive impact on target species (koala).
D	Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality.	Minor reduction in operational ease for pipeline inspections or maintenance activities.
E	Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations.	Historic value and Aboriginal cultural value are not significantly impacted.
F	Any impact on the habitat of protected animals (within the meaning of the <i>Biodiversity Conservation Act 2016</i>).	Improved movement through this corridor for koala.
G	Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air.	Unlikely to endanger any species of plant or animal.
H	Any long-term effects on the environment.	Negligible short term impact and unlikely to give rise to any long term impact, noting the structures are capable of dismantling and removal (if needed) with only minor evidence remaining.
I	Any degradation of the quality of the environment.	Negligible degradation.
J	Any risk to the safety of the environment.	Negligible.
K	Any reduction in the range of beneficial uses of the environment.	Unlikely.
L	Any pollution of the environment.	Unlikely.
M	Any environmental problems associated with the disposal of waste.	Unlikely. Offsite pre-fabrication will result in only minor waste generation during installation.

Table 7.10 **Factors to be considered**

#	Factor	Finding
N	Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply.	Unlikely.
O	Any cumulative environmental effect with other existing or likely future activities.	Negligible.
P	Any impact on coastal processes and coastal hazards, including those under projected climate change conditions.	Not applicable. This site is not within the coastal zone.
Q	Any applicable local strategic planning statement, regional strategic plan or district strategic plan made under Division 3.1 of the Act.	The activities are consistent local and regional strategic planning instruments, and also with the CPCP.
R	Any other relevant environmental factors.	No significant environmental impact has been identified.

8 Mitigation measures

A range of construction impact mitigation measures will be considered in the detailed design, such as:

- Preparation of detailed shop drawings by the appointed contractor.
- Detailed survey of all installation sites by the contractor to allow for their accurate development of scaled 3D shop drawings for fabrication and installation purposes.
- Off-site fabrication of major components to minimise site time and disturbance.
- Pre-assembly of components in factory with inspection by the designers and engineers to ensure accuracy, allow for modifications, approvals prior to transport to site and minimise site time and disturbance.
- Defined laydown areas to minimise site disturbance.

A summary of mitigation measures recommended through the individual assessment areas in this REF is provided at Table 8.1.

Table 8.1 Summary of mitigation measures, by impact area

Technical assessment area
Biodiversity
To further reduce the impacts resulting from the crossing structures, it is proposed that a pre-clearance survey is undertaken by a qualified ecologist, looking specifically for small, threatened flora species growing within the impact areas, including temporary laydowns. If individuals are recorded, there may be opportunities to adjust the position of the crossings or laydown area to avoid impacts. This survey is not intended to be a comprehensive flora survey, as target species will have different survey periods that may not align with the timing of the survey and construction. It is intended to reduce impacts to any threatened species that can be identified at the time of survey. Threatened flora species found growing nearby to the impact areas can be flagged to avoid any incidental impacts during the construction period.
Aboriginal cultural heritage
If any Aboriginal object is discovered and/or harmed in, or under the land, while undertaking the proposed development activities, the proponent must: <ul style="list-style-type: none">• Not further harm the object.• Immediately cease all work at the particular location.• Secure the area so as to avoid further harm to the Aboriginal object.• Notify Heritage NSW and Water NSW by telephone as soon as practical, providing any details of the Aboriginal object and its location.• Not recommence any work at the particular location unless authorised in writing by Heritage NSW.
In the event that suspected human skeletal material is unexpectedly encountered during the activity, work must stop immediately, the area secured to prevent unauthorised access and NSW Police and Heritage NSW contacted.
Cooperate with the appropriate authorities and relevant Aboriginal community representatives to facilitate: <ul style="list-style-type: none">• The recording and assessment of the find(s).• The fulfilment of any legal constraints arising from the find(s), including complying with Heritage NSW directions.• The development and implementation of appropriate management strategies, including consultation with stakeholders and the assessment of the significance of the find(s).

Table 8.1 Summary of mitigation measures, by impact area

Technical assessment area
<p>Historic heritage</p> <p>Approval under Section 60 of the Heritage Act is required as the works will occur within the curtilage of the item listed on the State Heritage Register (SHR). It is EMM’s opinion that the project meets the criteria for a fast track application, however, the proponent should consult with Heritage NSW to confirm prior to lodging the application.</p> <p>The Statement of Heritage Impact (SoHI) appended to the REF should be lodged in support of the Section 60 application, whether fast track or otherwise.</p> <p>A photographic archival recording should be prepared in advance of works as per the Upper Canal Conservation Management Plan (CMP) Policy 3 <i>Elements of Exceptional Significance</i>, Policy 4 <i>Elements of High Significance</i> and Policy 40 <i>Keep Records</i>.</p> <p>WaterNSW should be provided with documentation to include in their records regarding the changes made in the curtilage of the SHR-listed item, as per CMP Policy 41 which states “Keep and archive ongoing, informal records of changes to the Canal”.</p> <p>In the unlikely event that archaeological resources are found during construction, an unexpected finds procedure must be included in the construction environmental management plan.</p>
<p>Noise and vibration</p> <p>Good work practice methods include:</p> <ul style="list-style-type: none"> • Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration. • Practices consistent with Water NSW Guideline for development adjacent to the Upper Canal and Warragamba Pipelines (2021) – notably Sections 2.52. and 2.53. • Implementation of feasible and reasonable mitigation measures that reduce construction noise levels. • Avoiding the use of public address systems or other methods of site communication that may unnecessarily impact upon nearby residents. • Develop routes for the delivery of materials and parking of vehicles to minimise noise. • Where possible, avoid the use of equipment that generates impulsive noise. • Notify residents prior to the commencement of intensive works. <p>Additional measures for plant and equipment include:</p> <ul style="list-style-type: none"> • Where possible, choose quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks. • Operate plant and equipment in the quietest and most efficient manner. • Regularly inspect and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
<p>Soils and contamination</p> <p>A construction environmental management plan (CEMP) should be prepared which will incorporate environmental management procedures and control measures for soil and water, including:</p> <ul style="list-style-type: none"> • An initial testing regime for determining if surface soil has been impacted by lead. • An unexpected finds protocol for soil and water contamination, including procedures to identify and manage contamination, if encountered. • Procedures for the handling, storage and disposal of waste including contaminated materials. • Surface water management and sediment and erosion control measures including a progressive erosion and sediment control plan for the works. • Water quality control measures are to be used to prevent any materials (e.g. concrete, grout, soil slurry) entering waterways. • Remediation and rehabilitation requirements.

Table 8.1 **Summary of mitigation measures, by impact area**

Technical assessment area
<p>Erosion and sediment control measures are to be implemented and maintained to:</p> <ul style="list-style-type: none">• Prevent soil and sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets.• Reduce water velocity and capture sediment on site.• Minimise the amount of material transported from site to surrounding pavement surfaces.• Divert clean water around the site.
<p>Emergency spill management measures will be developed in the CEMP, and including:</p> <ul style="list-style-type: none">• Spill management measures in accordance with the relevant EPA guidelines.• Initial response and containment (e.g. shutting valves, crimping of hoses, use of booms, pads and absorbent material).• Notification of emergency services and relevant authorities e.g. (DPI).
<p>An Asbestos Management Procedure (AMP) would be developed in the CEMP to address unexpected finds of ACM during construction. Specifically, protocols would be stipulated for separation, monitoring, validation and clearance of asbestos.</p> <p>The AMP and associated Standard Work Procedures would satisfy the requirements of:</p> <ul style="list-style-type: none">• Work Health and Safety Regulation 2017.• the Safe Work Australia Asbestos Codes of Practice and Guidance Notes:<ul style="list-style-type: none">– <i>Code of Practice: How to Manage and Control Asbestos in the Workplace.</i>– <i>Code of Practice: How to Safely Remove Asbestos.</i>
<p>An unexpected finds procedure would be included in the CEMP. An unexpected find is potential contamination that was not previously identified during this contaminated land review</p>
<p>The procedure would include (as a minimum) that in the event of an unexpected find:</p> <ul style="list-style-type: none">• Excavation works would temporarily be suspended at the location of the unexpected find, the environment manager contacted and the area of concern appropriately isolated.• Subject to the nature of the unexpected find, the area would be inspected by a contaminated land consultant and if required, appropriate sampling and analysis would be undertaken, the sampling works would be documented in a report.• The requirement for additional controls would be assessed by the consultant and implemented by the proponent.• Workplace health and safety and environmental protection requirements would be reviewed, depending on the type of unexpected finds encountered.

9 Summary

The State Environmental Planning Policy (Biodiversity and Conservation) 2021 includes provisions under Part 13.2 of Chapter 13, for koala fencing and fauna crossings to be development permitted without consent, provided that the crossing or fence is consistent with the Cumberland Plain Conservation Plan.

The *Cumberland Plain Conservation Plan* provides for infrastructure to be installed for the purpose of fauna crossings and a key deliverable of the conservation program is “installing crossings and fences in key areas to protect koalas and facilitate their safe movement”.

As the activities are permitted without consent, Part 5 of the EP&A Act applies.

Section 5.5 of the EP&A Act creates a requirement for a determining authority to consider the environmental impact of a proposed activity.

Division 1 of Part 8 of the Environmental Planning and Assessment Regulation 2021 (the EP&A Regulation) provides that the Planning Secretary may issue guidelines in relation to the factors to be taken into account by a determining authority and the form of the document to be prepared.

Further, Section 171(2) of the EP&A Regulation lists factors to be considered and Section 171(3) requires the preparation of a review of environmental factors (REF) that demonstrates how the environmental factors specified in the environmental factors guidelines were taken into account when considering the likely impact of an activity.

The Department of Planning and Environment has, pursuant to Section 170 of the EP&A Regulation, published *Guidelines for Division 5.1 assessments* (June 2022). The guidelines itemise a number of factors to be considered when assessing the impact of a proposed activity.

All of the above matters have been examined through this REF and after consideration of the various environmental factors, the REF finds that the activities are unlikely to significantly affect the environment.

This finding that the activities are unlikely to significantly affect the environment means that an environmental impact statement (EIS) is not required pursuant to Section 5.7 of the EP&A Act.

Nevertheless, a range of mitigation measures have been recommended to further reduce the environmental impacts of the proposed activities.

The determining authority (or authorities) may therefore consider this REF in discharging their obligations under Section 5.5 of the EP&A Act.

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